Nos. 07-1482; 07-1483

UNITED STATES COURT OF APPEALS
FOR THE FIRST CIRCUIT

COMMONWEALTH OF MASSACHUSETTS,
Petitioner,

v.

UNITED STATES; UNITED STATES NUCLEAR REGULATORY COMMISSION
Respondents,

ENTERGY NUCLEAR OPERATIONS, INC.; ENTERGY NUCLEAR VERMONT LLC; ENTERGY NUCLEAR GENERATION COMPANY,
Intervenors.

ON PETITIONS FOR REVIEW OF ORDERS OF THE
U.S. NUCLEAR REGULATORY COMMISSION

JOINT APPENDIX

MARTHA COAKLEY
ATTORNEY GENERAL

Matthew Brock
Assistant Attorney General
Office of the Attorney General
Environmental Protection Division
One Ashburton Place
Boston, MA 02108
617/727-2200 X 2425

Diane Curran
Harmon, Curran, Spielberg
& Eisenberg, L.L.P.
1726 M Street N.W., Suite 600
Washington, D.C. 20036
202-328-3500

TABLE OF CONTENTS

[1] The attachments to the Commonwealth's hearing request regarding the Vermont Yankee nuclear power plant are virtually identical to the attachments to the Commonwealth's Pilgrim license renewal application (See JA at 401).

appeals by an admitted intervenor, and the Commission generally "disfavor[s] interlocutory, piecemeal appeals."[6]

In exceptional instances, the Commission may in its discretion grant a petition for interlocutory review, where a party demonstrates that a ruling threatens it "with immediate and serious irreparable impact" or "[a]ffects the basic structure of the proceeding in a pervasive or unusual matter."[7] Here, Pilgrim Watch makes neither claim. Moreover, "[c]laims that a board has wrongly rejected a contention ... are commonplace," and cannot without more "be said to affect a proceeding's 'basic structure' ..."[8]

For the reasons provided in this decision, we *deny* Pilgrim Watch's appeal of LBP-06-23.

IT IS SO ORDERED.

For the Commission

ANNETTE L. VIETTI-COOK
Secretary of the Commission

Dated at Rockville, Maryland,
this 11th day of January 2007.

[6] *See Clinton*, CLI-04-31, 60 NRC at 466.
[7] *See* 10 C.F.R. § 2.341(f)(2).
[8] *See Clinton*, CLI-04-31, 60 NRC at 467.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

COMMISSIONERS:

Dale E. Klein, Chairman
Edward McGaffigan, Jr.
Jeffrey S. Merrifield
Gregory B. Jaczko
Peter B. Lyons

In the Matter of **Docket No. 50-271-LR**

ENTERGY NUCLEAR VERMONT YANKEE, LLC, and ENTERGY NUCLEAR OPERATIONS, INC.
(Vermont Yankee Nuclear Power Station)

In the Matter of **Docket No. 50-293-LR**

ENTERGY NUCLEAR GENERATION COMPANY and ENTERGY NUCLEAR OPERATIONS, INC.
(Pilgrim Nuclear Power Station) **January 22, 2007**

GENERIC ISSUES

LICENSE RENEWAL

ENVIRONMENTAL IMPACT STATEMENT

Generic environmental impacts analyzed in the GEIS for license renewal are designated "Category 1" issues, for which the license renewal applicant is generally excused from discussing. 10 C.F.R. § 51.53(c)(3)(i). Generic analysis is "clearly an appropriate method" of meeting the agency's statutory obligations

under NEPA. *See Baltimore Gas & Electric Co. v. Natural Resources Defense Council, Inc.*, 462 U.S. 87, 101 (1984).

GENERIC ISSUES

LICENSE RENEWAL

ENVIRONMENTAL IMPACT STATEMENT

The license renewal GEIS determined that the environmental effects of storing spent fuel for an additional 20 years at the site of nuclear reactors would be "not significant." *See* NUREG-1427, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants (May 1996)," at 6-72 to -75, 6-85. Accordingly, this finding was expressly incorporated into our regulations. *See* 10 C.F.R. Part 51, Subpart A, App. B, Table B-1, "Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants." Because the generic environmental analysis was incorporated into a regulation, the conclusions of that analysis are not subject to attack in an individual adjudication unless the rule is waived or suspended. 10 C.F.R. § 2.335(a), (b); *see also Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Units 2 and 3), CLI-01-24, 54 NRC 349, 364 (2001).

GENERIC ISSUES

LICENSE RENEWAL

ENVIRONMENTAL IMPACT STATEMENT

CONTENTIONS

One way to challenge a generic finding, or "Category 1" issue, in a particular license proceeding is to apply for a waiver where "special circumstances . . . are such that the application of the rule or regulation . . . would not serve the purposes for which the rule or regulation was adopted." 10 C.F.R. § 2.335(b). In theory, Commission approval of a waiver could allow a contention on a Category 1 issue to proceed where special circumstances exist.

GENERIC ISSUES

LICENSE RENEWAL

ENVIRONMENTAL IMPACT STATEMENT

CONTENTIONS

Adjudicating Category 1 issues site by site based merely on a claim of "new and significant information," would defeat the purpose of resolving generic issues in a GEIS.

GENERIC ISSUES

LICENSE RENEWAL

ENVIRONMENTAL IMPACT STATEMENT

RULEMAKING

Where a petitioner argues that new information contradicts assumptions underlying the entire generic analysis for all facilities or a whole class of facilities, the appropriate remedy is a rulemaking petition. It makes more sense for the NRC to study whether, as a technical matter, the agency should modify its requirements for all plants across the board than to litigate in particular adjudications whether generic findings in the GEIS are impeached by a claim of new information.

GENERIC ISSUES

LICENSE RENEWAL

ENVIRONMENTAL IMPACT STATEMENT

RULEMAKING

Pending resoultion of a rulemaking petition, the NRC Staff may, where appropriate, seek the Commission's permission to suspend the generic determination of a Category 1 issue and include a new analysis in the plant-specific environmental impact statements. *See* Statement of Considerations, Final Rule: "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses," 61 Fed. Reg. 28,467, 28,472 (June 5, 1996). If the rule is suspended for the analysis, each supplemental EIS would reflect the corrected analysis until such time as the rule is amended.

GENERIC ISSUES

LICENSE RENEWAL

ENVIRONMENTAL IMPACT STATEMENT

SEVERE ACCIDENT MITIGATION ANALYSIS

A license renewal applicant need not discuss severe accident mitigation alternatives for generic — or "Category 1" — issues. *See Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 NRC 3, 21-22 (2001). This makes obvious sense since "for all issues designated as Category 1 the Commission has concluded that [generically] additional site-specific mitigation alternatives are unlikely to be beneficial." *Id.* at 22.

MEMORANDUM AND ORDER

Today we deny appeals by the Massachusetts Attorney General (Mass AG) and affirm two Atomic Safety and Licensing Board decisions rejecting his sole contention in two separate license renewal proceedings. The Mass AG proposed essentially identical contentions in the proceedings to renew the operating license at the Vermont Yankee Power Station in Windam County, Vermont,[1] and the Pilgrim Nuclear Power Station in Plymouth, Massachusetts.[2] The Mass AG's contention says that new information calls into question previous NRC findings on the environmental impacts of fires in spent fuel pools. The Mass AG contention challenges one of the findings in the Generic Environmental Impact Statement (GEIS) for license renewal — namely, that storing spent fuel in pools for an additional 20 years would have insignificant environmental impacts. In each of the challenged decisions, the Licensing Board found the contention inadmissible. Both Boards found the GEIS finding controlling absent a waiver[3] of the NRC's generic finding[4] or a successful petition for rulemaking.[5] We conclude that the Boards' interpretation of the law and regulations concerning generic, or "Category 1," environmental findings is consistent with *Turkey Point*[6] and we affirm both rulings.

The Mass AG has in fact filed a petition for rulemaking raising the same issues

[1] LBP-06-20, 64 NRC 131 (2006).

[2] LBP-06-23, 64 NRC 255 (2006).

[3] 10 C.F.R. § 2.335.

[4] *See* 10 C.F.R. § 51.53(c)(3)(i).

[5] 10 C.F.R. § 2.802.

[6] *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 NRC 3 (2001).

as his contention.[7] As he in essence acknowledges,[8] the petition for rulemaking is a more appropriate avenue for resolving his generic concerns about spent fuel fires than a site-specific contention in an adjudication.

I. BACKGROUND

A. Environmental Analysis for License Renewal

In 1996, the Commission amended the environmental review requirements in 10 C.F.R. Part 51 to address the scope of environmental review for license renewal applications.[9] The regulations divide the license renewal environmental review into generic and plant-specific issues. The generic impacts of operating a plant for an additional 20 years that are common to all plants, or to a specific subgroup of plants, were addressed in a 1996 GEIS.[10] Those generic impacts analyzed in the GEIS are designated "Category 1" issues. A license renewal applicant is generally excused from discussing Category 1 issues in its environmental report.[11] Generic analysis is "clearly an appropriate method" of meeting the agency's statutory obligations under NEPA.[12]

The license renewal GEIS determined that the environmental effects of storing spent fuel for an additional 20 years at the site of nuclear reactors would be "not significant."[13] Accordingly, this finding was expressly incorporated into Part 51 of our regulations.[14] Because the generic environmental analysis was incorporated into a regulation, the conclusions of that analysis may not be challenged in

[7] *See* Massachusetts Attorney General's Petition for Rulemaking To Amend 10 C.F.R. Part 51 (Aug. 25, 2006), *see* 71 Fed. Reg. 64,169 (public notice).

[8] *See, e.g.,* Massachusetts Attorney General's Brief on Appeal of LBP-06-20 (Oct. 3, 2006), at 8 n.7, agreeing that the Mass AG's contention does not fit the criteria for a rule waiver. *See also* Massachusetts' Petition for Rulemaking at 18.

[9] Final Rule: "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses," 61 Fed. Reg. 28,467 (1996).

[10] *See* NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Final Report, Vol. 1 ("GEIS") (May 1996).

[11] 10 C.F.R. § 51.53(c)(3)(i).

[12] *See Baltimore Gas & Electric Co. v. Natural Resources Defense Council, Inc.*, 462 U.S. 87, 101 (1984).

[13] *See* NUREG-1427, at 6-72 to -75 ("even under the worst probable cause of a loss of spent-fuel pool coolant (a severe seismic-generated accident causing a catastrophic failure of the pool), the likelihood of a fuel-cladding fire is highly remote"), at 6-85 (in a high-density pool, "risks due to accidents and their environmental effects are found to be not significant").

[14] *See* 10 C.F.R. Part 51, Subpart A, App. B, Table B-1, "Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants" ("The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects").

litigation unless the rule is waived by the Commission for a particular proceeding or the rule itself is suspended or altered in a rulemaking proceeding.[15]

B. The Mass AG's Contention

In both license renewal proceedings before us today, the Mass AG submitted a petition for intervention and request for hearing on a single contention challenging Entergy's[16] environmental report for failing to include an analysis of the long-term environmental effects of storing spent fuel in high-density pools at the site. Specifically, the Mass AG cited studies issued subsequent to the GEIS claiming that even a partial loss of water in the spent fuel pool could lead to a severe fire.[17] The Mass AG argues that Entergy's failure to include the new information violated 10 C.F.R. § 51.53(c)(3)(iv)[18] and raises a litigable contention:

> Significant new information now firmly establishes that (a) if the water level in a fuel storage pool drops to the point where the tops of the fuel assemblies are uncovered, the fuel will burn, (b) the fuel will burn regardless of its age, (c) the fire will propagate to other assemblies in the pool, and (d) the fire may be catastrophic.[19]

[15] NRC regulations do not allow a contention to attack a regulation, unless the proponent requests a waiver from the Commission. 10 C.F.R. § 2.335(a), (b); *see also Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Units 2 and 3), CLI-01-24, 54 NRC 349, 364 (2001).

[16] Entergy Nuclear Operations, Inc., together with Entergy Nuclear Generation Company, holds the operating license for the Pilgrim Nuclear Power Station. Entergy Nuclear Operations, Inc., and Entergy Vermont Yankee, LLC, hold the license for the Vermont Yankee Nuclear Power Station. In today's decision we refer to the license applicants collectively as "Entergy."

[17] *See* NAS Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, *Safety and Security of Commercial Spent Nuclear Fuel Storage* (National Academies Press, 2006); Dr. Gordon Thompson, *Risks and Risk-Reducing Options Associated with Pool Storage of Spent Nuclear Fuel at the Pilgrim and Vermont Yankee Nuclear Power Plants* (May 25, 2006); Dr. Jan Beyea, *Report to the Massachusetts Attorney General on the Potential Consequences of a Spent-Fuel Pool Fire at the Pilgrim or Vermont Yankee Nuclear Plant* (May 25, 2006).

[18] In response to concerns raised by the Council on Environmental Quality and others that the NRC's generic approach in the license renewal GEIS would not take into consideration new pertinent information on environmental impacts, the NRC adopted a rule, 10 C.F.R. § 51.53(c)(3)(iv), requiring a license renewal applicant to include "new and significant information" concerning environmental effects. This information would be included in the site-specific supplemental EIS (SEIS) for each power plant which is issued as part of the license renewal application review.

[19] *See* Massachusetts Attorney General's Request for a Hearing and Petition for Leave To Intervene with Respect to Entergy Nuclear Operations Inc.'s Application for Renewal of the Vermont Yankee Nuclear Power Plant Operating License and Petition for Backfit Order Requiring New Design Features To Protect Against Spent Fuel Pool Accidents (May 26, 2006) ("VY Hearing Request") at 22; *see also* Massachusetts Attorney General's Request for a Hearing and Petition for Leave To Intervene

(Continued)

The Mass AG argued, therefore, that Entergy should have discussed consequences and mitigation of severe accidents in spent fuel pools (including those initiated by terrorist acts). In support of its claim that possible terrorist attacks increase the probability of an accident, the Mass AG pointed to the recent Ninth Circuit decision in *San Louis Obispo Mothers for Peace v. NRC*.[20] The Mass AG also claimed that NRC license renewal regulations require that the ER discuss severe accident mitigation alternatives for reducing the impact of a spent fuel accident, such as moving a portion of the fuel to dry storage to reduce density.[21]

The Mass AG also filed a petition for rulemaking to amend the applicable regulations. The Mass AG's petition covers somewhat broader grounds than his contention.[22] It asks NRC to consider the new information on pool fire risks, "revoke the regulations that codify the incorrect conclusion" that the environmental impacts of spent fuel storage are insignificant, issue a generic determination that the impacts of high-density pool storage are significant, and "order that any NRC licensing decision that approves high-density pool storage of spent fuel" (presumably in either a license renewal proceeding or any other license amendment proceeding) be accompanied by an environmental impact statement that discusses alternatives to avoid or mitigate the impacts. It also asks that no final decision issue on the *Vermont Yankee* and *Pilgrim* license renewal proceedings until the rulemaking petition is resolved.[23]

II. DISCUSSION

A. The Licensing Boards Correctly Found the Mass AG's Contention Not Admissible

1. *Category 1 Findings Based on the GEIS Analysis Not Subject To Attack in an Individual Licensing Proceeding*

Both Licensing Boards determined that this case is controlled by our ruling in the *Turkey Point* license renewal proceeding. In *Turkey Point*, a petitioner proposed to litigate the issue of the possible environmental effects of an accident involving stored fuel, including an accident resulting from an attack by the Cuban

with Respect to Entergy Nuclear Operations Inc.'s Application for Renewal of the Pilgrim Nuclear Power Plant Operating License and Petition for Backfit Order Requiring New Design Features To Protect Against Spent Fuel Pool Accidents (May 26, 2006) ("Pilgrim Hearing Request").

[20] 449 F.3d 1016 (9th Cir. 2006), *cert. denied*, No. 06-466 (Jan. 16, 2007).

[21] *See* VY Hearing Request at 23, *citing* 10 C.F.R. § 51.53(c)(3)(iii).

[22] *See* Massachusetts Attorney General's Petition for Rulemaking To Amend 10 C.F.R. Part 51 (Aug. 25, 2006).

[23] *See* Massachusetts Attorney General's Rulemaking Petition at 3.

Air Force.[24] The Commission agreed with the Board that this contention fell outside the scope of a license renewal proceeding, which focuses on those detrimental effects of aging that are not addressed as a matter of ongoing agency oversight and enforcement.[25] Our *Turkey Point* decision outlined the opportunity and procedures for presenting new and significant information that could undermine the findings in the GEIS, including asking for a rule waiver or filing a petition for rulemaking to change the GEIS finding.[26]

The Mass AG argues that *Turkey Point* is inapposite because, there, the petitioners did not argue that the license renewal applicant had violated the regulation requiring it to disclose "new and significant" information, whereas here the Mass AG does make that argument.[27] The Mass AG's argument that its "new and significant information" distinguishes this case from *Turkey Point* is not convincing in light of the regulatory history of the license renewal rulemaking, as explained by the *Vermont Yankee* Board.[28]

Fundamentally, any contention on a "Category 1" issue amounts to a challenge to our regulation that bars challenges to generic environmental findings. There are, however, procedural steps available to make such a challenge. A rule can be waived in a particular license proceeding only where "special circumstances . . . are such that the application of the rule or regulation . . . would not serve the purposes for which the rule or regulation was adopted."[29] In theory, Commission approval of a waiver could allow a contention on a Category 1 issue to proceed where special circumstances exist.

Here, the Mass AG does not argue that unique or unusual characteristics of the Pilgrim and Vermont Yankee facilities undermine the GEIS's generic determinations, but instead argues that new information contradicts assumptions underlying the entire generic analysis for *all* spent fuel pools at all reactors, whether in a license renewal proceeding or not. It therefore appears that the Mass AG chose the appropriate way to challenge the GEIS when he filed his rulemaking petition. The Mass AG's appeal, as well as his petition for rulemaking, appears to recognize as much.[30] It makes more sense for the NRC to study whether, as a technical matter, the agency should modify its requirements relating to spent fuel storage for all plants across the board than to litigate in particular adjudications

[24] CLI-01-17, 54 NRC at 5-6.

[25] *See id.* at 7-8, 21-23.

[26] *See id.* at 11-13.

[27] Massachusetts Attorney General's Brief on Appeal of LBP-06-20, at 12, *citing* 10 C.F.R. § 51.53(c)(3)(iv); *see* note 18, *supra*.

[28] *See* LBP-06-20, 64 NRC at 157-59.

[29] 10 C.F.R. § 2.335(b).

[30] *See, e.g.*, Massachusetts Attorney General's Brief on Appeal of LBP-06-20, at 8. *See also* Petition for Rulemaking at 18.

whether generic findings in the GEIS are impeached by the Mass AG's claims of new information.[31] Adjudicating Category 1 issues site by site based merely on a claim of "new and significant information," would defeat the purpose of resolving generic issues in a GEIS.

2. *No Discussion of Severe Accident Mitigation Alternatives Necessary for Category 1*

The Boards were correct to disregard the Mass AG's argument that Entergy's environmental report was required to discuss severe accident mitigation alternatives such as reducing the density of fuel in the pool by moving some of it to dry storage.[32] The Commission held in *Turkey Point* that no discussion of mitigation alternatives is needed in a license renewal application for a Category 1 issue.[33] This makes obvious sense since "for all issues designated as Category 1, the Commission has concluded that [generically] additional site-specific mitigation alternatives are unlikely to be beneficial."[34] Both Boards found that license renewal applicants need only to discuss such alternatives with respect to "Category 2" issues (that is, environmental issues *not* generically resolved in the GEIS).

As we explained in *Turkey Point*, it is not necessary to discuss mitigation alternatives when the GEIS has already determined that, due to existing regulatory requirements, the probability of a spent fuel pool accident causing significant harm is remote.[35] The Mass AG's rulemaking petition, of course, has challenged the GEIS determination. If the NRC should find the Mass AG's concerns well founded, then one result might be that the GEIS designation is changed and a discussion of mitigation alternatives required. Another result might be that mitigation measures already put in place as a result of NRC's post-9/11 security review could be generically determined to be adequate and consistent with the existing GEIS designation.

[31] The Mass AG claims that the Ninth Circuit's decision in *San Louis Obispo Mothers for Peace v. NRC*, 449 F.3d 1016 (9th Cir. 2006), requires admitting its spent fuel contention. But that decision — which calls on NRC to consider the environmental effects of terrorist attacks when licensing nuclear facilities — is also raised in the Mass AG's rulemaking petition and can be considered in that context. The Ninth Circuit decision nowhere says or implies that the NRC cannot consider spent fuel pool or other environmental issues generically.

[32] *See* LBP-06-20, 64 NRC at 161; LBP-06-23, 64 NRC at 288, 289-93.

[33] *See Turkey Point*, CLI-01-17, 54 NRC at 21-22.

[34] *Id.* at 22.

[35] *See* License Renewal GEIS at 6-86 ("The need for the consideration of mitigation alternatives within the context of renewal of a power reactor license has been considered, and the Commission concludes that its regulatory requirements already in place provide adequate mitigation incentives for on-site storage of spent fuel"); *see also id.* at 6-91.

B. Effect of Rulemaking Petition

The NRC posted a notice of receipt of the Mass AG's rulemaking petition on November 1, 2006, and has requested public comments by March 19, 2007.[36] After considering the petition and public comments, the NRC will make a decision on whether to deny the petition or proceed to make necessary revisions to the GEIS. The license renewal proceeding is not suspended during this period.[37] Nonetheless, depending on the timing and outcome of the NRC Staff's resolution of the Mass AG's rulemaking petition, it is possible that the NRC Staff could seek the Commission's permission to suspend the generic determination and include a new analysis in the Pilgrim and Vermont Yankee plant-specific environmental impact statements. This approach is described in the statement of considerations for our license renewal regulations, where the Commission noted:

> b. If a commenter provides new information which is relevant to the plant and is also relevant to other plants (i.e., generic information) and that information demonstrates that the analysis of an impact codified in the final rule is incorrect, the NRC staff will seek Commission approval to either suspend the application of the rule on a generic basis with respect to the analysis or delay granting the renewal application (and possibly other renewal applications) until the analysis in the GEIS is updated and the rule amended. If the rule is suspended for the analysis, each supplemental EIS would reflect the corrected analysis until such time as the rule is amended.[38]

The Commission, in short, has in place various procedures for considering new and significant environmental information. Thus, whatever the ultimate fate of the Mass AG's "new information" claim, admitting the Mass AG's contention for an adjudicatory hearing is not necessary to ensure that the claim receives a full and fair airing.

---

[36] 71 Fed. Reg. 64,169; deadline for public comments extended to March 19, 2007, *see* 72 Fed. Reg. 24 (Jan. 19, 2007).

[37] The Mass AG's rulemaking petition (at 3) asked the NRC to withhold final decisions in the *Vermont Yankee* and *Pilgrim* license renewal proceedings until the rulemaking petition is resolved. But final decisions in those proceedings are not expected for another year or more. Those proceedings involve many issues unrelated to the Mass AG's rulemaking petition. It is therefore premature to consider suspending proceedings or delaying final decisions. NRC regulations provide that a petitioner who has filed a petition for rulemaking "may request the Commission to suspend all or any part of any licensing proceeding to which the petitioner is a party pending disposition of the petition for rulemaking." 10 C.F.R. § 2.802(d). An interested governmental entity participating under 10 C.F.R. § 2.315 could also make this request.

[38] Statement of Considerations, Final Rule: "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses," 61 Fed. Reg. 28,467, 28,472 (June 5, 1996).

III. CONCLUSION

We find that the Licensing Boards were correct to reject the Mass AG's sole contention in the two cases, and therefore *affirm* the Boards' decisions.

IT IS SO ORDERED.

For the Commission

ANNETTE L. VIETTI-COOK
Secretary of the Commission

Dated at Rockville, Maryland,
this 22d day of January 2007.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

COMMISSIONERS:

Dale E. Klein, Chairman
Edward McGaffigan, Jr.
Jeffrey S. Merrifield
Gregory B. Jaczko
Peter B. Lyons

In the Matter of **Docket No. 50-271-LR**

ENTERGY NUCLEAR VERMONT YANKEE, LLC, and ENTERGY NUCLEAR OPERATIONS, INC.
(Vermont Yankee Nuclear Power Station)

In the Matter of **Docket No. 50-293-LR**

ENTERGY NUCLEAR GENERATION COMPANY and ENTERGY NUCLEAR OPERATIONS, INC.
(Pilgrim Nuclear Power Station) **March 15, 2007**

MOTIONS FOR RECONSIDERATION

A motion for reconsideration must demonstrate "compelling circumstances, such as the existence of a clear and material error in a decision, which could not have reasonably been anticipated, that renders the decision invalid." 10 C.F.R. § 2.323(e). The Massachusetts Attorney General has not demonstrated a "clear and material error" in our affirming the two Board decisions we were reviewing.

FINALITY

Our decision in CLI-07-3 was final as to the Massachusetts Attorney General's only claims in the two license renewal proceedings. The Massachusetts Attorney General has no claim remaining in either adjudication. A request for judicial review must be brought immediately if at all. *See Environmental Law and Policy Center v. NRC,* 470 F.3d 676, 681 (7th Cir. 2006). She also has the option of awaiting an NRC decision in her petition for rulemaking. Agency decisions on rulemaking petitions are judicially reviewable. *See, e.g., Bullcreek v. NRC,* 359 F.3d 536 (D.C. Cir. 2004).

FINALITY

The mere potential that an issue may become moot in the future due to a rulemaking does not affect the finality of a decision resting on current law.

STAY

Only a "party" to a proceeding, or an interested governmental entity participating under 10 C.F.R. § 2.315, may file a request to stay proceedings pending a rulemaking under 10 C.F.R. § 2.802. The Mass AG did not offer an admissible contention and was never admitted to either of these two proceedings as a "party."

MEMORANDUM AND ORDER

Today we deny the Massachusetts Attorney General's (Mass AG's) Motion for Reconsideration of CLI-07-3.[1] In CLI-07-3 we rejected the Mass AG's appeal of decisions by two different Licensing Boards in proceedings to renew the operating license at the Vermont Yankee Power Station in Windam County, Vermont,[2] and the Pilgrim Nuclear Power Station in Plymouth, Massachusetts.[3]

I. BACKGROUND

In CLI-07-3, we affirmed the Boards' rejection in each proceeding of a contention which disputed findings in the Generic Environmental Impact Statement for license renewal concerning the environmental consequences of spent fuel

[1] CLI-07-3, 65 NRC 13 (2007).
[2] LBP-06-20, 64 NRC 131 (2006).
[3] LBP-06-23, 64 NRC 257 (2006).

storage. The contention argued that recent evidence showed that high-density storage in spent fuel pools is more dangerous than previously believed. In our decision, we noted that the Mass AG had filed a petition for rulemaking raising even broader issues than the contention,[4] and said that a petition for rulemaking is a more appropriate avenue for resolving generic concerns about spent fuel fires than a site-specific contention in an adjudication.[5]

The Mass AG argues that CLI-07-3 was ambiguous in terms of its finality and whether the Mass AG is considered a "party" to the ongoing license proceedings. Her motion asks that the Commission:

> (a) confirm [that CLI-07-3] is a non-final decision with respect to the Attorney General, (b) clarify that the Attorney General continues to have party status in the individual license renewal proceedings until those proceedings are concluded, and (c) further clarify that the Attorney General has the right to seek judicial review, as necessary, to ensure the application of the final rulemaking to the individual license renewal proceedings for Pilgrim and Vermont Yankee.[6]

The Mass AG pointed to language in CLI-07-3 saying that it would be "premature" to consider staying the license renewal proceedings to await the outcome of the rulemaking petition because many issues unrelated to the Mass AG's rulemaking petition must also be resolved in those proceedings.[7] The Mass AG contends that if it is premature to rule on her request to halt the license renewal proceedings, then her request is still pending and, therefore, CLI-07-3 is not in all respects a "final" decision.

The NRC Staff and Entergy[8] oppose the Motion for Reconsideration.[9] They say that the Mass AG's motion has not shown any basis for us to reconsider the ruling, and the motion is more a request for clarification than a request for reconsideration. They also suggest that the Commission make clear that our

[4] *See* Massachusetts Attorney General's Petition for Rulemaking To Amend 10 C.F.R. Part 51 (Aug. 25, 2006); *see* 71 Fed. Reg. 64,169 (public notice).
[5] CLI-07-3, 65 NRC at 17.
[6] *See* Massachusetts Attorney General's Motion for Reconsideration and Clarification of CLI-07-03, at 3 (Feb. 1, 2007).
[7] *See* CLI-07-3, 65 NRC at 22 n.37.
[8] Entergy Nuclear Operations, Inc., together with Entergy Nuclear Generation Company, holds the operating license for the Pilgrim Nuclear Power Station. Entergy Nuclear Operations, Inc. and Entergy Vermont Yankee, LLC, hold the license for the Vermont Yankee Nuclear Power Station. In today's decision we refer to the license applicants collectively as "Entergy."
[9] *See* NRC Staff Answer to Massachusetts Attorney General Motion for leave To File and Motion for Reconsideration of CLI-07-03 (Feb. 16, 2007); Entergy's Response to Massachusetts Attorney General's Motion for Reconsideration and Clarification of CLI-07-03 (Feb. 16, 2007).

previous ruling was final with respect to the Mass AG's participation in the *Pilgrim* and *Vermont Yankee* license renewal proceedings.[10]

II. ANALYSIS

A. No Basis for Reconsideration

Despite its characterization as a motion for "reconsideration," the Mass AG's pleading gives us no reason to reconsider our decision in CLI-07-3. A motion for reconsideration must demonstrate "compelling circumstances, such as the existence of a clear and material error in a decision, which could not have reasonably been anticipated, that renders the decision invalid."[11] The Mass AG calls the decision "internally inconsistent, unclear, or potentially prejudicial" to her claims,[12] but does not contend that it violates our regulations or NEPA. The whole of the Mass AG's argument goes to the supposed "ambiguity" concerning the decision's finality. She has not demonstrated a "clear and material error" in our affirming the two Board decisions we were reviewing.

B. Finality of Decision

Our decision in CLI-07-3 was final as to the Mass AG's only claims in the two license renewal proceedings. The Mass AG has no claim remaining in either adjudication. Thus, if she wants to pursue judicial review of our rejection of her contentions, she must do so now.[13] It is true that the petition for rulemaking currently under consideration might possibly render judicial review moot. But the mere potential that an issue may become moot in the future due to a rulemaking does not affect the finality of the decision today.

To clarify an additional point, under NRC regulations, the Mass AG currently has no right to request that the final decisions in *Pilgrim* and *Vermont Yankee* license renewal proceedings be stayed until the rulemaking is resolved.[14] As we indicated in CLI-07-3, only a "party" to the proceedings, or an interested governmental entity participating under 10 C.F.R. § 2.315, may file a request to

[10] NRC Staff Answer at 5; Entergy's Response at 5.

[11] 10 C.F.R. § 2.323(e).

[12] Massachusetts Attorney General's Motion for Reconsideration at 2.

[13] *See Environmental Law and Policy Center v. NRC*, 470 F.3d 676, 681 (7th Cir. 2006). She also has the option of awaiting an NRC decision in her petition for rulemaking. Agency decisions on rulemaking petitions are judicially reviewable. *See, e.g., Bullcreek v. NRC*, 359 F.3d 536 (D.C. Cir. 2004).

[14] The Mass AG's rulemaking petition requested such. CLI-07-3, 64 NRC at 22 n.37.

stay proceedings (pending a rulemaking) under 10 C.F.R. § 2.802.[15] The Mass AG is neither. Because she did not offer an admissible contention, she was never admitted to either of the two proceedings as a "party."[16]

III. CONCLUSION

For the forgoing reasons, the Mass AG's motion for reconsideration is denied. Our decision in CLI-07-3 is clarified as above.

IT IS SO ORDERED.

For the Commission

ANNETTE L. VIETTI-COOK
Secretary of the Commission

Dated at Rockville, Maryland,
This 15th day of March 2007.

[15] *Id.*

[16] A state may participate *either* as an interested governmental entity *or* as a party with its own contentions, but not both. *Louisiana Energy Services, L.P.* (National Enrichment Facility), CLI-04-35, 60 NRC 619, 626-27 (2004). Therefore, the Mass AG could not have sought "participation" status under section 2.315 while the appeal on the admissibility of her contention was still pending. But, as at least one contention has been admitted for hearing in each of the *Vermont Yankee* and *Pilgrim* proceedings, the Mass AG could seek participant status even now.

environment and the correlative uncertain corrosion rate in the sand bed region of the drywell shell, AmerGen's proposed plan to perform UT tests prior to the period of extended operations, two refueling outages later, and thereafter at an appropriate frequency not to exceed 10-year intervals is insufficient to maintain an adequate safety margin. We *reject* as inadmissible Citizens' other contentions.

This proceeding shall continue to be governed by the Initial Scheduling Order and Administrative Directives contained in our Memorandum and Order of April 19, 2006. Additionally, as we previously ruled, the hearing shall be conducted in accordance with the informal adjudicatory procedures prescribed in Subpart L of 10 C.F.R. Part 2. *See* LBP-06-7, 63 NRC at 228; Memorandum and Order (Denying [Citizens'] Motion To Apply Subpart G Procedures) (June 5, 2006) (unpublished).

It is so ORDERED.

THE ATOMIC SAFETY AND
LICENSING BOARD[30]

E. Roy Hawkens, Chairman
ADMINISTRATIVE JUDGE

Dr. Paul B. Abramson
ADMINISTRATIVE JUDGE

Dr. Anthony J. Baratta (by E. Roy Hawkens)
ADMINISTRATIVE JUDGE

Rockville, Maryland
October 10, 2006

[30] Copies of this Memorandum and Order were sent this date by e-mail to counsel for: (1) AmerGen; (2) Citizens; (3) the NRC Staff; and (4) New Jersey.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

Ann Marshall Young, Chair
Dr. Paul B. Abramson
Dr. Richard F. Cole

In the Matter of **Docket No. 50-293-LR**
(ASLBP No. 06-848-02-LR)

ENTERGY NUCLEAR GENERATION COMPANY and ENTERGY NUCLEAR OPERATIONS, INC.
(Pilgrim Nuclear Power Station) **October 16, 2006**

In this license renewal proceeding the Licensing Board rules that the public interest organization, Pilgrim Watch, and the Massachusetts Attorney General, both of which have petitioned to intervene, have standing to participate in the proceeding; that Pilgrim Watch has submitted two admissible contentions and is therefore admitted as a party; but that the Attorney General has failed to submit an admissible contention and is therefore not admitted as a party to the proceeding.

RULES OF PRACTICE: STANDING TO INTERVENE; INTERVENTION

A petitioner's standing, or right to participate in a Commission licensing proceeding, is grounded in section 189a of the Atomic Energy Act (AEA), which requires the NRC to provide a hearing "upon the request of any person whose interest may be affected by the proceeding," and which has been implemented in Commission regulations at 10 C.F.R. § 2.309.

ATTACHMENT 1

000010

RULES OF PRACTICE: STANDING TO INTERVENE; INTERVENTION

Judicial concepts of standing, to which licensing boards are to look in ruling on standing, provide the following guidance in determining whether a petitioner has established the necessary "interest" under 10 C.F.R. § 2.714(d)(1): To qualify for standing a petitioner must allege (1) a concrete and particularized injury that is (2) fairly traceable to the challenged action and (3) likely to be redressed by a favorable decision, criteria commonly referred to, respectively, as "injury in fact," causality, and redressability. The injury may be either actual or threatened, but must lie arguably within the "zone of interests" protected by the statutes governing the proceeding — here, either the AEA or the National Environmental Policy Act (NEPA).

RULES OF PRACTICE: STANDING TO INTERVENE; INTERVENTION

Individual petitioners living within 50 miles of a nuclear power plant may establish standing based on a longstanding "proximity presumption" principle in NRC adjudicatory proceedings, under which the elements of standing will be presumed to be satisfied if an individual lives within the zone of possible harm from a significant source of radioactivity, in the geographical area that might be affected by an accidental release of fission products, which has been defined in proceedings involving nuclear power plants as being within a 50-mile radius of such a plant.

RULES OF PRACTICE: STANDING TO INTERVENE; INTERVENTION

An organization that wishes to establish standing to intervene may do so by demonstrating either organizational standing or representational standing. In order to establish organizational standing it must show that the interests of the organization will be harmed by the proceeding. To establish representational standing it must (1) demonstrate that the interests of at least one of its members may be affected by the licensing action and would have standing to sue in his or her own right, (2) identify that member by name and address, and (3) show that the organization is authorized to request a hearing on behalf of that member. Public interest group Petitioner Pilgrim Watch is found to have established representational standing under these criteria.

RULES OF PRACTICE: STANDING TO INTERVENE; INTERVENTION

Under 10 C.F.R. § 2.309(d)(2) a State that wishes to be a party in a proceeding for a facility located within its boundaries need not address the standing requirements, and the Massachusetts Attorney General is therefore found to have standing to participate as the representative of the State of Massachusetts.

RULES OF PRACTICE: CONTENTIONS

To intervene in an NRC proceeding, a petitioner must, in addition to demonstrating standing, submit at least one contention meeting the requirements of 10 C.F.R. § 2.309(f)(1). Failure of a contention to meet any of the requirements of section 2.309(f)(1) is grounds for its dismissal.

RULES OF PRACTICE: CONTENTIONS

The "strict contention rule serves multiple interests," including, first, focusing the hearing process on real disputes susceptible of resolution in an adjudication (for example, a petitioner may not demand an adjudicatory hearing to attack generic NRC requirements or regulations, or to express generalized grievances about NRC policies); second, by requiring detailed pleadings, putting other parties in the proceeding on notice of the petitioner's specific grievances and thereby giving them a good idea of the claims they will be either supporting or opposing; and, third, helping to ensure that full adjudicatory hearings are triggered only by those able to proffer at least some minimal factual and legal foundation in support of their contentions.

RULES OF PRACTICE: CONTENTIONS

Although the February 2004 revision of the NRC procedural rules no longer incorporates provisions formerly found in 10 C.F.R. § 2.714(a)(3), (b)(1), which permitted the amendment and supplementation of petitions and filing of contentions after the original filing of petitions, they contain essentially the same substantive admissibility standards for contentions, which are now found in 10 C.F.R. § 2.309(f), and which are discussed in an Appendix to the Memorandum and Order that also addresses various case law interpreting the requirements in question.

LICENSE RENEWAL: SCOPE

The regulatory authority relating to license renewal is found in 10 C.F.R.

Parts 51 and 54. Part 54 concerns the "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," and addresses safety-related issues in license renewal proceedings. Part 51, concerning "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," addresses the environmental aspects of license renewal.

LICENSE RENEWAL: SCOPE

As described by the Commission in the license renewal adjudicatory proceeding of *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 NRC 3 (2001), the NRC license renewal safety review is focused "upon those potential detrimental effects of aging that are not routinely addressed by ongoing regulatory oversight programs," which the Commission considers "the most significant overall safety concern posed by extended reactor operation," and on "plant systems, structures, and components for which current [regulatory] activities and requirements may not be sufficient to manage the effects of aging in the period of extended operation." An issue can be related to plant aging and still not warrant review at the time of a license renewal application, if an aging-related issue is "adequately dealt with by regulatory processes" on an ongoing basis. For example, if a structure or component is already required to be replaced "at mandated, specified time periods," it would fall outside the scope of license renewal review.

LICENSE RENEWAL: SCOPE

The regulatory provisions relating to the environmental aspects of license renewal arise out of the requirement that the National Environmental Policy Act (NEPA), 42 U.S.C. § 4332(C), places on federal agencies to "include in every recommendation or report on . . . major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on . . . the environmental impact of the proposed action . . . ." As noted by the Supreme Court in *Robertson v. Methow Valley Citizens Council,* 490 U.S. 332, 349 (1989), the "statutory requirement that a federal agency contemplating a major action prepare such an environmental impact statement [EIS] serves NEPA's 'action-forcing' purpose in two important respects. . . . It ensures that the agency, in reaching its decision, will have available, and will carefully consider, detailed information concerning significant environmental impacts; it also guarantees that the relevant information will be made available to the larger audience that may also play a role in both the decisionmaking process and the implementation of that decision."

000012

LICENSE RENEWAL: SCOPE

Although the requirements of NEPA are directed to federal agencies and thus the primary duties of NEPA fall on the NRC Staff in NRC proceedings, the initial requirement to analyze the environmental impacts of an action, including license renewal, is directed to applicants, and 10 C.F.R. § 51.53(c) requires a license renewal applicant to submit with its application an environmental report (ER), which "must contain a description of the proposed action, including the applicant's plans to modify the facility or its administrative control procedures as described in accordance with § 54.21," and "describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment."

LICENSE RENEWAL: SCOPE

Environmental issues identified as "Category 1," or "generic," issues in Appendix B to Subpart A of Part 51 are not within the scope of a license renewal proceeding. On these issues the Commission found that it could draw generic conclusions that are applicable to nuclear power plants generally. Thus these issues need not be repeatedly assessed on a plant-by-plant basis, and license renewal applicants may in their ERs refer to and adopt the generic environmental impact findings found in Table B-1, Appendix B, for all Category 1 issues, with the following exception: as required by 10 C.F.R. § 51.53(c)(3)(iv), ERs must also contain "any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware," even if this concerns a Category 1 issue.

LICENSE RENEWAL: SCOPE

The Commission was not able to make generic environmental findings on issues identified as "Category 2," or "plant specific," issues in Appendix B to Subpart A, and thus these issues are within the scope of license renewal, and applicants must provide a plant-specific review of them. These issues are characterized by the Commission as involving environmental impact severity levels that could differ significantly from plant to plant, or impacts for which additional plant-specific mitigation measures should be considered.

LICENSE RENEWAL: SCOPE

As required under 10 C.F.R. § 51.95(c), the Commission in 1996 adopted a "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), published as NUREG-1437, which provides data supporting the

table of Category 1 and 2 issues in Appendix B. Issuance of the 1996 GEIS was part of an amendment of the requirements of Part 51 undertaken by the Commission to establish environmental review requirements for license renewals "that were both efficient and more effectively focused."

LICENSE RENEWAL: SCOPE

Section 51.103 of 10 C.F.R. defines the requirements for the "record of decision" relating to any license renewal application, including the standard that the Commission, in making such a decision pursuant to Part 54, "shall determine whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable."

RULES OF PRACTICE: CONTENTIONS; LICENSE RENEWAL

Contentions that the Applicant's ER fails to satisfy NEPA because it does not address the environmental impacts of severe spent fuel pool accidents, and fails to address severe accident mitigation alternatives (SAMAs) that would reduce the potential for spent fuel pool water loss and fires, are found inadmissible, on two grounds, neither or which is addressed by relevant rules, but both of which are mandated by relevant Commission precedent in the *Turkey Point* license renewal proceeding. First, the Commission interpreted the term, "severe accidents," to encompass only reactor accidents and not spent fuel pool accidents, which fall within the analysis of the generic Category 1 issue of onsite storage of spent fuel. Second, the Commission has stated, notwithstanding the responsibility of an applicant in its ER (and the NRC Staff in the supplemental EIS that it must prepare) to address "new and significant information" relating even to Category 1 issues, that an alleged failure to address such "new and significant information" does not give rise to an admissible contention, absent a waiver of the rule in 10 C.F.R. § 51.53(c)(3)(i) that Category 1 issues need not be addressed in a license renewal, and no waiver was requested, because the matters at issue were not considered to involve "special circumstances with respect to the subject matter of the particular proceeding," as required by 10 C.F.R. § 2.335(b).

RULES OF PRACTICE: CONTENTIONS; LICENSE RENEWAL

A contention, that Applicant's aging management program is inadequate with regard to aging management of buried pipes and tanks that contain radioactively contaminated water because it does not provide for monitoring wells that would detect leakage, is admitted, based on its being within the scope of license renewal, and sufficiently supported as required under the contention admissibility standards of 10 C.F.R. § 2.309(f)(1). In litigation of this contention, scientific articles and reports, as well as the existence of leaks at other facilities and the response to those leaks, may, along with whatever other evidence and expert testimony is provided, be relevant evidence on the factual issues of whether Applicant's aging management program for underground pipes and tanks is satisfactory or deficient, and whether as a result the sort of monitoring wells that Petitioner seeks should be included in this program.

RULES OF PRACTICE: CONTENTIONS; LICENSE RENEWAL

A contention, that Applicant's aging management program fails to adequately assure the continued integrity of the drywell liner for the requested license extension, is denied, because it fails to meet the requirement of 10 C.F.R. § 2.309(f)(vi) that sufficient information be shown to demonstrate that a genuine dispute exists with the Applicant on a material issue of law or fact. Applicant provided a detailed application amendment on how it addressed the matter, and Petitioner failed to state with any specificity or provide information showing how the actions and proposed actions of the Applicant do not comply with the Interim Staff Guidance that Petitioner relied on in support of its contention. A licensing board is not permitted to draw any inferences on behalf of a petitioner, and in the absence of any more specific statement than has been provided, showing how the specific actions of Applicant fall short, or some nexus with problems at other plants, the contention is found to be lacking in its failure to show any genuine dispute on a material issue of fact relating to the matters at issue.

RULES OF PRACTICE: CONTENTIONS

A contention, that Applicant's severe accident mitigation alternatives (SAMA) analysis for the plant is deficient regarding input data on evacuation times, economic consequences, and meteorological patterns, resulting in incorrect conclusions about the costs versus benefits of possible mitigation alternatives such that further analysis is called for, is admitted. SAMAs are within the scope of license renewal as a Category 2 issue; Petitioner is found to have raised questions about input data that are material in these three areas because they concern significant health and safety issues that affect the outcome of the proceeding; and Petitioner is found to have adequately supported its contention under the contention admissibility standards of 10 C.F.R. § 2.309(f)(1).

That some of the information provided by Petitioner on evacuation-related issues is apparently in conflict with some of the data taken by Applicant from the plant's emergency plan is found not to preclude its being considered, because,

while emergency planning has been found in the *Turkey Point* proceeding to be "one of the *safety issues* that need not be re-examined within the context of license renewal," what is challenged in this contention is whether particular bits of information taken from such a plan are sufficiently accurate for use in computing the health and safety consequences of an accident, as an *environmental issue*. Because this challenge is focused upon the accuracy of certain assumptions and input data used in the SAMA computations and how they affect the validity of the SAMA analysis under NEPA, it is found to be appropriate in the three areas admitted.

RULES OF PRACTICE: CONTENTIONS; LICENSE RENEWAL

A contention, that new and significant information about cancer rates in communities around the plant shows that another 20 years of operations may result in greater offsite radiological impacts on human health than was previously known, is denied, because it attempts to challenge both generic findings made in the GEIS, and NRC dose limit rules, without a waiver. Petitioner conceded that it was not suggesting that radiological releases from the plant are greater than currently allowed by the NRC regulations, and thus its contention regarding radiological releases must necessarily be construed as a challenge to the current NRC dose limit regulations found in 10 C.F.R. Part 20, and without a waiver under 10 C.F.R. § 2.335, no request for which was submitted, such a challenge is impermissible in an adjudication proceeding.

TABLE OF CONTENTS

MEMORANDUM AND ORDER

(Ruling on Standing and Contentions of Petitioners Massachusetts Attorney General and Pilgrim Watch)

I. INTRODUCTION

This proceeding involves the application of Entergy Nuclear Operations, Inc., to renew its operating license for the Pilgrim Nuclear Power Station for an additional 20-year period. The Massachusetts Attorney General and the nonprofit citizens' organization, Pilgrim Watch, have filed petitions to intervene, in which they submit contentions challenging various safety and environmental aspects of the proposed license renewal. In addition, the Town of Plymouth, Massachusetts, where the Pilgrim plant is located, is participating in this proceeding as an interested local governmental body, pursuant to 10 C.F.R. § 2.315(c).

In this Memorandum and Order we find that both Petitioners have shown standing to participate in the proceeding and that Pilgrim Watch has submitted two admissible contentions. We therefore grant the hearing request of Pilgrim Watch as to Contentions 1 and 3, to the extent discussed and defined below. These contentions relate, respectively, to the aging management program for the Pilgrim plant with regard to inspection for corrosion of buried pipes and tanks and detection of leakage of radioactive water that might result from undetected corrosion and aging; and to certain input data that Pilgrim Watch asserts should have been considered by the Applicant in its "severe accident mitigation alternatives," or "SAMA," analysis.

II. BACKGROUND

Entergy Nuclear Generation Company and Entergy Nuclear Operations, Inc. ("Entergy" or "Applicant") submitted its application requesting renewal of the Pilgrim Nuclear Power Station (PNPS, or "Pilgrim") operating license on January 25, 2006.[1] In response to a March 27, 2006, *Federal Register* notice of opportunity for hearing on the proposed license renewal,[2] timely requests for a hearing and petitions to intervene were filed by Petitioners Pilgrim Watch (PW)[3] and the Massachusetts Attorney General (AG),[4] on May 25 and 26, 2006, respectively. Pilgrim Watch's Petition included five contentions; the Petition filed by the Attorney General proffered a single contention. Subsequently, on June 5, 2006, Pilgrim Watch gave notice pursuant to 10 C.F.R. §§ 2.309(f)(3) and 2.323 of its adoption of the contention filed by the Attorney General,[5] and on June 16 the Attorney General filed a letter requesting that the Licensing Board apply the June 2, 2006, decision of the U.S. Court of Appeals for the Ninth Circuit in the case, *San Luis Obispo Mothers for Peace v. Nuclear Regulatory Commission*, in ruling on its contention.[6]

Meanwhile, on June 7, 2006, a Licensing Board constituted of Judges Young, Cole, and Nicholas Trikouros was established to preside over this proceeding, and on June 14 the Board issued a scheduling order, providing guidance for the

[1] *See* 71 Fed. Reg. 15,222 (Mar. 27, 2006); *see also* Pilgrim Nuclear Power Station License Renewal Application, ADAMS Accession No. ML060300028 [hereinafter Application]. In addition to other appendices, the Pilgrim Application includes the Applicant's Environmental Report for Operating License Renewal Stage, ADAMS Accession No. ML060830611 [hereinafter Environmental Report or ER].

[2] *See* 71 Fed. Reg. at 15,222.

[3] *See* Request for Hearing and Petition To Intervene by Pilgrim Watch (May 25, 2006) [hereinafter Pilgrim Watch Petition or PW Petition].

[4] *See* Massachusetts Attorney General's Request for a Hearing and Petition for Leave To Intervene with Respect to Entergy Nuclear Operation's Inc.'s Application for Renewal of the Pilgrim Nuclear Power Plant Operating License and Petition for Backfit Order Requiring New Design Features To Protect Against Spent Fuel Pool Accidents (May 26; 2006) [hereinafter Attorney General Petition or AG Petition].

As indicated by its title, the AG in its Petition also requests the Commission "to initiate a proceeding for the backfitting of the Pilgrim nuclear power plant to protect against a design-basis accident involving a fire in the spent fuel pool." Attorney General Petition at 50; *see id.* at 48-50. As this part of the petition is directed to the Commission and not this Licensing Board, we have not ruled on it. *See* Tr. at 157; *see also* Massachusetts Attorney General's Reply to Entergy's and NRC Staff's Responses to Hearing Request and Petition To Intervene with Respect to Pilgrim License Renewal Proceeding (June 29, 2006) at 31 [hereinafter Attorney General Reply or AG Reply]. We note that on October 10, 2006, the Commission issued an order denying the Attorney General's petitions for backfitting in this and the *Vermont Yankee* proceeding (in which the AG filed an essentially identical contention to that filed in this proceeding, *see* Massachusetts Attorney General's Request for a Hearing and Petition for Leave To Intervene with Respect to Entergy Nuclear Operations Inc.'s Application for Renewal of the Vermont Yankee Nuclear Power Plant Operating License and Petition for Backfit Order Requiring New Design Features To Protect Against Spent Fuel Pool Accidents (May 26, 2006), ADAMS Accession No. ML061640065), and advising that if the AG wishes to pursue the matter he may file a request for NRC enforcement action under 10 C.F.R. § 2.206. *See* CLI-06-26, 64 NRC 225, 226-27 (2006).

In addition, the Attorney General on August 25, 2006, filed with the Commission a Petition for Rulemaking To Amend 10 C.F.R. Part 51 with respect to issues relating to spent fuel storage, which likewise is not before this Licensing Board. *See* Massachusetts Attorney General's Petition for Rulemaking To Amend 10 C.F.R. Part 51 (Aug. 25, 2006), ADAMS Accession No. ML062640409.

[5] *See* Notice of Adoption of Contention by Pilgrim Watch (June 5, 2006).

[6] Letter from Diane Curran to Licensing Board (June 16, 2006), providing Recent Decision by U.S. Court of Appeals for the Ninth Circuit (June 16, 2006), ADAMS Accession No. ML061740349 [hereinafter AG Letter]. The *Mothers for Peace* decision was subsequently published at 449 F.3d 1016 (9th Cir. 2006).

conduct of the proceeding.[7] The Board subsequently, on June 20, 2006, held a telephone conference to address various prehearing matters,[8] and, in an Order issued June 21, among other things scheduled, in response to the requests of the Petitioners and the Town of Plymouth, a limited appearance session to hear comments from the public pursuant to 10 C.F.R. § 2.315(a), to be held in early July in conjunction with oral argument on Petitioners' contentions.[9]

The NRC Staff responded to Pilgrim Watch's Notice of Adoption on June 15, 2006,[10] and to the Petitions of Pilgrim Watch and the Attorney General on June 19 and 22, 2006, respectively.[11] Entergy filed its Answer to the Attorney General's Petition on June 22, and responded to the Pilgrim Watch Petition on June 26, 2006, including therein its response to Pilgrim Watch's Notice of Adoption of Contention.[12] On June 29, 2006, the Massachusetts Attorney General filed a combined reply to the Answers of Entergy and the NRC Staff.[13] Pilgrim Watch filed its Replies to the Answers of the NRC Staff and Entergy on June 27 and July 3, 2006, respectively.[14]

On July 6 and 7, 2006, the Board held oral argument on the admissibility of the Petitioner's contentions, with the Petitioners, the NRC Staff, Entergy, and the Town of Plymouth participating, in Plymouth, Massachusetts.[15] Following oral argument, the Board required the participants to file supplemental briefs on

[7] *See* 71 Fed. Reg. 34,170 (June 13, 2006); Licensing Board Order (Regarding Schedule and Guidance for Proceedings) (June 14, 2006) (unpublished).

[8] *See* Transcript at 1-42.

[9] *See* Licensing Board Order and Notice (Regarding Oral Argument and Limited Appearance Statement Sessions) (June 21, 2006) (unpublished); Request of Town of Plymouth To Participate as of Right Under 2.315(c) (June 16, 2006).

[10] *See* NRC Staff Answer to Notice of Adoption of Contentions by Pilgrim Watch (June 15, 2006).

[11] *See* NRC Staff's Response to Request for Hearing and Petition To Intervene Filed by Pilgrim Watch (June 19, 2006) [hereinafter Staff Response to PW Petition]; NRC Staff Answer Opposing Massachusetts Attorney General's Request for Hearing and Petition for Leave To Intervene and Petition for Backfit Order (June 22, 2006) [hereinafter Staff Response to AG Petition].

[12] *See* Entergy's Answer to the Massachusetts Attorney General's Request for a Hearing, Petition for Leave To Intervene, and Petition for Backfit Order (June 22, 2006) [hereinafter Entergy Answer to AG Petition]; Entergy's Answer to the Request for Hearing and Petition To Intervene by Pilgrim Watch and Notice of Adoption of Contention (June 26, 2006) [hereinafter Entergy Answer to PW Petition].

[13] *See* Attorney General Reply.

[14] *See* Pilgrim Watch Reply to NRC Answer to Request for Hearing and Petition To Intervene by Pilgrim Watch (June 27, 2006) [hereinafter PW Reply to NRC Staff]; Pilgrim Watch Reply to Entergy Answer to Request for Hearing and Petition To Intervene by Pilgrim Watch (July 3, 2006) [hereinafter PW Reply to Entergy].

[15] *See* Tr. at 40-456. While in Plymouth the Board also conducted the previously scheduled limited appearance session, hearing statements of members of the public pursuant to 10 C.F.R. § 2.315(a). Limited Appearance Transcript at 1-36.

material insufficiently addressed by the participants to that point.[16] The parties submitted these briefs on July 21,[17] and the Attorney General filed a reply to the briefs filed by Entergy and the NRC Staff on July 26, 2006.[18] On July 27, 2006, the Board held a teleconference to discuss the supplemental briefs and topics regarding two of the proffered NEPA-based contentions.[19]

Additionally, at the conclusion of the July 27 teleconference, Judge Trikouros read into the record a disclosure statement outlining work that was previously performed by a consulting company of which he was a principal, which included certain analytical services for Entergy regarding a spent fuel pool for another pressurized water reactor owned and operated by Entergy.[20] This was followed by the August 4 filing, by the Attorney General and Pilgrim Watch, of Motions for Disqualification of Judge Trikouros, which were opposed by Entergy in a Response filed August 14, 2006.[21] Acting on the Motions, Judge Trikouros recused himself from the proceeding on August 30, 2006; on the same date, the Chief Administrative Judge of the Atomic Safety and Licensing Board Panel reconstituted the Licensing Board by appointing Administrative Judge Paul B. Abramson to sit in place of Judge Trikouros.[22] The deliberations that have led to the rulings herein stated have been among the members of the Board as currently constituted.

III. BOARD RULINGS ON STANDING OF PETITIONERS TO PARTICIPATE IN PROCEEDING

A petitioner's standing, or right to participate in a Commission licensing proceeding, is derived from section 189a of the Atomic Energy Act (AEA), which

[16] *See* Licensing Board Order (Regarding Need for Further Briefing on Definition of "New and Significant Information" as Addressed in Participants' Petitions, Answers and Replies Relating to Massachusetts Attorney General Contention and Pilgrim Watch Contention 4) (July 14, 2006) (unpublished).

[17] *See* Entergy's Brief on New and Significant Information in Response to Licensing Board Order of July 14, 2006 (July 21, 2006); Massachusetts Attorney General's Brief Regarding Relevance to This Proceeding of Regulatory Guide's Definition of "New and Significant Information" (July 21, 2006); NRC Staff's Response to July 14, 2006 Licensing Board Order (July 21, 2006).

[18] *See* Massachusetts Attorney General's Reply Brief Regarding Relevance to This Proceeding of Regulatory Guide's Definition of "New and Significant Information" (July 26, 2006).

[19] *See* Tr. at 457-93.

[20] *See* Tr. at 489-92.

[21] *See* Massachusetts Attorney General's Motion for Disqualification of Judge Nicholas Trikouros (Aug. 4, 2006); Motion on Behalf of Pilgrim Watch for Disqualification of Judge Nicholas Trikouros in the Pilgrim Nuclear Power Station Re-licensing Proceeding (Aug. 4, 2006); Entergy's Response to Motions for Disqualification of Judge Nicholas Trikouros (Aug. 14, 2006).

[22] *See* Notice of Reconstitution (Aug. 30, 2006), 71 Fed. Reg. 52,590 (Sept. 6, 2006).

requires the NRC to provide a hearing "upon the request of any person whose interest may be affected by the proceeding."[23] The Commission has implemented this requirement in its regulations at 10 C.F.R. § 2.309.[24]

When determining whether a petitioner has established the necessary "interest" under Commission rules, licensing boards are directed by Commission precedent to look to judicial concepts of standing for guidance.[25] Under this authority, in order to qualify for standing a petitioner must allege "(1) a concrete and particularized injury that is (2) fairly traceable to the challenged action and (3) likely to be redressed by a favorable decision" — three criteria commonly referred to as "injury in fact," causality, and redressability.[26] The requisite injury may be either actual or threatened,[27] but must arguably lie within the "zone of interests" protected by the statutes governing the proceeding — here, either the AEA or the National Environmental Policy Act (NEPA).[28] Additionally, Commission case law has established a "proximity presumption," whereby an individual may satisfy these standing requirements by demonstrating that his or her residence is within the geographical area that might be affected by an accidental release of fission products, and in proceedings involving nuclear power plants this area has been defined as being within a 50-mile radius of such a plant.[29] Accordingly, it will be presumed that the elements of standing are satisfied if an individual lives within the zone of possible harm from the significant source of radioactivity, without requiring a party to specifically plead injury, causation, and redressability.[30]

An organization, such as Pilgrim Watch, that wishes to establish standing to intervene may do so by either demonstrating organizational standing or representational standing. In order to establish organizational standing it must show that the interests of the organization will be harmed by the proceeding, while an organization seeking representational standing must demonstrate that the interests of at least one of its members will be harmed by the proceeding.[31] For an organization to establish representational standing, the organization must: (1) show that at least one of its members may be affected by the licensing action and, accordingly, would have standing to sue in his or her own right; (2) identify that member by name and address; and (3) show that the organization is authorized to request a hearing on behalf of that member.[32] Further, the Commission's regulations explain that a State "that wishes to be a party in a proceeding for a facility located within its boundaries need not address the standing requirements." 10 C.F.R. § 2.309(d)(2).

Entergy does not challenge either the Massachusetts Attorney General's or Pilgrim Watch's standing to participate in this proceeding.[33] The NRC Staff does not contest the standing of the Massachusetts Attorney General to intervene in this proceeding,[34] and because Pilgrim Watch's representative, Mary Lampert, meets the longstanding "proximity presumption" principle in NRC adjudicatory proceedings, the NRC Staff does not dispute that Pilgrim Watch has demonstrated representational standing.[35]

We agree, based on the physical proximity of their representative to the Pilgrim Nuclear Power Station, and because the affected member has authorized the Petitioner organization to represent her in this proceeding, that the Pilgrim Watch has demonstrated representational standing to participate under AEA § 189a and the Commission's rules.[36] Further, we find that the Massachusetts Attorney General has standing to participate in this proceeding as a representative of the State of Massachusetts as outlined by the Commission in 10 C.F.R. § 2.309(d)(2).

---

[23] 42 U.S.C. § 2239(a)(1)(A) (2000).

[24] Subsection (d)(1) of section 2.309 provides in relevant part that the Board shall consider three factors when deciding whether to grant standing to a petitioner: the nature of the petitioner's right under the AEA to be made a party to the proceeding; the nature and extent of the petitioner's property, financial, or other interest in the proceeding; and the possible effect of any order that may be entered in the proceeding on the petitioner's interest. 10 C.F.R. § 2.309(d)(1)(ii)-(iv). The provisions of 10 C.F.R. § 2.309 were formerly found in 10 C.F.R. § 2.714, prior to a major revision of the Commission's procedural rules for adjudications in 2004.

[25] *See, e.g., Yankee Atomic Electric Co.* (Yankee Nuclear Power Station), CLI-98-21, 48 NRC 185, 195 (1998); *Quivira Mining Co.* (Ambrosia Lake Facility, Grants, New Mexico), CLI-98-11, 48 NRC 1, 5-6 (1998); *Georgia Institute of Technology* (Georgia Tech Research Reactor, Atlanta, Georgia), CLI-95-12, 42 NRC 111, 115 (1995).

[26] *Yankee*, CLI-98-21, 48 NRC at 195 (citing *Steel Co. v. Citizens for a Better Environment*, 523 U.S. 83, 102-04 (1998); *Kelley v. Selin*, 42 F.3d 1501, 1508 (6th Cir. 1995)).

[27] *Id.* (citing *Wilderness Society v. Griles*, 824 F.2d 4, 11 (D.C. Cir. 1987)).

[28] *Id.* at 195-96 (citing *Ambrosia Lake Facility*, CLI-98-11, 48 NRC at 6).

[29] *See Florida Power & Light Co.* (St. Lucie Nuclear Power Plant, Units 1 and 2), CLI-89-21, 30 NRC 325, 329 (1989); *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), LBP-01-6, 53 NRC 138, 146-50 (2001); *Virginia Electric and Power Co.* (North Anna Nuclear Power Station, Units 1 and 2), ALAB-522, 9 NRC 54, 56 (1979) ("close proximity [to a facility] has always been deemed to be enough, standing alone, to establish the requisite interest" to confer standing).

[30] *See id.*

[31] *See Yankee*, CLI-98-21, 48 NRC at 195.

[32] *See GPU Nuclear, Inc.* (Oyster Creek Nuclear Generating Station), CLI-00-6, 51 NRC 193, 202 (2000).

[33] *See* Entergy Answer to AG Petition at 2; Entergy Answer to Pilgrim Watch at 2.

[34] *See* NRC Staff Answer to AG Petition at 3.

[35] *See* NRC Staff Answer to Pilgrim Watch at 5.

[36] *See Yankee*, CLI-98-21, 48 NRC at 195; *Georgia Tech*, CLI-95-2, 42 NRC at 115; *Turkey Point*, LBP-01-6, 53 NRC at 146-50.

IV. STANDARDS FOR ADMISSIBILITY OF CONTENTIONS IN LICENSE RENEWAL PROCEEDINGS

A. Regulatory Requirements on Contentions

To intervene in an NRC proceeding, a petitioner must, in addition to demonstrating standing, submit at least one contention meeting the requirements of 10 C.F.R. § 2.309(f)(1).[37] Failure of a contention to meet any of the requirements of section 2.309(f)(1) is grounds for its dismissal.[38] Heightened standards for the admissibility of contentions originally came into being in 1989, when the Commission amended its rules to "raise the threshold for the admission of contentions."[39] The Commission has more recently stated that the "contention rule is strict by design," having been "toughened . . . in 1989 because in prior years 'licensing boards had admitted and litigated numerous contentions that appeared to be based on little more than speculation.' "[40]

[37] *See* 10 C.F.R. § 2.309(a). Section 2.309(f)(1) states that:

(1) A request for hearing or petition for leave to intervene must set forth with particularity the contentions sought to be raised. For each contention, the request or petition must:

(i) Provide a specific statement of the issue of law or fact to be raised or controverted;

(ii) Provide a brief explanation of the basis for the contention;

(iii) Demonstrate that the issue raised in the contention is within the scope of the proceeding;

(iv) Demonstrate that the issue raised in the contention is material to the findings the NRC must make to support the action that is involved in the proceeding;

(v) Provide a concise statement of the alleged facts or expert opinions which support the requestor's/petitioner's position on the issue and on which the petitioner intends to rely at hearing, together with references to the specific sources and documents on which the requestor/petitioner intends to rely to support its position on the issue; and

(vi) Provide sufficient information to show that a genuine dispute exists with the applicant/licensee on a material issue of law or fact. This information must include references to the specific portions of the application (including the applicant's environmental report and safety report) that the petitioner disputes and the supporting reasons for each dispute, or, if the petitioner believes that the application fails to contain information on a relevant matter as required by law, the identification of each failure and the supporting reasons for the petitioner's belief.

[38] *See Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), CLI-99-10, 49 NRC 318, 325 (1999); *Arizona Public Service Co.* (Palo Verde Nuclear Generating Station, Units 1, 2, and 3), CLI-91-12, 34 NRC 149, 155-56 (1991).

[39] Rules of Practice for Domestic Licensing Proceedings — Procedural Changes in the Hearing Process, 54 Fed. Reg. 33,168, 33,168 (Aug. 11, 1989); *see also Duke Energy Corp.* (Oconee Nuclear Station, Units 1, 2, and 3), CLI-99-11, 49 NRC 328, 334 (1999).

[40] *Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Units 2 and 3), CLI-01-24, 54 NRC 349, 358 (2001) (citing *Oconee*, CLI-99-11, 49 NRC at 334).

The Commission has explained that the "strict contention rule serves multiple interests."[41] These include the following (quoted in list form):

> First, it focuses the hearing process on real disputes susceptible of resolution in an adjudication. For example, a petitioner may not demand an adjudicatory hearing to attack generic NRC requirements or regulations, or to express generalized grievances about NRC policies.
>
> Second, the rule's requirement of detailed pleadings puts other parties in the proceeding on notice of the Petitioners' specific grievances and thus gives them a good idea of the claims they will be either supporting or opposing.
>
> Finally, the rule helps to ensure that full adjudicatory hearings are triggered only by those able to proffer at least some minimal factual and legal foundation in support of their contentions.[42]

In February 2004 a new revision of the procedural rules came into effect.[43] Although these rules no longer incorporate provisions formerly found in 10 C.F.R. § 2.714(a)(3), (b)(1), which permitted the amendment and supplementation of petitions and the filing of contentions after the original filing of petitions,[44] and contain various changes to provisions relating to the hearing process,[45] they contain essentially the same substantive admissibility standards for contentions. In its Statement of Considerations adopting the new rules, the Commission reiterated the same principles that previously applied, namely, that "[t]he threshold standard is necessary to ensure that hearings cover only genuine and pertinent issues of concern and that the issues are framed and supported concisely enough at the outset to ensure that the proceedings are effective and focused on real, concrete issues."[46] Additional guidance with respect to each of the requirements now found in subsections (i) through (vi) of section 2.309(f)(1) is found in NRC case law.

Although we do not recount this guidance in any detail in the body of this Memorandum, primarily in view of the sheer size of this body of law, we

[41] *Oconee*, CLI-99-11, 49 NRC at 334.

[42] *Id.* (citations omitted).

[43] Changes to Adjudicatory Process, 69 Fed. Reg. 2182 (Jan. 14, 2004).

[44] Under the current rules, contentions must be filed with the original petition, within 60 days of notice of the proceeding in the *Federal Register* (unless another period is therein specified). *See* 10 C.F.R. § 2.309(b)(3)(iii).

[45] In this connection we note that a challenge to the new rules by several public interest groups (supported by several states including Massachusetts) was overruled in the case of *Citizens Awareness Network, Inc. v. NRC* [*CAN v. NRC*], 391 F.3d 338 (1st Cir. 2004). The Court denied the petitions for review, finding that the new procedures "comply with the relevant provisions of the APA and that the Commission has furnished an adequate explanation for the changes." *Id.* at 343.

[46] 69 Fed. Reg. at 2189-90.

have — because of its critical importance in determining whether petitioners are granted evidentiary hearings in NRC adjudicatory proceedings — attached as an Appendix to our Memorandum and Order a more detailed and in-depth discussion highlighting the contention admissibility standards as they have been interpreted in various NRC adjudication proceedings. Our rulings herein are informed by these requirements and principles.

B. Scope of Subjects Admissible in License Renewal Proceedings

One of the contention admissibility standards limits contentions to issues demonstrated to be "within the scope" of a proceeding.[47] Commission regulations and case law address in some detail the scope of license renewal proceedings, which generally concern requests to renew 40-year operating licenses for additional 20-year terms.[48] The regulatory authority relating to license renewal is found in 10 C.F.R. Parts 51 and 54. Part 54 concerns the "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," and addresses safety-related issues in license renewal proceedings.[49] Part 51, concerning "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," addresses the environmental aspects of license renewal.[50] The Commission has interpreted these provisions in various adjudicatory proceedings, probably most extensively in a decision in the 2001 *Turkey Point* proceeding.[51]

[47] *See* 10 C.F.R. § 2.309(f)(1)(iii).

[48] Section 54.31(b) of 10 C.F.R. provides that:

> [a] renewed license will be issued for a fixed period of time, which is the sum of the additional amount of time beyond the expiration of the operating license (not to exceed 20 years) that is requested in a renewal application plus the remaining number of years on the operating license currently in effect. The term of any renewed license may not exceed 40 years.

Section 50.51(a) of 10 C.F.R. states in relevant part that "[e]ach [original] license will be issued for a fixed period of time to be specified in the license but in no case to exceed 40 years from date of issuance."

[49] *See* 10 C.F.R. Part 54.

[50] *See* 10 C.F.R. Part 51.

[51] *See Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 NRC 3, 11-13 (2001); *see also Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-26, 56 NRC 358, 363-64 (2002); *Baltimore Gas & Electric Co.* (Calvert Cliffs Nuclear Power Plant, Units 1 and 2), CLI-98-14, 48 NRC 39, 41 (1998), *motion to vacate denied*, CLI-98-15, 48 NRC 45 (1998); *Duke Energy Corp.* (Oconee Nuclear Station, Units 1, 2, and 3), CLI-98-17, 48 NRC 123, 125 (1998); *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-00-23, 52 NRC 327, 329 (2000); *Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Units 2 and 3), LBP-04-15, 60 NRC 81, 90, *aff'd*, CLI-04-36, 60 NRC 631 (2004).

1. *Safety-Related Issues in License Renewal Proceedings*

Various sections of Part 54 speak to the scope of safety-related issues in license renewal proceedings. First, 10 C.F.R. § 54.4, titled "Scope," specifies the plant systems, structures, and components that are within the scope of this part.[52] Sections 54.3 (containing definitions), 54.21 (addressing technical information to be included in an application and further identifying relevant structures and components), and 54.29 (stating the "Standards for issuance of a renewed license") provide additional definition of what is encompassed within a license renewal review, limiting the scope to aging-management issues and some "time-limited aging analyses" that are associated with the functions of relevant plant systems, structures, and components.[53] Applicants must "demonstrate how their programs will be effective in managing the effects of aging during the proposed period of extended operation," at a "detailed . . . 'component and structure level,' rather than at a more generalized 'system level.' "[54]

The Commission in *Turkey Point* stated that, in developing 10 C.F.R. Part 54 beginning in the 1980s, it sought "to develop a process that would be both efficient, avoiding duplicative assessments where possible, and effective, allowing the NRC Staff to focus its resources on the most significant safety concerns at issue during the renewal term."[55] Noting that the "issues and concerns involved in an extended 20 years of operation are not identical to the issues reviewed when a reactor facility is first built and licensed," the Commission found that

[52] Section 54.4(a) describes those "systems, structures, and components" that are within scope as:

> (1) Safety-related systems, structures, and components which are those relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49 (b)(1)) to ensure the following functions —
>
> (i) The integrity of the reactor coolant pressure boundary;
>
> (ii) The capability to shut down the reactor and maintain it in a safe shutdown condition; or
>
> (iii) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in § 50.34(a)(1), § 50.67(b)(2), or § 100.11 of this chapter, as applicable.
>
> (2) All nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in paragraphs (a)(1)(i), (ii), or (iii) of this section.
>
> (3) All systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63).

[53] *See* Final Rule: "Nuclear Power Plant License Renewal; Revisions," 60 Fed. Reg. 22,461, 22,463 (May 8, 1995).

[54] *Turkey Point*, CLI-01-17, 54 NRC at 8 (quoting 60 Fed. Reg. at 22,462).

[55] *Id.* at 7.

requiring a full reassessment of safety issues that were "thoroughly reviewed when the facility was first licensed" and continue to be "routinely monitored and assessed by ongoing agency oversight and agency-mandated licensee programs" would be "both unnecessary and wasteful."[56] Nor did the Commission "believe it necessary or appropriate to throw open the full gamut of provisions in a plant's current licensing basis to re-analysis during the license renewal review."[57]

The Commission chose, rather, to focus the NRC license renewal safety review "upon those potential detrimental effects of aging that are not routinely addressed by ongoing regulatory oversight programs," which it considered "the most significant overall safety concern posed by extended reactor operation."[58] The Commission in *Turkey Point* described some of the "Detrimental Effects of Aging and Related Time-Limited Issues" as follows:

> By its very nature, the aging of materials "becomes important principally during the period of extended operation beyond the initial 40-year license term," particularly since the design of some components may have been based explicitly upon an assumed service life of 40 years. *See* [Final Rule: "Nuclear Power Plant License Renewal," 56 Fed. Reg. 64,943, 64,946 (Dec. 13, 1991)]; *see also* Final Rule, "Nuclear Power Plant License Renewal; Revisions," 60 Fed. Reg. 22,461, 22,479 (May 8, 1995). Adverse aging effects can result from metal fatigue, erosion, corrosion, thermal and radiation embrittlement, microbiologically induced effects, creep, and shrinkage. Such age-related degradation can affect a number of reactor and auxiliary systems, including the reactor vessel, the reactor coolant system pressure boundary, steam generators, electrical cables, the pressurizer, heat exchangers, and the spent fuel pool. Indeed, a host of individual components and structures are at issue. *See* 10 C.F.R. § 54.21(a)(1)(i). Left unmitigated, the effects of aging can overstress equipment, unacceptably reduce safety margins, and lead to the loss of required plant functions, including the capability to shut down the reactor and maintain it in a shutdown condition, and to otherwise prevent or mitigate the consequences of accidents with a potential for offsite exposures.[59]

The Commission has also framed the focus of license renewal review as being on "plant systems, structures, and components for which current [regulatory] activities and requirements *may not* be sufficient to manage the effects of aging in the period of extended operation."[60] An issue can be related to plant aging and still not warrant review at the time of a license renewal application, if an aging-related issue is "adequately dealt with by regulatory processes" on an ongoing basis.[61] For example, if a structure or component is already required to be replaced "at mandated, specified time periods," it would fall outside the scope of license renewal review.[62]

2. *Environmental Issues in License Renewal Proceedings*

Regulatory provisions relating to the environmental aspects of license renewal arise out of the requirement that the National Environmental Policy Act (NEPA) places on federal agencies to "include in every recommendation or report on . . . major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on [] the environmental impact of the proposed action . . . ."[63] As has been noted by the Supreme Court, the "statutory requirement that a federal agency contemplating a major action prepare such an environmental impact statement [EIS] serves NEPA's 'action-forcing' purpose in two important respects":

> It ensures that the agency, in reaching its decision, will have available, and will carefully consider, detailed information concerning significant environmental impacts; it also guarantees that the relevant information will be made available to the larger audience that may also play a role in both the decisionmaking process and the implementation of that decision.[64]

---

[56] *Id.*

[57] *Id.* at 9. "Current licensing basis" (CLB) is described by the Commission in *Turkey Point* as follows:

> ["CLB" is] a term of art comprehending the various Commission requirements applicable to a specific plant that are in effect at the time of the license renewal application. The current licensing basis consists of the license requirements, including license conditions and technical specifications. It also includes the plant-specific design basis information documented in the plant's most recent Final Safety Analysis Report, and any orders, exemptions, and licensee commitments that are part of the docket for the plant's license, i.e., responses to NRC bulletins, generic letters, and enforcement actions, and other licensee commitments documented in NRC safety evaluations or licensee event reports. *See* 10 C.F.R. § 54.3. The current licensing basis additionally includes all of the regulatory requirements found in Parts 2, 19, 20, 21, 30, 40, 50, 55, 72, 73, and 100 with which the particular applicant must comply. *Id.*
>
> . . . . The [CLB] represents an "evolving set of requirements and commitments for a specific plant that are modified as necessary over the life of a plant to ensure continuation of an adequate level of safety." 60 Fed. Reg. at 22,473. It is effectively addressed and maintained by ongoing agency oversight, review, and enforcement.

Id.

[58] *Turkey Point*, CLI-01-17, 54 NRC at 7.

[59] *Id.* at 7-8.

[60] *Id.* at 10 (citing 60 Fed. Reg. at 22,469) (alteration in original).

[61] *Id.* at 10 n.2.

[62] *Id.*

[63] 42 U.S.C. § 4332; *see Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 348 (1989).

[64] *Robertson*, 490 U.S. at 349. Of course, as the Court also noted, "NEPA itself does not mandate particular results, but simply prescribes the necessary process. . . . If the adverse environmental effects of the proposed action are adequately identified and evaluated, the agency is not constrained by NEPA from deciding that other values outweigh the environmental costs." *Id.* at 350 (citations omitted). As

(Continued)

Part 51 of 10 C.F.R. contains NRC's rules relating to and implementing relevant NEPA requirements, and section 51.20(a)(2) requires an environmental impact statement for issuance or renewal of a nuclear reactor operating license. Other sections relating to license renewal include, most significantly, 10 C.F.R. §§ 51.53(c), 51.95(c), and 51.103(a)(5), and Appendix B to Subpart A.

Although the requirements of NEPA are directed to federal agencies and thus the primary duties of NEPA fall on the NRC Staff in NRC proceedings,[65] the initial requirement to analyze the environmental impacts of an action, including license renewal, is directed to applicants under relevant NRC rules.[66] Accordingly, section 51.53(c) requires a license renewal applicant to submit with its application an environmental report (ER), which "must contain a description of the proposed action, including the applicant's plans to modify the facility or its administrative control procedures as described in accordance with § 54.21," and "describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment."[67] The report is not required to contain analyses of environmental impacts identified as "Category 1," or "generic," issues in Appendix B to Subpart A of Part 51, but "must contain analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term," for those issues identified as "Category 2," or "plant specific," issues in Appendix B to Subpart A.[68]

As required under 10 C.F.R. § 51.95(c), the Commission in 1996 adopted a "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), an extensive study of the potential environmental impacts of extending the operating licenses for nuclear power plants, which was published as NUREG-1437 and provides data supporting the table of Category 1 and 2 issues in Appendix B.[69] Issuance of the 1996 GEIS was part of an amendment of the requirements of Part 51 undertaken by the Commission to establish environmental

the Court also observed, in the companion case of *Marsh v. Oregon Natural Resources Council*, 490 U.S. 360, 371 (1989), "by focusing Government and public attention on the environmental effects of proposed agency action," NEPA "ensures that the agency will not act on incomplete information, only to regret its decision after it is too late to correct."

[65] *See, e.g.*, 10 C.F.R. § 51.70(b), which states among other things that "[t]he NRC staff will independently evaluate and be responsible for the reliability of all information used in the draft environmental impact statement."

[66] *See* 10 C.F.R. § 51.41.

[67] 10 C.F.R. § 51.53(c)(2); *see* § 51.53(c)(1).

[68] 10 C.F.R. § 51.53(c)(3)(i), (ii).

[69] *See* NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (May 1996) [hereinafter GEIS]; Final Rule: "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses," 61 Fed. Reg. 28,467 (June 5, 1996), *amended by* 61 Fed. Reg. 66,537 (Dec. 18, 1996); 10 C.F.R. Part 51, Subpart A, App. B n.1.

review requirements for license renewals "that were both efficient and more effectively focused."[70]

Issues on which the Commission found that it could draw "generic conclusions applicable to all existing nuclear power plants, or to a specific subgroup of plants," were, as indicated above, identified as "Category 1" issues.[71] This categorization was based on the Commission's conclusion that these issues involve "environmental effects that are essentially similar for all plants," and thus they "need not be assessed repeatedly on a site-specific basis, plant-by-plant."[72] Thus, under Part 51, license renewal applicants may — with an exception relevant in this case that we discuss further below, requiring that ERs contain "any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware"[73] — in their site-specific ERs refer to and adopt the generic environmental impact findings found in Table B-1, Appendix B, for all Category 1 issues.[74]

On the other hand, environmental issues for which the Commission was not able to make generic environmental findings are designated as Category 2 matters, and applicants must provide plant-specific analyses of the environmental impacts of these.[75] These issues are characterized by the Commission as involving environmental impact severity levels that "might differ significantly from one plant to another," or impacts for which additional plant-specific mitigation measures should be considered.[76] For example, the "impact of extended operation on endangered or threatened species varies from one location to another," according to the Commission, and is thus included within Category 2.[77] Another example, relevant in this proceeding, is the requirement that "alternatives to mitigate severe accidents must be considered for all plants that have not [previously] considered such alternatives."[78] Again, although the initial requirement falls upon applicants,

[70] *Turkey Point*, CLI-01-17, 54 NRC at 11.

[71] *Id.* at 11 (citing 10 C.F.R. Part 51, Subpart A, App. B).

[72] *Id.*

[73] 10 C.F.R. § 51.53(c)(3)(iv).

[74] *Turkey Point*, CLI-01-17, 54 NRC at 11 (citing 10 C.F.R. § 51.53(c)(3)(i)).

[75] *Id.* (citing 10 C.F.R. Part 51, Subpart A, App. B).

[76] *Id.*

[77] *Id.* at 12.

[78] 10 C.F.R. Part 51, Subpart A, Appendix B; *see* § 51.53(c)(3)(ii)(L). This requirement arises out of "NEPA's 'demand that an agency prepare a detailed statement on 'any adverse environmental effects which cannot be avoided should the proposal be implemented,' 42 U.S.C. § 4332(C)(ii),'" implicit in which "is an understanding that the EIS will discuss the extent to which adverse effects can be avoided." *Robertson*, 490 U.S. at 351-52. The basis for the requirement is that "omission of a reasonably complete discussion of possible mitigation measures would undermine the 'action-forcing' function of NEPA. Without such a discussion, neither the agency nor other interested groups or individuals can properly evaluate the severity of the adverse effects." *Id.* at 352.

the ultimate responsibility lies with the Staff, who must address these issues in a Supplemental Environmental Impact Statement (SEIS)[79] that is specific to the particular site involved and provides the Staff's independent assessment of the applicant's ER.[80]

Finally, section 51.103 defines the requirements for the "record of decision" relating to any license renewal application, including the standard that the Commission, in making such a decision pursuant to Part 54, "shall determine whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable."[81]

V. PETITIONERS' CONTENTIONS, PARTY ARGUMENTS, AND LICENSING BOARD ANALYSIS AND RULINGS

With the preceding general contention admissibility requirements and license renewal scope principles in mind, we turn now to the Petitioners' contentions.

A. Massachusetts Attorney General's Contention and Pilgrim Watch Contention 4 (Regarding Spent Fuel Pool Accidents)

Because of their similarity, and because Pilgrim Watch has also sought to adopt the Attorney General's Contention, we consider this contention together with Pilgrim Watch Contention 4. Our discussion addresses the points raised in support of both, and the arguments raised in opposition to both. Because we do not admit either contention, it is not necessary that we rule on Pilgrim Watch's motion to adopt the AG's contention, and therefore we do not address it herein.

The contentions here at issue state as follows:

> AG Contention: The Environmental Report for Renewal of the Pilgrim Nuclear Power Plant Fails to Satisfy NEPA Because it Does Not Address the Environmental Impacts of Severe Spent Fuel Pool Accidents.[82]

> Pilgrim Watch Contention 4: The Environmental Report Fails to Address Severe Accident Mitigation Alternatives (SAMAs) Which Would Reduce the Potential for Spent Fuel Pool Water Loss and Fires.[83]

[79] *See* 10 C.F.R. § 51.95(c).

[80] *See Turkey Point*, CLI-01-17, 54 NRC at 12 (citing 10 C.F.R. §§ 51.70, 51.73-.74).

[81] 10 C.F.R. § 51.103(a)(5).

[82] AG Petition at 21.

[83] PW Petition at 50.

Pilgrim Watch in its contention centers on the SAMA argument, stating as follows:

> The Environmental Report [ER] is inadequate because it fails to address the environmental impacts of the on-site storage of spent fuel assemblies which, already densely packed in the cooling pool, will be increased by fifty percent during the renewal period. A severe accident in the spent fuel pool should have been considered in Applicant's SAMA review just as accidents involving other aspects of the uranium fuel cycle were. In addition, new information shows spent fuel will remain on-site longer than was anticipated and is more vulnerable than previously known to accidental fires and acts of malice and insanity. The ER should address [SAMAs] that would substantially reduce the risks and the consequences associated with on-site spent fuel storage. Petitioners have outlined some of these alternatives.[84]

Pilgrim Watch argues that "[a]ny exemption in the [GEIS] and 10 C.F.R. § 51.53 for spent fuel storage covers normal operations only, not severe accidents," and therefore severe accidents involving the spent fuel pool should also be considered to be a Category 2 issue.[85] PW also claims to have brought forth "new and significant information that makes consideration of the spent fuel pool necessary under NEPA."[86] Pilgrim Watch suggests that an adjudicatory hearing is the "only way to properly address Petitioners' concerns,"[87] arguing that other means such as a petition for enforcement under 10 C.F.R. § 2.206 or a rulemaking petition under 10 C.F.R. § 2.802 could not realistically address their concerns in a timely fashion.[88]

Among other arguments offered as basis to support Contention 4, PW urges that new information, relating to questions about national storage of high-level waste, indicates that spent fuel "will remain on-site longer than anticipated" at the time either the GEIS or the Waste Confidence Rule was adopted.[89] In PW's view, "it makes more sense and is more protective of the environment to assess the impacts of on-site spent fuel storage *before* permission is given to generate more waste."[90] PW also contends that new information suggests a greater risk of

[84] *Id.*

[85] *Id.*; *see id.* at 52.

[86] *Id.* at 50.

[87] *Id.* at 54.

[88] *See id.* at 55.

[89] *Id.* at 56; *see id.* at 56-61.

[90] *Id.* at 61-62; *see also* 10 C.F.R. § 51.23. We note that the U.S. Court of Appeals for the D.C. Circuit recently dismissed a challenge to the Waste Confidence Rule brought by the State of Nevada, finding, in an unpublished decision, that Nevada did not have standing because it "can point to no injury in fact as a legal or practical consequence of the rule," and that "[t]he rule has no legal effect in the anticipated Yucca Mountain proceeding." *Nevada v. NRC*, No. 05-1350, 2006 WL 2828864, at *1 (D.C. Cir., Sept. 22, 2006).

accidental fires in spent fuel pools than previously thought, in part because the fuel is more densely packed than originally planned; in part because an accident or act of malice or insanity could lead to loss of water from the pool; in part because the spent fuel pools of boiling-water Mark I and Mark II reactors like Pilgrim are particularly vulnerable to attack, being above ground; and in part because terrorist attacks on nuclear plants are asserted to be reasonably foreseeable threats in the wake of September 11, 2001.[91]

Emphasizing the SAMA aspect of its contention, PW argues that the consequences of water loss as a result of any of several causes could be catastrophic and suggests several mitigation alternatives for consideration, including: using a combination of low-density, reconfigured storage of spent fuel assemblies and moving older assemblies to dry cask storage; installing a spray cooling system; and limiting the frequency of full core offloads.[92] Finally, PW suggests that dry cask storage makes sense from an economic, cost-benefit perspective, and calls for further analysis on SAMAs.[93]

Using some of the same arguments and supporting its contention as well with expert reports and other sources, the AG in his sole contention also argues that the ER fails to satisfy 10 C.F.R. § 51.53(c)(3)(iii) because it does not considers SAMAs for a severe spent fuel pool accident.[94] His primary argument, however, essentially consists of the assertion that Entergy's ER "does not satisfy the requirements of 10 C.F.R. § 51.53(c)(3)(iv) and NEPA . . . because it fails to address new and significant information regarding the reasonably foreseeable potential for a severe accident involving nuclear fuel stored in high-density storage racks in the Pilgrim fuel pool."[95] As with PW's contention, the AG points out that NEPA and 10 C.F.R. § 51.53(c)(3)(iv) require that "new and significant information" not previously considered by the NRC in an environmental impact statement (EIS) be included in the ER.[96] More specifically, the AG argues that the regulation requires the ER to include new and significant information even if it concerns a Category 1 matter otherwise covered in the GEIS.[97] Also, just as PW

[91] PW Petition at 62-71.

[92] *See id.* at 73-75.

[93] *See id.* at 75-77.

[94] AG Petition at 23.

[95] *Id.* at 21.

[96] *Id.* at 15. The AG acknowledges that the NRC issued a generic EIS (GEIS) to evaluate many of the common environmental impacts of license renewals and therefore NRC regulations do not require the preparation of a complete ER and EIS for all aspects of each license renewal application. AG Petition at 12-13 (citing 10 C.F.R. §§ 51.53(c)(3)(i), 51.71(d)). However, the AG points to 10 C.F.R. § 51.53(c)(3)(iv), which, consistent with the Court's decision in *Marsh*, 490 U.S. at 374, requires that an ER "contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware." AG Petition at 15.

[97] AG Petition at 15; AG Reply at 8.

does, the AG asserts that such new and significant information exists concerning the potential impact of an accident involving a high-density spent fuel pool storage facility, and that the ER is deficient because it fails to include such new and significant information.[98] The AG argues that he has presented "sufficient information to create a 'genuine material dispute of fact or law adequate to warrant further inquiry' into the question of whether the likelihood of a pool fire falls within the range of probability considered reasonably foreseeable by the NRC."[99]

The AG summarizes the key principles arising out of the "new and significant information" he submits, relating to the risks of a spent fuel pool fire, as follows:

> (a) if the water level in a fuel storage pool drops to the point where the tops of the fuel assemblies are uncovered, the fuel will burn, (b) the fuel will burn regardless of its age, (c) the fire will propagate to other assemblies in the pool, and [d] the fire may be catastrophic.[100]

The AG supports his allegation that such new and significant information exists with five "facts or expert opinion[s]"[101]: (1) the expert declaration and report of Dr. Gordon Thompson,[102] (2) the expert declaration and report of Dr. Jan Beyea,[103] (3) excerpts from NUREG-1738, (4) the 2006 "Safety and Security of Commercial Spent Nuclear Fuel Storage" report of the National Academy of Sciences,[104] and (5) the terrorist attacks of September 11, 2001.[105]

[98] *See* AG Petition at 22; PW Petition at 50.

[99] AG Petition at 23 (citing *Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), LBP-00-19, 52 NRC 85, 97-98 (2000)).

[100] *Id.* at 22.

[101] *See id.*

[102] AG Petition, Exh. 1, Decl. of Dr. Gordon Thompson in Support of [AG]'s Contention and Petition for Backfit Order (May 25, 2006).

[103] AG Petition, Exh. 2, Decl. of Dr. Jan Beyea in Support of [AG]'s Contention and Petition for Backfit Order (May 25, 2006).

[104] AG Petition, Exh. 4, Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, Board on Radioactive Waste Management, National Research Council, Safety and Security of Commercial Spent Nuclear Fuel Storage: Public Report (Washington, DC: National Academies Press, 2006). This report is also cited by PW in support of its Contention 4. *See* PW Petition at 65.

[105] *See, e.g.*, AG Petition at 22, 33-40. As indicated above, the Attorney General also, on June 16, 2006, filed a letter requesting the Licensing Board to apply the June 2, 2006, decision of the U.S. Court of Appeals for the Ninth Circuit in the case, *San Luis Obispo Mothers for Peace v. Nuclear Regulatory Commission*, "by ruling that the environmental impacts of an intentional attack on the Pilgrim fuel storage pool must be addressed in an EIS, or seek appropriate guidance from the Commission." AG Letter at 2. (In *Mothers for Peace*, the Court reversed the Commission's determination that NEPA does not require an analysis of the environmental impact of terrorism, in that the NRC's "categorical refusal to consider the environmental effects of a terrorist attack" is unreasonable under NEPA. Thus,

(Continued)

The AG argues that NRC never considered this information in its original EIS for Pilgrim or in the GEIS for license renewals, and that Entergy's failure to include this new and significant information in its ER thus contravenes 10 C.F.R. § 51.53(c)(3)(iv) and the Supreme Court decision in the *Marsh* case.[106] The AG also contends that the environmental impacts of a spent fuel pool accident must be considered by the Staff in the SEIS in order for the Staff to comply with its obligation to consider significant new information relevant to the environmental impacts of license renewal because this information has not been considered by the NRC in a previous EIS.[107] Further, the AG asserts, when the likelihood of a terrorist attack is taken into account, the estimated probability of this type of accident is within the range that must be discussed in an ER and EIS.[108]

With respect to its argument that the ER is deficient because it does not consider reasonable alternatives for avoiding or mitigating the environmental impacts of a severe spent fuel pool fire, the AG contends that a combination of two potential SAMAs "would virtually eliminate the vulnerability of the Pilgrim fuel pool to attack": low-density racking of fuel assemblies in the pool, and dry storage in casks.[109]

1. *Entergy Answer to Massachusetts AG Contention and Pilgrim Watch Contention 4*

Entergy opposes both the AG's contention and Pilgrim Watch Contention 4, claiming that the environmental impacts of spent fuel storage are codified as Category 1 environmental issues, and thus are beyond the scope of this license renewal proceeding.[110] According to Entergy, the attempt to bring these issues within the scope of the proceeding by invoking section 51.53(c)(3)(iv) falls short because the generic Category 1 findings resulting from the analysis of the GEIS

the Court found, the "EA [environmental assessment] prepared in reliance on that determination is inadequate and fails to comply with NEPA's mandate." 449 F.3d at 1028, 1035. The Court denied the petition for review with regard to additional claims by the petitioner that the NRC's actions had violated the Atomic Energy Act and the Administrative Procedure Act, noting among other things that NRC's "reliance on its own prior opinions in its decision in this case does not violate the APA's notice and comment provisions," and that "[t]he agency has the discretion to use adjudication to establish a binding legal norm." *Id.* at 1027.)

[106] *See* AG Petition at 23, 24-30.

[107] *Id.* at 15, 21.

[108] *Id.* at 33-41.

[109] *Id.* at 41; *see also id.* at 23, 47. As discussed above, *see supra* pp. 281-82, PW also suggests these same two mitigation alternatives. *See* PW Petition at 73.

[110] *See* Entergy Answer to AG Petition at 11-13 (citing 10 C.F.R. Part 51, App. B, Table B-1, 10 C.F.R. §§ 51.53(c), 51.95(c)); Entergy Answer to PW Petition at 46-48 (citing 10 C.F.R. Part 51, App. B, Table B-1, 10 C.F.R. §§ 51.53(c), 51.95(c); GEIS at 6-72–6-75).

are NRC rules and, as such, may only be challenged or altered upon the granting of a waiver or rulemaking petition.[111] Moreover, Entergy argues that the recent decision in *San Luis Obispo Mothers for Peace v. NRC* is inapplicable here because Commission case law establishes that, even if terrorism issues require analysis under NEPA, the GEIS concluded that "if such an event were to occur, the resultant core damage and radiological release would be no worse than those expected from internally initiated events."[112]

Entergy challenges the AG's claim that new and significant information exists, arguing that the risks associated with high-density racking in spent fuel pools were known and considered by NRC long ago and that nothing new is contained in the AG's exhibits.[113] In any event, Entergy asserts, none of the sources cited by the Attorney General contain new or significant information, or "controvert[ ] the conclusion in the GEIS that the occurrence of a zirconium spent fuel pool fire is 'highly remote.'"[114] In addition, the NRC "has fully considered the NAS report and found no basis, even in the context of a terrorist attack, to change its conclusion regarding the risks of spent fuel pool fires stated in the GEIS,"[115] and has concluded that the Alvarez report cited in the Thompson and Beyea reports "suffer[s] from excessive conservatisms, with the result that its recommendations do not have a sound technical basis."[116] Entergy characterizes the claims of the Thompson report as being "broad, unsupported claims," and argues that the Attorney General's contention is "not supported by any credible basis establishing the probability of a spent fuel fire or demonstrating that it is sufficiently foreseeable to warrant consideration under NEPA."[117]

Entergy also argues that SAMAs are limited to nuclear reactor accidents and do not include spent fuel storage accidents,[118] that the challenge to the Waste Confidence rule is based upon information that is neither new nor significant,[119] and that PW's remaining arguments provide insufficient support to admit the contentions at issue.[120]

[111] Entergy Answer to AG Petition at 13; Entergy Answer to PW Petition at 49-50.

[112] Entergy Answer to AG Petition at 26 (quoting *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-26, 56 NRC 358, 365 n.24 (2002)); Entergy Answer to PW Petition at 54.

[113] *See* Entergy Answer to AG Petition at 14-15.

[114] *Id.* at 15; *see id.* at 15-16.

[115] *Id.* at 15-16.

[116] *See id.* at 16, 17.

[117] *Id.* at 19, 25; *see id.* at 17-25.

[118] *See* Entergy Answer to PW Petition at 48-49.

[119] *Id.* at 51 (citing *Oconee*, CLI-99-11, 49 NRC at 344-45).

[120] *See id.* at 51-56.

2. *NRC Staff Response to Massachusetts AG Contention and Pilgrim Watch Contention 4*

The Staff likewise argues that Category 1 environmental issues are outside of the scope of license renewal proceedings, citing 10 C.F.R. § 51.53(c)(2) and *Turkey Point*[121] for the proposition that a license renewal ER need not provide information regarding the storage of spent fuel.[122] The Staff also relies on *Turkey Point* in arguing that an ER need not address SAMAs for mitigating spent fuel pool accidents.[123] According to the Staff, by asking the Board to address a spent fuel storage issue, the AG and PW essentially seek to have the Board treat spent fuel pool issues as a Category 2 issue, which runs counter to the prohibition against challenging a regulation in an adjudicatory proceeding without seeking a waiver.[124] The Staff also argues that the information in the AG petition is not new and, therefore, need not be included in Entergy's ER as it has already been presented to the NRC.[125] Finally, the Staff asserts that, to the extent the AG's contention attempts to raise terrorism issues, these issues are also outside of the scope of the proceeding.[126]

3. *Massachusetts AG and Pilgrim Watch Replies to Entergy and NRC Staff*

In its reply to Entergy and the Staff, the AG argues that the case law and regulatory history make clear that "Category 1 impacts are included in the scope of the new and significant impacts that must be discussed in an ER pursuant to 10 C.F.R. § 51.53(c)(3)(iv)."[127] The AG maintains that the alternative procedures suggested in *Turkey Point* (e.g., the filing of a waiver petition or a rulemaking petition) are inconsistent with NEPA as construed by the Supreme Court in *Marsh*.[128] Further, the AG asserts that *Turkey Point* is inapposite because it did not deal with a contention alleging new and significant information, and that its discussion of issues relating to new and significant information is dicta.[129] The AG goes on to explain how in its view the information in its petition is indeed "new and significant."[130] Finally, the AG asks the Board to rule that NEPA requires that Entergy and the Staff consider the environmental impacts of an intentional attack on the Pilgrim spent fuel pool, and then to refer its ruling to the Commission to determine the applicability of the *Mothers for Peace* decision.[131]

Pilgrim Watch replies that the inclusion of onsite spent fuel as a Category 1 issue under "Uranium Fuel Cycle" in Appendix B to Subpart A of Part 51 relates only to normal operations and "does not prevent it from being a Category 2 issue for the purposes of 'Severe Accidents.'"[132] PW cites the Licensing Board's decision in *Turkey Point* as distinguishing SAMAs when it denied a contention relating only to "severe accidents" and not SAMAs,[133] and argues that the alternative procedural avenues of waiver and rulemaking petitions are inconsistent with *Marsh* and NEPA's requirement for supplementation of EISs.[134] It further argues that the issue it has raised is site-specific rather than generic, and that it has "submitted new and significant information which casts doubt on the current generic treatment of this issue and supports its contention that NEPA requires that this issue be reviewed as part of the license renewal process."[135] PW makes similar arguments in its Reply to the Staff,[136] and also cites the *Mothers for Peace* decision[137] in support of its contention insofar as it raises terrorist attacks as a new and significant issue.[138]

---

[121] *Turkey Point*, CLI-01-17, 54 NRC at 6-13.

[122] *See* Staff Response to AG Petition at 10-12; Staff Response to PW Petition at 34-36; *see also Turkey Point*, CLI-01-17, 54 NRC at 6-13.

[123] *See* Staff Response to AG Petition at 9-11; Staff Response to PW Petition at 34-36 (citing *Turkey Point*, CLI-01-17, 54 NRC at 21-22).

[124] *See* Staff Response to AG Petition at 10-11, 14; Staff Response to PW Petition at 36.

[125] *See* Staff Response to PW Petition at 37; Staff Response to AG Petition at 15-18.

[126] *See* Staff Response to AG Petition at 19-20; Staff Response to PW Petition at 38.

[127] AG Reply at 8.

[128] *See id.* at 9-10. The Attorney General has also argued that, "in order to get a hearing and in order to raise a legitimate contention," the "one door" open to it was to file a contention, Tr. at 87, in part because it did not believe it met the requirements for a waiver under 10 C.F.R. § 2.335 that "*special circumstances with respect to the subject matter of the particular proceeding* [must be] such

(Continued)

that application of the rule . . . would not serve the purposes for which the rule . . . was adopted," or as characterized by the Commission in *Turkey Point*, in which it stated that "[i]n the hearing process . . . petitioners with new information showing that a generic rule would not serve its purpose at a particular plant may seek a waiver of a rule," but "[p]etitioners with evidence that a generic finding is incorrect for all plants may petition [for a] rulemaking." *Turkey Point*, CLI-01-17, 54 NRC at 12; *see* Tr. at 88-90, 109-115, 138-40. The AG argues that the "new and significant information" at issue concerns not only the Pilgrim plant but also others. Tr. at 88. As indicated above, *see supra* note 4, the AG has filed a rulemaking petition.

[129] AG Reply at 11.

[130] *See id.* at 12-27.

[131] *Id.* at 27-28.

[132] PW Reply to Entergy at 25.

[133] *Id.* at 26-27.

[134] *Id.* at 27-28.

[135] *Id.* at 30; *see id.* at 28-30.

[136] PW Reply to NRC Staff at 19-20.

[137] *See id.* at 20.

[138] *Id.* at 20-21.

4. *Licensing Board Ruling on Massachusetts AG Contention and PW Contention 4*

We find these contentions to be inadmissible, on two separate grounds. We address first the Petitioners' arguments (primarily espoused by Pilgrim Watch) that the contentions should be admitted because they raise matters relating to "severe accidents" and "severe accident mitigation alternatives," or "SAMAs," a site-specific Category 2 issue[139] that must be addressed in a license renewal under 10 C.F.R. § 51.53(c)(ii)(L) and Appendix B to Subpart A of 10 C.F.R. Part 51. For reasons we set forth in some detail below, we find that these arguments fail because of Commission precedent interpreting the term, "severe accidents," to encompass only reactor accidents and not spent fuel pool accidents, which fall within the analysis of the generic Category 1 issue of onsite storage of spent fuel.

Next, we address the Petitioners' arguments (indeed, the Attorney General's central argument) that the contentions should be admitted because they challenge the Applicant's failure to address various matters that they contend constitute "new and significant information," which must be addressed under 10 C.F.R. § 51.53(c)(3)(iv), *even if* they concern a Category 1 issue. Again, these arguments fail in the face of Commission precedent, in this instance establishing that, notwithstanding the responsibility of an applicant in its ER (and the NRC Staff in the SEIS) to address "new and significant information" relating even to Category 1 issues, an *alleged failure to address* such "new and significant information" does not give rise to an admissible contention, absent a waiver of the rule in 10 C.F.R. § 51.53(c)(3)(i) that Category 1 issues need not be addressed in a license renewal.

We would note with regard to both of these issues that the analysis that brings us to our conclusions regarding them does not follow an entirely straight path, primarily because relevant rules in neither instance directly resolve the issues in question. However, Commission precedent in the *Turkey Point* license renewal proceeding, interpreting the rules in question and the regulatory framework within which they fall, mandates our rulings on both issues.

We note further that we do *not* rule herein on two other questions relating to the contentions at issue. First, in light of our rulings on the preceding two primarily legal issues, we need not, and do not, go into the question whether either Petitioner has sufficiently supported either contention insofar as it alleges as a factual matter that there exists "new and significant information" that should have been addressed by the Applicant, relating to the risks and environmental impacts of high-density racking in, and accidents involving, spent fuel pools. Nor

[139] *See supra* Section IV.B, discussion of "Category 1," or "generic" issues, and "Category 2," or "site-specific" issues.

should our rulings herein be interpreted as suggesting a finding on this in either direction.

Second, regarding the Petitioners' arguments based on the Ninth Circuit's decision in *Mothers for Peace v. NRC*, we again follow Commission precedent, in this instance declining to rule on such matters at this time in light of the procedural posture of that case. We recognize, as another Licensing Board has recently observed (ruling in the *Vermont Yankee* license renewal proceeding on a virtually identical contention filed by the Massachusetts Attorney General in that case), that the *Mothers for Peace* decision might impact our rulings herein.[140] However, a majority of the Commission has recently issued two rulings declining to apply the Court's decision in *Mothers for Peace* in NRC proceedings at this time. First, in the NRC proceeding from which the *Mothers for Peace* decision arose, it denied Petitioners' motion for various relief based on the Court's decision, finding it "unnecessary and premature," and noting as well that the Court's ruling did not "circumscrib[e] the procedures that the NRC must employ" for addressing terrorism in the NEPA context and thus the Commission has "maximum procedural leeway" to address the issue.[141] Second, it postponed addressing a request of the State of New Jersey in the *Oyster Creek* license renewal proceeding that it consider the Ninth Circuit's decision in ruling on the State's appeal of the Licensing Board's denial of its contention relating, *inter alia*, to SAMAs and spent fuel pool vulnerability.[142] Based upon this authority, we also will refrain from issuing a ruling based on the *Mothers for Peace* decision at this time, without, however, foreclosing the possibility that future pleadings may be filed based on future developments in that case, as appropriate at such time.

a. *Ruling on "Severe Accident"- and SAMA-Related Arguments*

As indicated above, the critical determinative issue relating to severe accidents and SAMAs is what the term "severe accident" encompasses, thus defining what accidents are to be examined in the context of a "*severe accident* mitigation alternatives," or "SAMA," analysis. At first blush, the arguments of PW and the AG, to the effect that severe accidents include spent fuel pool accidents and that a SAMA analysis must therefore address such accidents, seem plausible. The Licensing Board in *Turkey Point* indeed distinguished SAMAs in denying contentions concerning "severe accidents" that contained no mention of "mitigation

[140] *Entergy Nuclear Vermont Yankee, LLC* (Vermont Yankee Nuclear Power Station), LBP-06-20, 64 NRC 131, 160 (2006) (citing 449 F.3d at 1016).

[141] *See Pacific Gas and Electric Co.* (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation), CLI-06-23, 64 NRC 107, 108 (2006).

[142] *See Amergen Energy Co., LLC* (Oyster Creek Nuclear Generating Station), CLI-06-24, 64 NRC 111, 115 (2006).

alternatives," which is the crux of a SAMA.[143] In addition, NRC regulations offer little guidance, providing neither a definition of the term "severe accident," nor stating explicitly whether the "severe accidents" to be examined in SAMA analyses include or exclude spent fuel pool accidents.

Section 51.53(c)(3)(ii) states that the environmental report must contain analyses of the environmental impacts of the proposed action that are identified as Category 2 issues in Appendix B to Subpart A of Part 50, and then goes on to recount in narrative form the same issues identified as Category 2 issues in Appendix B (with SAMAs addressed in section 51.53(c)(3)(ii)(L)). It does not, however, define "severe accidents" or "SAMAs," or limit SAMAs in any way other than as stated in subsection (L) — i.e., "a consideration of alternatives to mitigate severe accidents must be provided" only "[i]f the staff has not previously considered severe accident mitigation alternatives for the applicant's plant in an [EIS] or related supplement or in an environmental assessment." And the entry in Appendix B, Table B-1, likewise provides no assistance on the question before us, stating merely as follows:

> Severe accidents — 2 — SMALL. The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives. See § 51.53(c)(ii)(L).

Certainly, "severe accidents" is a term of art long used in the nuclear industry and incorporated into Commission guidance documents, including NUREG-1150, which is focused singularly upon accidents involving damage to the

[143] *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), LBP-01-6, 53 NRC 138 (2001). That Licensing Board stated:

> [S]ection 51.53 does not require the Applicant broadly to consider severe accident risks. Rather, it only requires the Applicant to consider 'severe accident mitigation alternatives' (SAMAs). 10 C.F.R. § 51.53(c)(3)(ii)(L). The Commission, therefore, has left consideration of SAMAs as the only Category 2 issue with respect to severe accidents, but this portion of Ms. Lorion's contention does not seek to raise any issue related to severe accident mitigation alternatives. Her contention neither identifies any mitigation alternatives that should be considered nor challenges the Applicant's evaluation of SAMAs in its environmental report.

Id. at 160-61. Further:

> Mr. Oncavage's allegation that an accident involving spent fuel is a Category 2 issue does not make the contention admissible. As discussed earlier (*see supra* p. 160), only severe accident mitigation alternatives may be considered for license renewal severe accident Category 2 issues, and Mr. Oncavage has not raised any issue involving mitigation alternatives.

Id. at 165.

reactor core.[144] But the rules themselves contain no such reference or limitation.

The most on-point source on the issue is Commission case law in the *Turkey Point* proceeding. It must be noted that, when it considered the question of severe accidents and SAMAs, on the appeal of one of the petitioners in that proceeding, the Commission endorsed the distinction made by the Licensing Board, between the need to propose a SAMA and the more substantive question of risk associated with severe accidents.[145] It then went on, however, to focus upon what is essentially an alternative, and ultimately more significant, rationale for its ruling upholding the denial of the contention in question — that SAMAs apply only to reactor accidents, not to spent fuel pool accidents.[146]

It is argued that the Commission's language in this regard is "gratuitous," on an issue that did not need to be decided directly.[147] The length and specificity of the Commission's discussion, however, belies such an interpretation, and suggests that the Commission saw this second ground for its ruling as being more important than, and indeed in effect rendering irrelevant, the question whether that petitioner mentioned SAMAs in his "severe accident" contention. We quote at length from this discussion in order to illustrate this:

> *a. Onsite Storage of Spent Fuel Is a Category I Issue*
>
> Our rules explicitly conclude that "[t]he expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available." Table B-1, Subpart A, Appendix B to Part 51. *See Oconee*, CLI-99-11, 49 NRC at 343-44. The GEIS provides the background analyses and justification for this generically applicable finding. *See* GEIS at 6-70 to 6-86. It finds "ample basis to conclude that continued storage of existing spent fuel and storage of spent fuel generated during the license renewal period can be accomplished safely and without significant environmental impacts." *Id.* at 6-85. The GEIS takes full account of "the total accumulated volumes of spent fuel after an additional 20 years of operation." *Id.* at 6-79; *see also id.* at 6-80 to 6-81.
>
> *The GEIS's finding encompasses spent fuel accident risks and their mitigation. See* GEIS, at xlviii, 6-72 to 6-76, 6-86, 6-92. The NRC has spent years studying in great detail the risks and consequences of potential spent fuel pool accidents,

[144] NUREG-1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants" (Dec. 1990). *See also* Policy Statement on Severe Reactor Accidents Regarding Future Designs and Existing Plants, 50 Fed. Reg. 32, 138 (Aug. 1985).

[145] *Turkey Point*, CLI-01-17, 54 NRC at 21-22.

[146] *Id.*

[147] *See* PW Reply to NRC Staff at 19.

and the GEIS analysis is rooted in these earlier studies. NRC studies and the agency's operational experience support the conclusion that onsite reactor spent fuel storage, which has continued for decades, presents no undue risk to public health and safety. Because the GEIS analysis of onsite spent fuel storage encompasses the risk of accidents, Contention 2 falls beyond the scope of individual license renewal proceedings.

Mr. Oncavage argues, however, that a "catastrophic radiological accident at a spent fuel facility would be a severe accident which is a category 2 issue." Amended Petition at 2. Part 51 does provide that "alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives." *See* Appendix B to Subpart A of Part 51; *see also* GEIS at 5-106 to 5-116. But Mr. Oncavage's Contention 2 says nothing about mitigation alternatives. And, *in any event, Part 51's reference to "severe accident mitigation alternatives" applies to nuclear reactor accidents, not spent fuel storage accidents. Not only Mr. Oncavage, but also the NRC Staff and FPL, apparently was confused on this point, for no one raised the important distinction between reactor accidents and spent fuel accidents.* As we have seen, the GEIS deals with spent fuel storage risks (including accidents) generically, and concludes that "regulatory requirements already in place provide adequate mitigation." GEIS at 6-86, 6-92, xlviii; *see also id.* at 6-72 to 6-76.

On the issue of onsite fuel storage, then, the GEIS rejects the need for further consideration of mitigation alternatives at the license renewal stage. Id. Indeed, for all issues designated as Category 1, the Commission has concluded that additional site-specific mitigation alternatives are unlikely to be beneficial and need not be considered for license renewal. *See* 61 Fed. Reg. at 28,484; GEIS at 1-5, 1-9.

The NRC customarily has studied reactor accidents and spent fuel accidents separately. For instance, our "*Policy Statement on Severe Reactor Accidents Regarding Future Designs and Existing Plants*" discusses only reactor accidents *and defines "[s]evere nuclear accidents [as] those in which substantial damage is done to the reactor core whether or not there are serious offsite consequences."* 50 Fed. Reg. 32,138 (Aug. 1985) (emphasis added). Similarly, the various NRC studies on severe accidents typically focus upon potential damage to the reactor core of nuclear power plants.[10] A different set of studies altogether is devoted to spent fuel pool accidents, and has concluded that the risk of accidents is acceptably small.[11] Hence, Part 51 and the GEIS treat the matter generically. Indeed, the events that could lead to a severe reactor accident vary significantly from plant to plant, thereby requiring plant-specific consideration, whereas accidents involving spent fuel pools or dry casks are more amenable to generic consideration.

[Discussion of possibility of spent fuel pool accidents caused by hurricanes.] Mr. Oncavage did not seek a waiver of the Category 1 determination for spent fuel issues, nor did his hurricane discussions raise any information that might render the GEIS's Category 1 finding inapplicable to the Turkey Point facility. Nothing in Mr. Oncavage's "hurricane" claim renders it litigable under our license renewal rules.

In short, Part 51's license renewal provisions cover environmental issues relating to onsite spent fuel storage generically.[14] All such issues, including accident risk, fall outside the scope of license renewal proceedings.

[FN10] *See, e.g.*, NUREG-1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants (Dec. 1990) (examining core meltdown risks); NUREG/CR-5042, "Evaluation of External Hazards to Nuclear Power Plants in United States" (Dec. 1987) (examining the risk of core damage from external events).

[FN11] *See, e.g.*, NUREG-1353, "Regulatory Analysis for the Resolution of Generic Issue 82, 'Beyond Design Basis Accidents in Spent Fuel Pools' (April 1989); NUREG/CR-4982, "Severe Accidents in Spent Fuel Pools in Support of Generic Safety Issue 82" (July 1987); NUREG/CR-5281, "Value/Impact Analyses of Accident Preventive and Mitigative Options for Spent Fuel Fools" (Mar. 1989); NUREG/CR-5176, "Seismic Failure and Cask Drop Analysis of the Spent Fuel Pools at Two Representative Nuclear Power Plants (Jan. 1989). A recent study of spent fuel storage risks at decommissioning reactors finds the risk of accident somewhat greater than originally believed, but still very low. *See* NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants (Feb. 2001).

[FN14] [Discussion noting that Waste Confidence rule applies only to storage of spent fuel after a reactor ceases operation.] As we hold in the text, it is Part 51, with its underlying GEIS, that precludes litigation of that issue.[148]

The Commission in the preceding passage clearly did not address merely in passing the issue of whether the severe accidents to be addressed in a SAMA analysis under 10 C.F.R. Part 51 include spent fuel pool accidents. Rather, it explicitly noted that all participants in that proceeding had overlooked the "important distinction between reactor accidents and spent fuel accidents," going into great detail discussing the differences between reactor and spent fuel pool accidents, and explaining why it found that SAMAs do not apply to accidents involving spent fuel pools. It cited the GEIS extensively in support of its statements to this effect. The passage indeed may be read as emphasizing that, even were the contention in question there to have been read as implicitly bringing SAMAs into play, it would not have been deemed admissible. In this light, and taking into account the references to the cited portions of the GEIS, noted by the Commission as underlying Part 51 of the regulations, while we might observe that it would have been preferable to include specific language in the actual SAMA rule limiting SAMAs to reactor accidents if that is what was intended, the Commission is hardly equivocal in the interpretation provided in the passage quoted above.

On this basis, we are constrained to find the Massachusetts AG Contention and PW Contention 4 to be inadmissible insofar as they are based on the SAMA-related arguments summarized above.

---

[148] *Turkey Point*, CLI-01-17, 54 NRC at 21-23 (emphasis added).

000028

b. *Ruling on Legal Issues Involved in "New and Significant Information"-Related Arguments*

We likewise must find the contentions at issue to be inadmissible insofar as they are based on the requirement of 10 C.F.R. § 51.53(c)(3)(iv) that the ER "must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware."

Again, the rule itself does not dictate this ruling. Indeed, section 51.53(c)(3)(iv) may be read as in effect creating an exception to section 51.53(c)(3)(i)'s allowance that an applicant's ER "is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in Appendix B." Commission precedent supports this reading that the requirement of section 51.53(c)(3)(iv) applies not only to Category 2 issues but also to Category 1 issues — at least to the extent that it applies to the responsibilities of the Applicant and the Staff. In *Turkey Point* the Commission stated that, "[e]ven where the GEIS has found that a particular impact applies generically (Category 1), the applicant *must still provide* additional analysis in its Environmental Report if new and significant information may bear on the applicability of the Category 1 finding at its particular plant."[149] Later, in the *McGuire* proceeding, the Commission reinforced this ruling, stating again that "the applicant must provide additional analysis of even a Category 1 issue if new and significant information has surfaced."[150] Similarly, the Commission has indicated in its rulemaking that the Staff must, when preparing the SEIS, consider any significant new information related to Category 1 issues.[151]

On the basis of the foregoing, one might read subsection (c)(3)(iv) of section 51.53 as an exception to subsection (c)(3)(i) also in an adjudication context, particularly in light of the Commission's statement in *Turkey Point* that "[a]djudicatory hearings in individual license renewal proceedings will share the same scope of issues as our NRC Staff review."[152] Thus the Petitioners' argument, that an alleged failure of an applicant to comply with the requirement of section 51.53(c)(3)(iv) may give rise to an admissible contention (assuming proper support under the contention admissibility rules), might also be persuasive — but for other statements of the Commission in *Turkey Point* that lead to a contrary conclusion.

[149] *Id.* at 11 (emphasis added).

[150] *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-14, 55 NRC 278, 290 (2002).

[151] *See* 10 C.F.R. §§ 51.92(a)(2), 51.95(c)(3); 61 Fed. Reg. at 28,470. In addition, in *Turkey Point* the Commission stated that the "final SEIS also takes account of public comments, including . . . new information on generic findings." *Turkey Point*, CLI-01-17, 54 NRC at 12; *see also McGuire/Catawba*, CLI-02-14, 55 NRC at 290-91.

[152] *Turkey Point*, CLI-01-17, 54 NRC at 10.

In these other statements, the Commission has indicated that any new and significant information on matters designated as Category 1 issues in Part 51 may be initiated by petitioners only through means other than the submission of contentions. First, the Commission identified three specific options that individuals and petitioners might pursue to address new and significant information that may have arisen after the GEIS on Category 1 issues was finalized:

> The Commission recognizes that even generic findings sometimes need revisiting in particular contexts. Our rules thus provide a number of opportunities for individuals to alert the Commission to new and significant information that might render a generic finding invalid, either with respect to all nuclear power plants or for one plant in particular. In the hearing process, for example, petitioners with new information showing that a generic rule would not serve its purpose at a particular plant may seek a waiver of the rule. . . . Petitioners with evidence that a generic finding is incorrect for all plants may petition the Commission to initiate a fresh rulemaking. . . . Such petitioners may also use the SEIS notice and comment process to ask the NRC to forgo use of the suspect generic finding and to suspend license renewal proceedings, pending a rulemaking or updating of the GEIS. *See* 61 Fed. Reg. at 28,470; GEIS at 1-10 to 1-11.[153]

Later in its decision, in the specific context of spent fuel pool accidents (which, as indicated above, it found to fall within the Category 1 issue of onsite storage of spent fuel[154]), the Commission made clear that its intent was that these options were to be the exclusive options open to members of the public on the issue, stating that "Part 51 treats all spent fuel accidents, whatever their cause, as generic, Category 1 events *not suitable for case-by-case adjudication*."[155] Further, removing any doubt as to its intent, the Commission added, "As we hold in the text, it is part 51, with its underlying GEIS, that *precludes the litigation* of that issue."[156]

As the *Vermont Yankee* Licensing Board noted in its decision in that license renewal proceeding, the preceding reading of *Turkey Point* is consistent with the regulatory history of 10 C.F.R. § 51.53(c)(3)(iv).[157] The requirement that the ER include any new and significant information was not part of the original proposed

[153] *Turkey Point*, CLI-01-17, 54 NRC at 12. We note that the Commission's language referring to the waiver process when information relates to "a particular plant" supports the AG's argument that it would need to show some special circumstances relating to the Pilgrim plant in particular in order to qualify for a waiver. *See supra* note 128.

[154] *See Turkey Point*, CLI-01-17, 54 NRC at 21-23; 10 C.F.R. Part 51, App. B, Table B-1.

[155] *Id.* at 22 (emphasis added).

[156] *Id.* at 23 n.14 (emphasis added).

[157] *See Vermont Yankee*, LBP-06-20, 64 NRC at 157-59.

rule.[158] It was added in the final rule in response to objections from the Council on Environmental Quality (CEQ), the U.S. Environmental Protection Agency (EPA), and members of the public. As the Commission noted:

> Federal and State agencies questioned how new scientific information could be folded into the GEIS findings because the GEIS would have been performed so far in advance of the actual renewal of an operating license. . . . A group of commenters, including CEQ and EPA noted that the rigidity of the proposed rule hampers the NRC's ability to respond to new information or to different environmental issues not listed in the proposed rule.[159]

The Commission in response added 10 C.F.R. § 51.53(c)(3)(iv), to expand "the framework for consideration of significant new information."[160] The Statement of Considerations to the final rule refers to SECY-93-032, a Staff memorandum to the Commission proposing certain rule changes, including the addition of the provision in 10 C.F.R. § 51.53(c)(3)(iv), to resolve the CEQ and EPA concerns.[161] One of the proposed changes was that "[l]itigation of environmental issues in a hearing will be limited to unbounded category 2 and category 3 issues unless the rule is suspended or waived."[162] The Commission approved modification of the proposed rule and specifically endorsed SECY-93-032.[163] Commission approval of SECY-93-032 may thus be read as demonstrating that, when the Commission adopted the final rule, it contemplated that Category 1 issues could be litigated only after the granting of a waiver petition pursuant to 10 C.F.R. § 2.335, suspending the provision in 10 C.F.R. § 51.53(c)(3)(i) that an ER need not address "Category 1" issues and thus allowing Petitioners to challenge a failure of the ER to address alleged "new and significant information" with regard to such an issue.[164]

---

[158] *See* Proposed Rule: "Environmental Review for Renewal of Operating Licenses," 56 Fed. Reg. 47,016, 47,027-28 (Sept. 17, 1991).

[159] 61 Fed. Reg. at 28,470.

[160] *Id.*

[161] *See id.*; SECY-93-032, Memorandum from James M. Taylor, EDO, to the Commissioners (Feb. 9, 1993) (ADAMS Accession No. ML051660667).

[162] SECY-93-032 at 4. We note that Category 2 and 3 issues were eventually combined into Category 2. *See* 61 Fed. Reg. at 28,474.

[163] Memorandum from Samuel J. Chilk, Secretary, to James M. Taylor, EDO (Apr. 22, 1993) (ADAMS Accession No. ML003760802).

[164] The additional change to the rule combining "category 2" and "category 3" issues into, simply, "category 2," would itself not appear to alter this conclusion, as the pertinent distinction being drawn was between those issues that were generic and those that were plant-specific, which would not affect the procedures contemplated vis a vis members of the public who might want to challenge an applicant's failure to address "new and significant information" about an otherwise "category 1" issue.

The failure to adopt an actual rule provision stating that "litigation of environmental issues in a hearing will be limited to category 2 issues unless the rule is suspended or waived" might well, as argued by Petitioners, be taken to indicate that the Commission ultimately decided against such a provision, except for subsequent indications of the Commission's intent to the contrary, both at the rulemaking stage and in its later *Turkey Point* decision, as discussed above. With respect to the former, we consider a dialogue that occurred when the Commission was deliberating the final rule and discussing SECY-93-032.[165] The briefing covered the resolution of the CEQ and EPA objections and included an exchange between Commissioner James R. Curtiss and Martin Malsch, the Deputy General Counsel for Licensing and Regulation. Twice the Commissioner asked whether, under 10 C.F.R. § 51.53(c)(3)(iv) or any other part of the license renewal regulations, a petitioner could litigate a Category 1 issue on the claim that there was new and significant information on the issue.[166] The Deputy General Counsel of NRC answered that such a claim could not be litigated without first obtaining approval, in the form of a waiver, from the Commission itself.[167] With

---

[165] *See* Public Meeting, "Briefing on Status of Issues and Approach to GEIS Rulemaking for Part 51" (Feb. 19, 1993) (ADAMS Accession No. ML051660665).

[166] *Id.* at 14.

[167] *See id.* The discussion in question was as follows:

> Commissioner Curtiss: "[A]ssume for the sake of discussion that the staff says, "This is not significant new information," is that kind of issue subsequently one that can be or you intend to be cognizable before the board?
>
> Mr. Malsch: Well, it would depend. If the information is — the basic answer is they have to come to the Commission first. If the information is considered significant by the interested party and staff says, "Now, this is not significant." If it's generic information, then the remedy is a petition for rulemaking and that usually comes to the Commission. Before the Commission would grant a petition for rulemaking, it would consider the merits of the information. If the information is site specific, then they'd need to petition for a waiver. But after being screened by the board, the board is referred to the Commission and only the Commission can grant waivers. So, again it comes before the Commission.
>
> So, the procedural route is somewhat different, but no matter how it gets there, the Commission would be looking at the staff judgment, looking at what other parties say about it, and making its own determination about significance.
>
> . . . .
>
> Commissioner Curtiss: So, there's no circumstance, in other words, where you envision that once a determination is made under the procedures that you've described with regard to the significance of the information by the Commission upon the staff's recommendation, that we would then in turn need to litigate before the board the significance of that information, whether it was or wasn't significant?
>
> Mr. Malsch: Not without the Commission's approval.

Id.

this understanding of the regulations, the Commission approved and finalized section 51.53(c)(3)(iv).[168]

With regard to whether the NRC's resolution of the matters raised by the CEQ and EPA commenters — requiring applicants and the NRC Staff to address any "new and significant information" but taking the position that any alleged lack of such information could *not* be the subject of an admissible contention absent a waiver — satisfies NEPA and case law interpreting it including the *Marsh* case, we find that this would not contravene such law, given that other means are provided for public participation in the SEIS process. It is not required that the public participation aspect of NEPA be accomplished in an adjudicatory proceeding.[169]

Again, while it might have been preferable to have written into the rule itself the prohibition on allowing contentions based on the exception to section 51.53(c)(3)(i) found in section 51.53(c)(3)(iv) and on allegations of "new and significant information" as therein provided, we must, based on the Commission precedent in *Turkey Point* and the preceding analysis, and as in the *Vermont Yankee* proceeding, rule in this proceeding that Petitioners Massachusetts Attorney General and Pilgrim Watch may not challenge in a contention the Applicant's ER for any alleged failure to consider new and significant information with regard to the Category 1 issue of onsite storage of spent fuel, without seeking and obtaining a waiver of the generic rule.[170] Although the Attorney General has recently filed

[168] *See* 61 Fed. Reg. at 28,467.

[169] This public participation aspect of NEPA arises from the "informational role" played by the EIS, in "giv[ing] the public the assurance that the agency 'has indeed considered environmental concerns in its decisionmaking process,' . . . and, perhaps more significantly, provid[ing] a springboard for public comment." *Robertson*, 490 U.S. at 349 (quoting *Baltimore Gas & Electric Co. v. Natural Resources Defense Council, Inc.*, 462 U.S. 87, 97 (1983)). The court in *Robertson* noted relevant Council on Environmental Quality (CEQ) regulations requiring agencies to request and consider comments from "other federal agencies, appropriate state and local agencies, affected Indian tribes, any relevant applicant, the public generally, and, in particular, interested or affected persons or organizations." *Id.* at 350 n.13 (citing 40 C.F.R. § 1503.1). Other CEQ regulations specifically address "Public involvement," and "public hearings or public meetings," but do not require adjudicatory hearings. 40 C.F.R. § 1506.6c. The Court also noted, in *Marsh*, that the required dissemination of information "permits the public . . . to react to the effects of a proposed action at a meaningful time." *Marsh*, 490 U.S. at 371. *See also* 10 C.F.R. § 51.92(d)(1).

[170] We note the Attorney General's argument in his reply that a "plain reading" of section 51.53(c)(3)(iv) leads not only to the conclusion that the "new and significant information" a licensee must provide includes information regarding Category 1 issues, but also to a finding that petitioners are entitled to challenge the adequacy of the ER in this regard in contentions. AG Reply at 9; *see id.* at 5-9. We note also his argument to the effect that any limitation associated with SECY-93-032, so as to exclude *litigation* of Category 1 issues without a waiver, should not be followed because it was "never codified in the final rule." *Id.* at 8 n.7. However, the AG also relies on regulatory

(Continued)

a Petition for Rulemaking with regard to the matters at issue in its Contention,[171] neither the AG nor Pilgrim Watch has sought a waiver,[172] and thus the contention must be ruled inadmissible insofar as it seeks to challenge the absence of alleged new and significant information in the Applicant's ER.[173]

Absent future developments in the *Mothers for Peace* case to the contrary,[174] this would include the matter of the alleged potential for terrorist attacks on the

history in arguing that its interpretation of the rule — i.e., that Entergy is required under section 51.53(c)(3)(iv) to address "new and significant information" even relating to Category 1 issues — should be followed. *See id.* at 6. Indeed, we agree with the AG on this interpretation, as evidenced in our discussion in the text. And, as we also discuss in the text, to construe section 51.53(c)(3)(iv) as an exception to section 51.53(c)(3)(i) also in a litigation context is a reasonable reading of the rule.

However, our inquiry cannot end so quickly, because, although "interpretation of any regulation must begin with the language and structure of the provision itself," *see Wrangler Laboratories*, ALAB-951, 33 NRC 505, 513 (1991) (cited by the AG in his Reply at 6), "administrative history and other available guidance may be consulted for . . . the resolution of ambiguities in a regulation's language[, so long as an] interpretation [does] not conflict with the plain meaning of the wording used in [a] regulation." *Wrangler*, ALAB-951, 33 NRC at 513-14. Section 51.53(c)(3)(iv) may well be viewed as being ambiguous, in that it clearly conflicts with section 51.53(c)(3)(i) and there is no "plain language" explicitly stating that section 51.53(c)(3)(iv) creates an exception to section 51.53(c)(3)(i) — in *any* context. From this perspective, the Commission — which, "[a]bsent constitutional constraints or extremely compelling circumstances . . . 'should be free to fashion [its] own rules of procedure and to pursue methods of inquiry capable of permitting [it] to discharge [its] multitudinous duties,'" *Vermont Yankee Nuclear Power Corp. v. Natural Resources Defense Council, Inc.*, 435 U.S. 519, 543 (1978) (citations omitted), and which may choose, "in its informed discretion," to proceed "by general rule or by individual, ad hoc litigation," *SEC v. Chenery Corp.*, 332 U.S. 194, 203 (1947) — may be viewed as having the discretion to state its interpretation of these regulatory provisions as it did in *Turkey Point*. And thus this Licensing Board would appear to be bound by the Commission's interpretation of section 51.53(c)(3)(iv) in *Turkey Point*, to the effect that section 51.53(c)(3)(iv) creates an exception to section 51.53(c)(3)(i) in the context of the requirements for ERs and EISs but *not* with regard to the scope of issues permitted to be raised in contentions in a license renewal adjudication context, absent a waiver, as discussed in the text. *See also CAN v. NRC*, 391 F.3d at 349, 360-61; *Mothers for Peace*, 449 F.3d at 1027.

[171] *See* Massachusetts Attorney General's Petition for Rulemaking To Amend 10 C.F.R. Part 51 (Aug. 25, 2006) (ADAMS Accession No. ML062640409).

[172] With respect to a petitioner who alleges "new and significant information" that applies not only to a particular plant or plants involved in a proceeding, but is more broadly applicable and thus raises a more "generic" issue, it would seem that the only recourse is indeed, as discussed at oral argument, *see supra* note 128, a petition for rulemaking, such as that filed by the Attorney General. We note that the AG and the City of Plymouth have both indicated that they are less concerned about *how* the matters at issue are addressed than that they *are* in fact addressed, not merely generically but in a manner that assures that the situation at Pilgrim is in fact addressed and not overlooked, as might be the case were any rulemaking not to become effective until *after* this license renewal proceeding is completed. *See* Tr. at 140, 144-47; *see id.* at 148-56.

[173] Thus we need not address, and have not addressed herein, the question whether there is indeed new and significant information in this instance.

[174] *See supra* p. 289.

spent fuel pool. In *McGuire*, the Commission held that there is no need to address terrorism issues in license renewal proceedings because "it is sensible not to devote resources to the likely impact of terrorism during the license renewal period, but instead to concentrate on how to prevent a terrorist attack in the near term at the already licensed facilities."[175] The Commission also, in holding that the GEIS adequately addresses terrorism issues generically, stated:

> Even if we were required by law to consider terrorism under NEPA, the NRC has already issued a . . . GEIS that considers sabotage in connection with license renewal. . . . The GEIS concluded that, if such an event were to occur, the resultant core damage and radiological releases would be no worse than those expected for internally initiated events.[176]

This authority supports a conclusion that terrorism concerns, even assuming new and significant information is presented, are not litigable in a license renewal proceeding without a waiver.

In conclusion, based on the preceding analysis, the Massachusetts Attorney General's Contention and Pilgrim Watch Contention 4 must be ruled inadmissible and are consequently denied.

B. Pilgrim Watch Contention 1: The Aging Management Plan Does Not Adequately Inspect and Monitor for Leaks in All Systems and Components That May Contain Radioactively Contaminated Water

Petitioner Pilgrim Watch in this contention states:

> The Aging Management program proposed in the Pilgrim application for license renewal is inadequate because (1) it does not provide for adequate inspection of all systems and components that may contain radioactively contaminated water and (2) there is no adequate monitoring to determine if and when leakage from these areas occurs. Some of these systems include underground pipes and tanks which the current aging management and inspection programs do not effectively inspect and monitor.[177]

As basis for this contention, Pilgrim Watch states that:

> . . . recent events around the country have demonstrated that leaks of underground pipes and tanks can result in the release of massive amounts of radioactive materials into the ground water. Exposure to this radiation can be a threat to human health, and is a violation of NRC regulations. Because older plants are more likely to experience corrosion and leakage problems, and low energy radionuclides can speed up the rate of corrosion, Pilgrim should be required, as part of its Aging Management Program, to adequately inspect and monitor any systems and components that carry radioactive water. The Aging Management Plan should be revised to include this inspection and monitoring before a license renewal is granted.[178]

Relying on the requirement for an aging management program that addresses structures and components including pipes, and referring to the provision for inspection of buried pipes and tanks in section B.1.2 of Entergy's Application, PW argues that deficiencies in the aging management plan for such pipes and tanks that contain radioactive water could "endanger the safety and welfare of the public"[179] and "significantly impact health,"[180] and therefore this contention is within the scope of this license renewal proceeding and material to the findings that must be made to support the action at issue in this proceeding.[181]

Pilgrim Watch has submitted exhibits produced by the Union of Concerned Scientists documenting leaks of radioactively contaminated water at eight nuclear facilities,[182] and also supports its contention by reference to various other documents. These include, with regard to health concerns related to radioactive material in groundwater, statements by Arjun Makhijani, Ph.D.,[183] scholarly and newspaper articles,[184] and the "BIER VII report."[185] Cited with regard to plant aging and corrosion are additional publications of the Union of Concerned Scien-

---

[175] *McGuire/Catawba*, CLI-02-26, 56 NRC at 361.

[176] *Id.* at 365 n.24.

[177] PW Petition at 4.

[178] *Id.* at 6.

[179] *Id.* at 5.

[180] *Id.* at 6.

[181] *Id.* at 4-6 (citing *Turkey Point*, CLI-00-23, 52 NRC at 329; *Turkey Point*, CLI-01-17, 54 NRC at 7; 10 C.F.R. § 54.21; Application at B-17; *Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Units 2 and 3), 60 NRC 81 (2004); *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), LBP-98-7, 47 NRC 142, 179-80 (1998), *aff'd in part*, CLI-98-13, 48 NRC 26 (1998)).

[182] PW Petition, Exh. A, Contaminated Water Leakage, A-1, Union of Concerned Scientists et al, Petition Pursuant to 10 CFR 2.206 — Enforcement Action — Longstanding Leakage of Contaminated Water, Appendix A, January 25, 2006; A-1, NRC Preliminary Notification of Event or Unusual Occurrence — PNP-III-06-004B, Byron NPS, April 20, 2006; A-3, NRC Event Number 42381, Palo Verde, NRC: Event Notification Report of March 3, 2006.

[183] PW Petition at 8 nn.2 & 3.

[184] *Id.* at 8 n.3 (citing J.D. Harrison, A. Khursheed, & B.E. Lambert, "Uncertainties in Dose Coefficients for Intakes of Tritiated Water and Organically Bound Forms of Tritium by Members of the Public," *Radiation Protection Dosimetry*, Vol. 98, No. 3, 2002, pp. 299-311); *id.* at 9 (*Indian Point Officials Zero in on Leak: Source of Radioactive Strontium 90 Turning Up in Groundwater Believed To Be from Spent Fuel Rod Pool*, Associated Press (May 12, 2006)).

[185] *Id.* at 9 (citing National Academy of Sciences, *Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII Phase 2* (2006)).

tists[186] and NASA,[187] on the greater likelihood of aging-related problems in later phases of life,[188] and a book by G. Bellanger on low-energy radionuclides inducing corrosion through degradation of the passive oxide layers that protect metals.[189] On the Pilgrim plant's asserted vulnerability to undetected leaks, PW cites a U.S. Government Accounting Office report discussing suspected counterfeit or substandard pipe fittings at the plant.[190] In support of its assertion that monitoring wells should be placed between the plant and the ocean, PW submits the final EIS for the original licensing of the plant, in which it is noted that "[s]urface topography is such that surface drainage from the station is seaward . . . ."[191]

Pilgrim Watch refers to Appendices A and B of Entergy's Application, including specifically Appendix A, § A.2.1.2 at A-14, and Appendix B, § B.1.2 at B-17, in support of its challenge to the Applicant's stated plans regarding its "Buried Pipes and Tanks Inspection Program."[192] The former describes the "Buried Piping and Tanks Inspection Program" as including "(a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel, stainless steel, and titanium components"; states that "[b]uried components are inspected when excavated during maintenance"; and states further that, "[i]f trending within the corrective action program identifies susceptible locations, the areas with a history of corrosion problems are evaluated for the need for additional inspection, alternate coating, or replacement."[193] The cited section from Appendix B, also titled "Buried Piping and Tanks Inspection," states that this program "is comparable to the program described in NUREG-1801, Section XI.M34, Buried Piping and Tanks Inspection," and provides that "[b]uried components are inspected when excavated during maintenance" and that a "focused inspection will be performed within the first 10 years of the period of extended operation, unless an opportunistic inspection (or an inspection via a method that allows assessment of pipe condition without excavation [such as 'phased array' ultrasonic, or 'UT,' technology]) occurs within this ten-year period."[194]

PW argues that the preceding "are insufficient if there is a potential leak of radioactive water from corroded components that could be migrating off-site,"[195] that the plan to use "opportunistic inspections" gives the "appearance [of] the matter of discovering leaks [] being left to chance," that the UT technology in question is untested by plant operating experience, and that instead there should be "regular and frequent inspections of all components that contain radioactive water."[196]

Emphasizing that small leaks, "if undetected, can eventually result in much larger releases of radioactive liquid into the ground, PW notes that smaller leaks are also more difficult to detect with measures such as noting drops in water levels in tanks.[197] Thus, according to PW, also relying on the fact that some of the recent cases of leaked radioactive water were detected through the use of monitoring wells, the "only effective way to monitor for [radioactive water being drained into the ground and then the ocean] would be to have on-site monitoring wells located between Pilgrim and the ocean," which would be suitably arrayed and sampled regularly, and used to supplement the Applicant's planned visual and ultrasonic tests.[198] Citing 10 C.F.R. § 20.1302 and Part 50, Appendix A,[199] for the proposition that licensees such as the Applicant are required to "demonstrate that effluents, including those from 'anticipated operational occurrences,' do not expose members of the public to excessive radiation doses,"[200] PW argues:

> While leaks of radioactively contaminated water into the ground for extended periods of time may not have been operational occurrences anticipated when the facilities were initially designed and licensed, they can scarcely be 'unanticipated' following the series of occurrences summarized in Exhibit A. As those events demonstrated, unless nuclear facilities aggressively monitor for leaks both off-site and on-site, a

[186] *Id.* (citing David Lochbaum, Union of Concerned Scientists, *U.S. Nuclear Plants: The Risk of a Lifetime* (2004)).

[187] *Id.* at 9-10 (citing National Aeronautics and Space Administration (NASA), *Using Reliability-Centered Maintenance as the Foundation for an Efficient and Reliable Overall Maintenance Strategy* (2001)).

[188] PW cites the NASA-originated example of the "Bathtub Curve" graph, used in the Union of Concerned Scientists publication to illustrate that "after a relatively stable (bottom of the bathtub) period in the middle life of [a] subject, a steep rise in age-related failures occurs towards the end of its life." *Id.* at 10 (citing Lochbaum at 4).

[189] *Id.* at 10-11 (citing G. Bellanger, Corrosion Induced by Low Energy Radionuclides: Modeling of Tritium and Its Radiolytic and Decay Products Formed in Nuclear Installations (Elsevier Publications, 2006)).

[190] *Id.* at 11 (citing U.S. GAO, Nuclear Safety and Health Counterfeit and Substandard Products Are a Government-wide Concern (Oct. 1990)).

[191] *Id.* at 13 n.5 (quoting Atomic Energy Commission, Pilgrim Nuclear Power Station Final EIS (May 1972)).

[192] *Id.* at 11-12.

[193] Application, Appendix A, § A.2.1.2, at A-14.

[194] *Id.*, Appendix B, § B.1.2 at B-17.

[195] PW Petition at 12.

[196] *Id.*

[197] *Id.* at 13.

[198] *Id.*

[199] *Id.* at 14 nn.6 & 7.

[200] *Id.* at 14. PW quotes 10 C.F.R. § 20.1302, which requires licensees to survey radiation levels so as to "demonstrate compliance with the dose limits for individual members of the public," and 10 C.F.R. Part 50, Appendix A, which refers, *inter alia*, to the requirement to "control suitably the release of radioactive materials . . . produced during normal reactor operation, including anticipated operational occurrences."

leak can go undetected for years, and potentially life threatening releases of radiation can migrate off-site before any problem is detected.[201]

PW concludes by asserting that "[m]anagement to detect possible leaks is a site specific safety issue which has not been properly addressed in the [Application] and has not been adequately dealt with by the [NRC] in a generic way at this time," and that, because of the potential for harm to public health and safety, the Applicant should be required to address this issue "more thoroughly . . . before a license extension for Pilgrim is granted."[202]

1. *Entergy Answer to Pilgrim Watch Contention 1*

Applicant Entergy argues that Pilgrim Watch's first contention "is inadmissible because (1) the Contention is overbroad and unduly vague and impermissibly challenges Commission regulation; (2) the Contention provides no basis to dispute the adequacy of aging management program for underground pipes and tanks; and (3) the Contention is beyond the scope of this proceeding."[203]

The Applicant insists that PW's claim, that the "Aging Management Plan does not adequately inspect and monitor for leaks in all systems and components that may contain radioactively contaminated water," is impermissibly overbroad because the scope of license renewal proceedings, as confined by 10 C.F.R. § 54.4, "does not encompass 'all systems and components that may contain radioactive water,'"[204] and "[m]any plant systems and components that may contain radioactively contaminated water do not fall within this defined scope of 10 C.F.R. Part 54."[205] Furthermore, the Applicant asserts, because the Commission has explicitly rejected a petition for rulemaking of the Union of Concerned Scientists, seeking to expand the scope of the license renewal rule to include "liquid and gaseous radioactive management systems," the contention "directly challeng[es] the Commission's contrary determination."[206] Thus, "[a]s such, the Contention impermissibly challenges Commission regulation, and to the extent the Contention encompasses systems and components that are not subject to the license renewal requirements of 10 C.F.R. Part 54, the Contention must be rejected as beyond the scope of this proceeding."[207]

---

[201] PW Petition at 15.

[202] *Id.* at 15-16.

[203] Entergy Answer to PW Petition at 11.

[204] *Id.*

[205] *Id.* at 12.

[206] *Id.* (citing Union of Concerned Scientists; Denial of Petition for Rulemaking, 66 Fed. Reg. 65,141 (Dec. 18, 2001)).

[207] *Id.*

000034

Attacking PW's asserted failure to identify "specific PNPS systems or components within the scope of the rule that will not be adequately managed for aging, or that contain radioactive water that might be released,"[208] Applicant argues that the contention "fails to provide a factual basis to support *any* claim challenging the adequacy of the Application."[209] Citing PW's reference to reports of radioactive water leaks at other nuclear power plants, the Applicant avers that PW fails to provide a basis to link those leaks "to any in-scope license renewal systems and components or to any claimed inadequacy of the Pilgrim aging management plan for buried piping and tanks."[210] Applicant distinguishes the Pilgrim plant, among other things as being a boiling water reactor with an elevated, above-grade spent fuel pool, unlike examples cited by PW,[211] and charges that PW has failed to provide support either for its allegations of " 'site specific attributes due to [the Pilgrim plant's] history and location which makes leaks from components and systems . . . more likely and more difficult to detect,' "[212] or for its claims regarding inadequate " 'current methods for monitoring systems and components such as buried piping and underground tanks.' "[213] Additionally, the Applicant argues that PW's references to expected failures over the life of a component or structure, and to the past use of "counterfeit or substandard pipe fittings and flanges," provide no support for the contention because the former is not site-specific to Pilgrim and the latter would be covered by a current design and licensing basis and is not an aging issue.[214]

Addressing claims regarding inspection and potential leaks of radioactive water from corroded components, Applicant argues that PW has provided nothing more than unsupported allegations regarding the adequacy of the inspection and aging management programs for underground pipes and tanks.[215] According to the Applicant, "[n]o facts or expert opinion are provided to support the claimed inadequacy of the aging management program," and "[n]o basis is offered to suggest that components are corroding nor is any information offered indicating the appropriateness of any other inspection period."[216]

---

[208] *Id.* at 13.

[209] *Id.* (emphasis in original).

[210] *Id.* at 13-14.

[211] *See id.* at 14.

[212] *Id.* at 15-16 (quoting Pilgrim Watch Petition at 8).

[213] *Id.* at 16 (quoting Pilgrim Watch Petition at 9).

[214] *Id.* at 16-17 (quoting Pilgrim Watch Petition at 11).

[215] *See id.* at 17.

[216] *Id.* Applicant cites *Georgia Tech*, LBP-95-6, 41 NRC at 305, and *Turkey Point*, LBP-90-16, 31 NRC at 521 & n.12, for the propositions that a petition must provide " '[t]echnical analyses and expert opinion' or other factual information 'showing why its bases support its contention,' " and that "an

(Continued)

The Applicant suggests that the contention's "real focus is not on aging management, but on the adequacy of the PNPS radiological monitoring program, which is beyond the scope of this proceeding."[217] Asserting that what PW is really requesting is an expanded radiological monitoring program at the site,[218] the Applicant contends that this concerns a current operational program that is "not properly part of this license renewal proceeding."[219]

2. *NRC Staff Response to PW Contention 1*

The NRC Staff agrees with Petitioner PW that Contention 1 is within the scope of license renewal proceedings, but argues that it is inadmissible, first, because it fails to meet the requirements of 10 C.F.R. § 2.309(f)(1)(vi) that it demonstrate that a genuine dispute exists with the Applicant regarding a material issue of law or fact, and that it challenge either specific portions of or alleged omissions from the Application, and instead relies on "vague or generalized studies and unsubstantiated assertions without reference to the LRA [and thus] fails to demonstrate that there are material issues of fact in dispute."[220] In addition, the Staff argues, the asserted bases for the contention "lack sufficient facts and contain no supporting expert opinion" as required under 10 C.F.R. § 2.309(f)(1)(v), and instead "impermissibly rel[y] on generalized suspicions and vague references to alleged events at other plants and equally unparticularized portions of general studies for providing a factual basis."[221]

Following the outline headings used by PW in its petition and treating the various outline points of PW's Contention 1 and its basis essentially as separate bases, the Staff challenges each separately.[222] According to the Staff, PW's references to leaks at other facilities do not support the contention's admissibility, because no site-specific facts relevant to the Pilgrim plant have been provided.[223] Nor, according to the Staff, does that part of the basis for the contention in which PW asserts that "[e]xposure to this radiation can be a threat to human health[ ] and is a violation of NRC regulations" pass muster "because Petitioner has failed to demonstrate that there is a genuine dispute as a matter of law or fact . . . and fails to provide an adequate basis in fact or expert opinion to support its assertion."[224] No deficiency or dispute with the Application is cited, according to the Staff, "that would lead to like releases," and the reference to the BEIR VII Report for the proposition that "there is no safe dose of radiation" is an "impermissible challenge to the Commission's regulations."[225]

Regarding the studies cited by PW related to aging and corrosion, the Staff argues that these are too general to support an admissible contention,[226] and with respect to the studies cited on low-energy radiation and corrosion, asserts that any suggestion that the Pilgrim plant suffers from the same effects constitutes "mere speculation" and "bare assertions" insufficient to support a contention.[227] The Staff also notes that PW mentions neither the NRC's response to the GAO study on counterfeit or substandard pipe fittings, nor subsequent actions taken in response to it, and suggests that this should be taken as a failure "to provide a reason why the GAO study is significant to this proceeding" and as "impermissibly seek[ing] the Licensing Board to make erroneous assumptions of fact."[228] The Staff considers PW's references to ultrasonic testing to be asking the Board to "make an impermissible assumption of fact," and its call for "regular and frequent inspections of all components that contain radioactive water" to be unsupported by any "factual or expert support."[229]

Finally, the Staff suggests PW has provided no expert or factual support for its challenge to the adequacy of the monitoring provided in the Application, or for its assertion that the monitoring program at Pilgrim must be improved.[230] According to the Staff, PW bases its arguments relating the purported need for monitoring

---

allegation that some aspect of a license application is 'inadequate' or 'unacceptable' does not give rise to a genuine dispute unless it is supported by facts and a reasoned statement of why the application is unacceptable in some material respect." *Id.* at 18.

[217] *Id.* at 18.

[218] *Id.* at 18-19.

[219] *Id.* at 20.

[220] NRC Staff Response to PW Petition at 10.

[221] *Id.*

[222] We note that the Staff approaches this and other contentions by addressing the information under different headings in the bases separately, without appearing to draw any connections between the various sections. We find it more appropriate to consider, and have considered, the basis for each contention as a whole, taking into account any logical connections between sections as well as any supporting material in one section for the point(s) made in any other section or sections.

[223] *See id.* at 11. The Staff notes PW's statement that the Pilgrim plant has "site-specific attributes due to its history and location which make leaks from components and systems such as underground piping more likely and difficult to detect," but argues that "Petitioner does not provide site-specific facts to support this assertion nor identify with any specificity how purported leaks at other plants are relevant to Pilgrim." *Id.* (quoting PW Petition at 7-8).

[224] Staff Response to PW Petition at 12 (citations omitted).

[225] *Id.* at 12-13.

[226] *See id.* at 13-14.

[227] *Id.* at 14.

[228] *Id.* at 15.

[229] *Id.* at 15-16.

[230] *Id.* at 16.

to the discoveries of leaks at other facilities on speculation and "generalized suspicion," and cites no part of the Application with which it has a dispute.[231]

3. *Pilgrim Watch Replies to Entergy and NRC Staff*

In its replies to Entergy and the Staff, Pilgrim Watch charges both with attempting to hold it to an incorrect standard of having to prove its contention at this stage of this proceeding, relying on the Commission's 1989 rulemaking statement to the effect that this is not part of the contention admissibility requirements.[232] Citing in addition the Commission's advice that the factual support necessary to show that a genuine dispute exists in relation to a contention "need not be of the quality necessary to withstand a summary disposition motion," PW states that, while it has not yet formally engaged the services of an expert, it "has provided the board with extensive sources as the basis for its contentions, gleaned from scientific, technical, public policy and government reports."[233] PW avers that the Staff also purports to make the rule stricter than it already is when it argues that expert opinion is always required, whereas the actual requirement is for "facts *or* expert opinion."[234]

In response to Entergy and Staff challenges to that part of the basis for Contention 1 that concerns leaks at other facilities, PW points out that, in reading the Application, it looked for assurances "that such an event at Pilgrim would be quickly detected and remedied and discovered that the Aging Management Plan does not give this assurance."[235] PW asserts that "[t]his is exactly the sort of 'deficiency or error' in an Application that has 'independent health and safety significance' that is material to these proceedings, and Petitioners referred directly to the Application sections as was required."[236] PW notes that the significance of the leaks at other facilities has been shown by the fact that the NRC has appointed a special tritium task force to address the problem.[237]

In response to Entergy's argument that the contention is overbroad in referring generally to pipes and other components, PW points out that its discussion is focused on those systems, including pipes and tanks, that are addressed in the Application, § B.1.2, at B-17, and that it is these pipes and tanks that are at issue in the contention.[238]

PW further notes that it included a discussion of the "site-specific" fact of the coastal topography of the Pilgrim plant in the basis for the contention, and cites its references to the various reports discussed in its Petition, provided to support the various "pieces" of its basis — noting that each piece is but a part of its overall basis.[239] With regard to the reports in question, PW points out that the issues they address — health, aging and corrosion of components, and low-energy radionuclides and corrosion — would be applicable to Pilgrim, even though they might not be specifically about the Pilgrim plant.[240]

PW emphasizes that the deficiency with regard to inspection that it alleges is the schedule of an inspection within the first 10 years, or "opportunistically."[241] PW notes that it highlighted the novelty of ultrasonic testing to support its "claim that additional monitoring is necessary to complement it,"[242] a proposal that is intended as an "adjunct to inspections, and as an integral part of the Aging Management Program at Pilgrim, not as part of its operational radiological monitoring program."[243] PW notes that "it was through monitoring wells that leaks at other facilities were discovered, and yet Pilgrim does not currently have monitoring wells that would detect leaks of radioactive water before that water was washed into Cape Cod Bay," and asserts that "[o]n-site wells in strategic locations could alert Licensee about possible problems in a more timely way."[244] Maintaining that it has shown "why it is unrealistic to expect to happen upon a leaking pipe during routine maintenance activities, particularly if those activities only take place every ten years," PW continues to argue that the "only effective way to monitor for such an occurrence would be to have on-site monitoring wells located between Pilgrim and the ocean."[245] According to PW, "[t]he genuine and material issue in dispute is whether or not the Licensee's application sufficiently deals with th[e] safety issue" presented in its contention.[246]

---

[231] *Id.* at 17-18.

[232] PW Reply to Entergy at 3; PW Reply to NRC Staff at 3 (citing, in each, 54 Fed. Reg. 33,170 (Aug. 11, 1989)).

[233] PW Reply to NRC Staff at 4-5; PW Reply to Entergy at 4.

[234] PW Reply to NRC Staff at 4.

[235] *Id.* at 5; *see also* PW Reply to Entergy at 6.

[236] PW Reply to NRC Staff at 5.

[237] *See id.*; PW Reply to Entergy at 6.

[238] *See* PW Reply to Entergy at 5.

[239] PW Reply to NRC Staff at 6-7.

[240] *See id.* at 6-8; PW Reply to Entergy at 7-8. PW observes that "[f]or the Staff to imply that Petitioners cannot even rely on pertinent scientific studies conducted in other parts of the country to support our basis in Massachusetts raises the bar very high indeed." PW Reply to NRC Staff at 8.

[241] *Id.*

[242] *Id.*

[243] PW Reply to Entergy at 8.

[244] PW Reply to NRC Staff at 8.

[245] PW Reply to Entergy at 8.

[246] *Id.*; *see* PW Reply to NRC Staff at 9.

4. *Licensing Board Ruling on Pilgrim Watch Contention 1*

We find this contention, as limited below, admissible, based upon the following analysis.

We turn first to the question of whether this contention falls within the scope of a license renewal proceeding. We agree with the Staff in its concession that Pilgrim Watch's first contention is within this scope, as defined at 10 C.F.R. Part 54.[247] Indeed, the fact that the Application itself contains sections concerning "Buried Piping and Tanks Inspection," both cited by Petitioner, indicates that Entergy implicitly agrees that this subject, insofar as it concerns those buried pipes and tanks in its aging management program, is within the scope of license renewal.[248] Obviously, if there are some pipes or tanks that do not for one reason or another individually fall within the scope of license renewal, issues concerning such pipes and/or tanks may not be litigated in this proceeding. But this is a different matter than whether any buried pipes and tanks are within scope, as some undisputedly are. While it is true that the contention's mention of "all systems and components" may, on its face, implicate systems and components that are not within the scope of a license renewal as defined in 10 C.F.R. Part 54, such language does not remove the entire contention from the scope of this proceeding.

We find that Pilgrim Watch, among other things by referencing the Application's aging management plan regarding buried pipes and tanks, has supported its contention "sufficient to establish that it falls directly within the scope" of this proceeding,[249] and therefore satisfies the requirements of 10 C.F.R. § 2.309(f)(1)(iii), to the extent that the contention concerns underground pipes and tanks that fall within the Pilgrim aging management plan. We further find that the contention — again, insofar as it concerns underground pipes and tanks that are part of Pilgrim's aging management program — does not improperly challenge any Commission rule or regulation.

We find that PW has fulfilled the requirements of 10 C.F.R. § 2.309(f)(1)(i) and (ii) by providing a sufficiently specific statement of the issue raised in the contention and the requisite brief explanation of the basis for the contention. Briefly summarized, PW in Contention 1 challenges Pilgrim's aging management program relating to the inspection of buried pipes and tanks for corrosion, and to detection of leakage of radioactive water that might result from undetected corrosion and aging. The essence of the contention is that the aging management

[247] *See* our discussion above in section IV.B of this Memorandum and Order.

[248] Application §§ A.2.1.2, B.1.2.

[249] *Arizona Public Service Co.* (Palo Verde Nuclear Generating Station, Units 1, 2, and 3), LBP-91-19, 33 NRC 397, 412 (1991), *appeal denied on other grounds*, CLI-91-12, 34 NRC 149 (1991). *See* PW Petition at 5.

plan incorporates no mechanism for early detection of leaks, and should do so, through the use of appropriately placed monitoring wells.[250] The basis for the contention includes two factors: First, the infrequency of inspections for corrosion of relevant pipes and tanks that are underground, viewed in light of recent discoveries of leaks at various nuclear facilities, supported by various factual arguments and sources; and second, the fact that the plan contains no mechanism for monitoring for leaks.

With regard to whether, as required at 10 C.F.R. § 2.309(f)(1)(iv), the issue raised in the contention is material to the findings that must be made to support the sought license renewal, we find that this requirement has been met. Obviously, the adequacy of the aging management program as it relates to underground pipes and tanks has health and safety significance[251] and is material to whether the license renewal may be granted.

We also find that PW has satisfied the requirements of 10 C.F.R. § 2.309(f)(1)(v) for a concise statement of the alleged facts or expert opinion supporting the contention, including references to sources and documents to be relied upon. PW has raised significant factual allegations about the matters at issue and provided various support for its contention. Petitioner alleges as fact that the aging management plan for buried pipes and tanks that is in the Application is deficient in limiting inspections to focused inspections within 10 years of the license renewal, "opportunistic inspections," and inspections during excavations for maintenance (along with additional inspections if "trending . . . identifies susceptible locations," and the possibility of some ultrasonic testing).[252] It points out that the plan does not include any monitoring wells, and urges that in addition to "regular and frequent inspections," the aging management program should include "monitoring wells in suitable locations . . . to supplement visual and ultrasonic tests."[253] Moreover, PW has referred to a number of scientific articles and reports in support of this contention, and we note that, according to some of these reports, discovery of some of the recently found leaks in various facilities was achieved through use of monitoring wells.[254]

In litigation of this contention, various scientific articles and reports referenced by PW, as well as the existence of leaks at other facilities and the response to those leaks, may, along with whatever other evidence and expert testimony is provided, be relevant evidence on the factual issue of whether Pilgrim's aging

[250] PW Reply to NRC Staff at 8-9; PW Reply to Entergy at 8.

[251] *See Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Units 2 and 3), LBP-04-15, 60 NRC 81, 89 (2004); *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), LBP-98-7, 47 NRC 142, 179-80 (1998), *aff'd in part*, CLI-98-13, 48 NRC 26 (1998).

[252] PW Petition at 12-13.

[253] *Id.* at 11-14.

[254] *See id.* at 13-14; PW Petition, Exh. A.

management program for underground pipes and tanks is satisfactory or deficient, and whether as a result — again, as a factual matter — the sort of monitoring wells that PW seeks should be included in this program.[255] No doubt there will be argument about the extent to which various items of evidence are relevant and do or do not establish various facts. But Petitioners are not required to prove alleged facts at the contention admissibility stage. In addition, although PW has indicated

[255] As with many scientific reports and studies, and as with many factual circumstances that are discovered at a number of locations, each of these may be quite relevant to conditions at an individual facility. The NRC's "lessons learned" approach to analyzing a problem at one or more facilities in a manner so as to prevent future occurrences at other facilities illustrates this. Indeed, we note the recent issuance of the Liquid Radioactive Release Lessons Learned Task Force Final Report (Sept. 1, 2006; issued publicly Oct. 4, 2006), available at *http://www.nrc.gov/reactors/operating/ops-experience/tritium/lr-release-lessons-learned.pdf* [hereinafter Tritium Report]. In this report, although the task force "did not identify any instances where the health of the public was impacted," *id.* at Executive Summary I, it did conclude that "under the existing regulatory requirements the potential exists for unplanned and unmonitored releases of radioactive liquids to migrate offsite into the public domain undetected," based on several elements, including the fact that some components such as buried pipes are not physically visible, the general absence of NRC requirements for monitoring groundwater onsite, and the possibility of migration of groundwater contamination offsite undetected. *Id.* at ii; *see id.* at 50. The report mentions the relevance of the 10 C.F.R. Part 54 license renewal requirements to the matters at issue, *id.* at 22; notes that buried systems and structures such as pipes are "particularly susceptible to undetected leakage," *id.* at 26; and recommends that the Staff verify that the license renewal process "reviews degradation of systems containing radioactive material" as discussed in the report, *id.* at 27. (We would further note that, as the report does not appear to be accompanied by any planned rulemaking at this time, it does not raise any questions about litigation of the matters at issue in this contention in this proceeding, which, in any event, as with the instances discussed in the report, involve various site-specific elements in addition to more generally relevant considerations that may be informed by the report, as well as by other relevant documents and sources. *See Oconee*, CLI-99-11, 49 NRC at 345 (quoting *Potomac Electric Power Co.* (Douglas Point Nuclear Generating Station, Units 1 and 2), ALAB-218, 8 AEC 79, 85 (1974) ("It has long been agency policy that Licensing Boards 'should not accept in individual license proceedings contentions which are (or are about to become) the subject of general rulemaking by the Commission' ")); *see also Duke Power Co.* (Catawba Nuclear Station, Units 1 and 2), ALAB-813, 22 NRC 59, 86 (1985); *Private Fuel Storage*, LBP-98-7, 47 NRC at 179; PW Petition at 7).

We would note that any NRC guidance documents on subjects related to Contention 1, while not controlling, may be relevant evidence on subjects relating to Contention 1. In this regard we observe as well that Entergy has, in support of its assertions that its aging management program for buried pipes and tanks is sufficient, directed us to the "GALL Report," which provides the NRC Staff's regulatory guidance on aging management of buried piping and tanks. NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Vol. 2, Rev. 1 at XI-M-95; *see* Entergy Answer to PW at 18 n.9; Tr. at 325-26. Without making any determination on the merits of this contention, it does appear that the Applicant's proposed program likely complies with the minimum standards of the guidance therein set out.

However, several factors with regard to the GALL Report are particularly noteworthy in the context of Contention 1 and the arguments regarding it. First, of course, the GALL Report represents general guidance for the Staff's review, and does not specify the only acceptable way to satisfy the requirements of 10 C.F.R. § 54.21. *Curators of the University of Missouri* (TRUMP-S Project), CLI-95-8, 41 NRC 386, 397 (1995) ("NUREGs and Regulatory Guides are advisory by nature and

(Continued)

do not themselves impose legal requirements on either the Commission or its licensees"). Second, the guidance of the report focuses primarily upon ensuring the continuing effectiveness of external coatings and wrappings to manage the effects of corrosion, rather than on any methods to detect failure other than by physical inspection. Third, while the report states that "inspections performed to confirm that coating and wrapping are intact are an effective method to ensure that corrosion of external surfaces has not occurred and the intended function is maintained," NUREG-1801, GALL Report, Vol. 2, Rev. 1 at XI-M-III, it goes on to indicate that, "because the inspection frequency is plant-specific and depends on the plant operating experience, the applicant's plant specific operating experience is further evaluated for the extended period of operation." *Id.* at point 10. Thus, the report implicitly contemplates that an acceptable plan will be plant-specific and depend on operating experience.

In this instance, Applicant has proposed to comply with the suggested general guideline for frequency of inspection — "an opportunistic inspection" within a 10-year period — that is the *minimum* suggested in the guidance (wherein it is stated that "it is anticipated that one *or more* opportunistic inspections may occur within a ten year period" and that "prior to entering the period of extended operation, the applicant is to verify that there is *at least one* opportunistic or focused inspection . . . performed within the past ten years"). *Id.* at XI-M-111-112 No party here argues that the applicant has failed to follow this guidance; rather, insofar as the report is viewed as providing guidance on an acceptable plan, at issue here is *sufficiency* of a plan that complies *only* with the *minimum* requirements thereof — which may or may not be sufficient based on circumstances including site-specific factors.

Pilgrim Watch questions whether visual inspection at the proposed intervals, together with possible use of ultrasonic testing (at only a selected sample of locations) is sufficient to manage the effects of aging by detecting *incipient* failure of the buried pipes and tanks (whether by incipient failure of coatings and wrappings or otherwise), and suggests that the plan should include leak detection mechanisms (such as monitoring wells) to discover any actual failure, rather than rely only on the proposed periodic visual inspections and potential use of ultrasonic testing. *See* PW Petition at 11-14.

We find that this challenge raises factual issues from two perspectives: First, it can be viewed, in its most direct form, as a challenge to the adequacy of the proposed interval of inspection. Second, it can be viewed, in its pointing out of the lack of monitoring for leaks that would be indicative of pipe or tank failure, as a challenge to the adequacy of a plan which merely satisfies the minimum requirements of regulatory guidance which, in and of itself, appears to contemplate some plant-specific elements. With regard to the first perspective, it is unclear at this point whether or not this proposed periodicity is sufficient for *this* plant, and with regard to the second, it is likewise premature to say whether or not monitoring for leaks is properly part of an aging management plan designed to prevent leaks. Thus, insofar as the Applicant may be viewed as arguing that it has complied with the requirements of NUREG-1801, we find such argument to be insufficient, for the purposes of contention admissibility considerations, to overcome such factual challenges. These are matters that are properly addressed on the merits at the appropriate stage of the proceeding for such consideration.

that it will have an expert to support its admitted contention(s),[256] it is not required to have such an expert at this time.[257]

We would also note that the subject of "monitoring" is not irrelevant merely because some monitoring may be part of operational activities on a continuing basis. The fact that some "monitoring" may occur as part of ordinary plant operations does not exclude it from license renewal, as illustrated, for example, by section A.2.1.10 of the Application, concerning the "Diesel Fuel Monitoring Program." PW alleges that the aging management program of inspection for corrosion and leakage from underground pipes and tanks at Pilgrim is insufficient, supported by various facts, documents, sources, and a reasoned fact-based argument, and asserts that the best way to address this deficiency (based on topographical facts set forth in the original FEIS for the Pilgrim plant) is to add leak detection through monitoring wells between the plant and Cape Cod Bay. Whether the addition of such wells may be appropriate and necessary, as part of Pilgrim's aging management plan for underground pipes and tanks, is, as indicated above, a factual matter, the answer to which depends upon whether the plan, absent such monitoring, is adequate to detect and remedy any corrosion or other potential for leakage, and any leakage that may actually occur, in a timely and effective manner. If a plan is found as a factual matter to be inadequate in this regard, and that additional inspection and other measures are unduly difficult or expensive such that monitoring wells or other leak detection devices may be the most efficient and cost-effective way of addressing the inadequacy, then they might well be called for, as a factual matter, to augment existing parts of the aging management plan.

Finally, with respect to the requirement at 10 C.F.R. § 2.309(f)(1)(vi) that PW provide sufficient information to show a genuine dispute on a material issue of law or fact, including specific references to portions of the Application it disputes and the reasons for the dispute, there is no doubt that Petitioners must provide something more than bare allegations or "unsubstantiated assertions." We find that PW has done more, and has satisfied the requirements of section 2.309(f)(1)(vi), insofar as the contention asserts that the aging management plan is inadequate in not including leak detection methods (such as monitoring wells) as a part of it, to supplement existing provisions. In support of this, PW has made a reasoned argument supported, as we note above, by facts, exhibits, scientific reports, and by reference to Appendices A and B of the Application, more

[256] Tr. at 300.

[257] If the remainder of the basis and support for a contention were so sparse as to preclude admission of the contention based solely on such other support, then the presence or absence of an expert might come into play in ruling on the admissibility of the contention. But this is not the situation with PW's Contention 1, which we find to be sufficiently supported, without indication of a retained expert at this point.

specifically to section A.2.1.2, at A-14, and section B.1.2, at B-17. It challenges the absence of monitoring wells to serve as leak detection devices, strategically placed between the plant and the coast toward which all water that may be released through any leaks from such pipes and tanks would flow. It asserts that such wells are a necessary part of a system to manage the aging of buried pipes and tanks, particularly where the plan is to inspect only once within the first 10 years of the new license unless an opportunistic occasion arises. It is clear that the participants are genuinely in dispute on this material issue of fact, which we find Petitioner PW has raised and supported sufficiently to admit Contention 1.

In admitting this contention, however, we limit it in two respects. First, the contention is limited to those underground pipes and tanks that do fall within those described in 10 C.F.R. Part 54,[258] which is an issue that may require further clarification as this proceeding progresses. Second, although PW in its basis for Contention 1 has specifically referenced "violation[s] of 10 C.F.R. § 20.1302 and § 50 Appendix A";[259] the basis also contains certain suggestions that doses *not in violation* of NRC regulations might be harmful to health.[260] The former may be litigated with respect to this contention; the latter may not. With such limitations, the contention we admit states as follows:

> The Aging Management program proposed in the Pilgrim Application for license renewal is inadequate with regard to aging management of buried pipes and tanks that contain radioactively contaminated water, because it does not provide for monitoring wells that would detect leakage.[261]

C. Pilgrim Watch Contention 2: The Aging Management Plan at Pilgrim Fails To Adequately Monitor for Corrosion in the Drywell Liner

Pilgrim Watch in their second contention states:

> The Aging Management program proposed in the Pilgrim application for license renewal fails to adequately assure the continued integrity of the drywell liner, or shell, for the requested license extension. The drywell liner is a safety-related containment component, and its actual wall thickness should be confirmed by periodic ultrasonic testing (UT) measurements at all critical areas, including those

[258] *See* 10 C.F.R. § 54.21(a)(1)(i) ("These structures and components *include, but are not limited to*, . . . piping . . . ." (emphasis added)); *see also* PW Petition at 4.

[259] PW Petition at 8.

[260] *See id.* at 8-9.

[261] With respect to exactly which pipes and tanks do fall within Pilgrim's aging management program, this is addressed to an extent in the Application, although further definition may be required as the adjudication of this case proceeds forward.

which are inaccessible for visual inspection. The current plan does not adequately monitor for corrosion in these inaccessible areas, nor does it include a requirement for a root cause analysis when corrosion is found.[262]

As basis for this contention, Pilgrim Watch states that:

> A contention about a matter not covered by a specific rule need only allege that the matter poses a significant safety problem. *Duke Power Co.* (Catawba Nuclear Station, Units 1 and 2), LBP-82-116, 16 NRC 1937, 1946 (1982). The drywell liner has been identified by the NRC and the Applicant as a safety-related structure to be maintained both as a pressure-related boundary and for structural support. It is required to contain and control the release of fission products to the Reactor Building in the event of a Design Basis Accident, including a Loss-Of-Coolant-Accident (LOCA) so that the off-site radiation dose to the surrounding communities remains within NRC designated limits. This structure is therefore vital to the protection of the health, safety and welfare of the public and Petitioners' members. Recent events cited herein have demonstrated that the corrosion of Mark I Drywells is a major safety issue that is not addressed by current NRC Guidance Documents. Pilgrim has a history of corrosion in different areas of the drywell and there has been a reduction in drywell wall thickness. Despite this fact, the Aging Management Program does not adequately monitor for corrosion in the drywell and drywell wall thickness. The Aging Management Program should address this issue, and perform root cause analysis where any corrosion is found, before a license renewal is granted.[263]

To support its allegation that corrosion of Mark I drywells is a major safety-related issue, Pilgrim Watch has referenced a 1986 NRC Information Notice (IN 86-99) acknowledging the potential for corrosion, as well as a 1992 NRC Safety Evaluation of drywell integrity at the Oyster Creek Nuclear Generating Station — also a Mark I reactor — discussing corrosion detected by UT measurements.[264] In conjunction with its discussion of known corrosion problems at Mark I steel containment shells, PW also notes a January 31, 2006, meeting held by NRC "to discuss the proposed interim staff guidance [ISG] for license renewal associated with Mark I steel containment drywell shell[s]."[265] Citing sentiments expressed by the NRC Staff in the meeting, PW argues that the NRC has recognized that a relevant "Generic Aging Lesson Learned" (GALL) report "does not provide sufficient guidance for detecting and monitoring potential corrosion in the drywell shell, particularly in inaccessible areas," and that "all Mark I reactors have a potential problem and require evaluation.[266] Pilgrim Watch cites, and includes as an attachment to its Petition, a 2006 *Federal Register* notice entitled "Proposed License Renewal Interim Staff Guidance LR-ISG-2006-01: Plant-Specific Aging Management Program for Inaccessible Areas of Boiling Water Reactor Mark I Steel Containment Drywell Shell"[267]; PW explains that it seeks to intervene on the drywell corrosion issue "because the license renewal process for Pilgrim has already begun and will likely be completed before a final Staff Guidance on this problem is issued."[268]

Petitioners argue that unless they are allowed to intervene on this issue — in effect, if this contention is not admitted — "these concerns will not be adequately addressed as part of the Pilgrim license renewal."[269] Conceding that the issue clearly now has the attention of the NRC, PW argues that the possibility of a future Staff Guidance being issued "should not preclude Petitioners' intervention on this issue," citing case law for the principle that "[p]articipation of the NRC Staff in a licensing proceeding is not equivalent to participation by a private intervenor."[270]

According to Pilgrim Watch, in addition to the evidence regarding all Mark I Steel Containment Drywell Shells, the Pilgrim Nuclear Power Station "has a history of corrosion in different areas of the drywell, and there has been a reduction in drywell wall thickness."[271]

Pointing to Appendix B of the Application, PW asserts that the Applicant has identified specific instances of corrosion that were discovered and remedied and that the Applicant incorrectly suggests that such discovery and remedy is evidence of a successful aging management program.[272] Instead, PW argues, this demonstrates that corrosion is occurring and does not prove that all corrosion and degradation is being detected and remedied.[273] To further support its assertions that corrosion and degradation are occurring or will occur at Pilgrim, Petitioner references the same "bathtub curve" risk profile it cited in support of its first contention as applying to aging nuclear power plants, again claiming that in the

---

[262] PW Petition at 17.

[263] *Id.* at 18-19.

[264] *Id.* at 19-20.

[265] *Id.* at 20 n.9 (citing "NRC Conference Call January 31, 2006 to discuss the proposed interim staff guidance for license renewal association with Mark I steel containment drywell shell. Power point Presentation and discussion by Ms. Linh Tran" (*see* NIRS Oyster Creek Motion for Leave To Add Contentions or Supplement (Feb. 7, 2006), ADAMS Accession No. ML0604705540).

[266] PW Petition at 20.

[267] 71 Fed. Reg. 27,010 (May 9, 2006).

[268] PW Petition at 21.

[269] *Id.*

[270] *Id.* (citing *Washington Public Power Supply System* (WPPSS Nuclear Project No. 3), ALAB-747, 18 NRC 1167, 1175-76 (1983)).

[271] *Id.* at 22.

[272] *Id.*

[273] *Id.*

renewal period Pilgrim will be in the "wear-out" phase, making degradation more likely.[274]

Turning to the specifics of the Aging Management Program at Pilgrim, Pilgrim Watch argues that an inspection of the drywell liner every 10 years is not adequate, nor is the primary reliance on visual examinations of the drywell because such inspections cannot monitor inaccessible areas.[275] Assessing the procedures set forth in Appendix A.2.1.17 of the Application, and the Aging Management Program's reference to the use of ultrasonic testing of drywell thickness, Pilgrim Watch states that it is "not clear from the Application where and how often" the drywell thickness would be measured using such tests.[276] Pilgrim Watch cites the work of Dr. Rudolf H. Hausler for the proposition that reliance on visual inspections would be of "limited usefulness."[277] Thus, PW asserts, noting the overall difficulty of inspecting inaccessible areas, visually or by UT, "the Aging Management Plan should require a root cause analysis any time water leakage into the drywell region has been found."[278]

Concluding, Pilgrim Watch contends that the Pilgrim aging management plan "should include regular UT measurements of all critical areas of the drywell liner and a root cause analysis of any drywell areas where water has been found before license renewal is granted."[279] PW advocates frequent enough UT measurements "to confirm that the actual corrosion measurement results are as projected"; that the measurements should be expanded into areas not previously inspected, including multiple measurements to determine "crevice corrosion" in the liner that is submerged in the concrete floor as well as those areas identified by a root cause analysis that may have caused leakage; submission of results to the NRC as publicly available documents in this license renewal proceeding; concurrence with relevant ASME standards; and immediate incorporation of the NRC Staff Interim Staff Guidance into the Aging Management Program.[280]

1. *Entergy Answer to Pilgrim Watch Contention 2*

The Applicant argues that Contention 2 is inadmissible because "it does not address and therefore fails to identify any deficiency in the discussion of this issue in the Application[,] . . . provides no basis to dispute the adequacy of aging management program for the drywell liner[, and t]herefore, fails to establish

[274] *Id.* at 22-23.
[275] *Id.* at 23.
[276] *Id.*
[277] *Id.* at 24.
[278] *Id.*
[279] *Id.*
[280] *Id.* at 24-25.

any genuine dispute concerning a material issue."[281] Turning first to Pilgrim Watch's references to the "Proposed License Renewal Interim Staff Guidance LR-ISG-2006-01: Plant-Specific Aging Management Program for Inaccessible Areas of Boiling Water Reactor Mark I Steel Containment Drywell Shell,"[282] the Applicant states that Pilgrim Watch has failed to acknowledge or "address the amendment to the license renewal application that Entergy submitted on May 11, 2006, to provide additional information responsive to this proposed guidance."[283] The Applicant argues that the contention "does not directly controvert [the] position taken by the applicant," in its application amendment, and thus, the "contention is subject to dismissal."[284]

The Applicant claims that "the proposed interim staff guidance does not support Pilgrim Watch's allegation that Entergy's aging management program does not adequately monitor for corrosion in inaccessible areas."[285] Insisting that the proposed guidance does not require monitoring in the inaccessible areas, Applicant argues that it instead "recommends development of a corrosion rate that can be inferred from past UT examinations." Pointing to Amendment No. 1 of its license renewal application, Applicant states that it "has addressed this issue in the manner recommended in the NRC proposed guidance.[286] The Applicant challenges other of PW's allegations as well, including those asserting inadequacies in the aging management program for the drywell liner. Applicant notes that PW has failed to contradict or assess the programs outlined in the Amendment to the Application, which include "[a] host of actions . . . not limited to 'inspection of the drywell liner every 10 years' as alleged in the Contention."[287] Applicant states that no basis has been shown for PW's allegation of a history of corrosion, and, finally, argues that PW has failed to address the root cause discussion in section B.0.3 of Appendix B to the Application when it asserts that the aging management program for the drywell shell impermissibly omits a requirement for root cause analysis when corrosion is found.[288]

[281] Entergy Answer to PW Petition at 20.
[282] 71 Fed. Reg. 27,010.
[283] Entergy Answer to PW Petition at 21 (citing Letter from S. Bethay to U.S. Nuclear Regulatory Commission, License Renewal Application, Amendment No. 1 (May 11, 2006), ADAMS Accession No. ML061380549).
[284] *Id.* at 21.
[285] *Id.*
[286] *Id.* at 22.
[287] *Id.* at 22-23.
[288] *Id.* at 24.

2. *NRC Staff Response to Pilgrim Watch Contention 2*

The NRC Staff does not dispute that the contention falls within the scope of the license renewal proceeding, but, like the Applicant, argues that it is inadmissible because it fails to present a genuine issue of law or fact as required by 10 C.F.R. § 2.309(f)(1)(vi), and also asserts that "it lacks a basis in fact or expert opinion" as required by section 2.309(f)(1)(v).[289] Instead, the Staff asserts, the "Petitioner impermissibly attempts to piggyback on to the Staff's dialogue with industry and the public relative to forthcoming Interim Support Guidance (ISG) . . . as a substitute for Petitioner's obligation to provide facts or technical expertise in support of its assertions."[290] PW has failed, Staff argues, to provide "independent facts or expert opinion beyond Staff dialogue with industry.[291] Further, the Staff faults Pilgrim Watch for making only vague references to the Application, and thus failing to include any challenge to specific deficiencies in the application.[292] With regard to the allegations of a "history of corrosion in different areas of the drywell" at Pilgrim, the Staff argues that the contention's reference to the "torus bays and drywell spray header" is misdirected, stating that these "are entirely distinct features from the drywell shell."[293] Similarly, the Staff contends that the Union of Concerned Scientists Report cited by Pilgrim Watch fails to provide a factual basis for the contention because it "makes no mention of Pilgrim, the LRA or drywell shell region."[294] Finally, regarding PW's argument that the Pilgrim Aging Management Plan is deficient for failing to provide for sufficient inspection of the drywell, the Staff also faults PW for failing to address the May amendment to the Application and urges that as a result PW's argument does not support admission of the contention because it fails to present a genuine dispute of law or fact.[295]

3. *Pilgrim Watch Replies to Entergy and NRC Staff*

In its reply to the Applicant, Pilgrim Watch concedes that it did not mention the Applicant's License Amendment regarding drywell monitoring in its Petition, but insists that the Applicant did not notify the Petitioner as to its existence, nor was the Amendment made part of the Application "on the Pilgrim I License Renewal Site."[296] However, having now assessed the Amendment, Pilgrim Watch argues that the Applicant fails to satisfy the standards in the recently released proposed guidance regarding this issue.[297] The guidance, according to Pilgrim Watch, requires the development of a plant-specific aging management plan to address corrosion in the inaccessible areas of the drywell shell, and a development of "corrosion rates" for these areas.[298] Pilgrim Watch faults the Applicant because "it appears that measurements have only been taken twice in the inaccessible embedded areas, and these measurements have been discontinued"; according to PW, "[t]his does not appear to conform with the proposed ISG."[299]

Responding to the Staff, PW disputes the argument that it "impermissibly attempts to piggyback" on the Staff's dialogue with industry as the basis for its contention.[300] According to PW, unlike instances where a Petitioner relies wholly on the "existence of RAIs to establish deficiencies in the application," as cited by the Staff, here Pilgrim Watch is simply arguing that Pilgrim should "at least meet the new standards outlined in [the] ISG."[301] Petitioner further contends that its contention and basis "directly refer to sections of the Licensee's Aging Management Program for the drywell liner,"[302] and, based on the inadequacies that it has shown in this program, again requests incorporation of the proposed NRC requirements into the Pilgrim aging management program before any license renewal is granted.[303]

4. *Licensing Board Ruling on Contention 2*

We find this contention, though within the scope of license renewal and meeting other relevant requirements of 10 C.F.R. § 2.309(f), to be inadmissible because it fails to meet the requirement of 10 C.F.R. § 2.309(f)(vi) that sufficient information be shown to demonstrate that a genuine dispute exists with the applicant on a material issue of law or fact. In this contention, as argued by Staff, PW essentially relies on the interim Staff guidance, seeking to require Applicant to comply with the guidance. Moreover, particularly with regard to the May 11, 2006, amendment to the Application, PW does not state with any specificity or provide information showing *how* the actions and proposed actions

---

[289] Staff Response to PW Petition at 19.
[290] *Id.* (citations omitted).
[291] *Id.*
[292] *See id.* at 21.
[293] *Id.*
[294] *Id.* at 22.
[295] *Id.*

[296] Pilgrim Watch Reply to Entergy at 10-11.
[297] *Id.* at 12; *see* LR-ISG-2006-01, Plant-Specific Aging Management Program for Inaccessible Areas of Boiling Water Reactor Mark I Steel Containment Drywell Shell.
[298] PW Reply to Entergy at 12.
[299] *Id.*
[300] PW Reply to NRC Staff at 10.
[301] *Id.*
[302] *Id.*
[303] *See id.* at 11.

of the Applicant do not comply with the Staff guidance, stating only, in its reply, that "[t]his does not *appear* to conform with the proposed ISG."[304] The Board is not permitted to draw any inferences on behalf of a petitioner, and in the absence of any more specific statement than has been provided, showing how the specific actions of Applicant fall short, or some nexus with problems at other plants, we find the contention fails to show any genuine dispute on a material issue of fact relating to the matters at issue.

Applicant Entergy has detailed in its amendment how it has in fact done UT testing of the drywell shell, both at points adjacent to the inaccessible sand cushion region and also, on two occasions, of the shell immediately above the sand cushion area, by chipping away the concrete above the points of testing.[305] It has stated that the result of this testing has been that the thickness of the shell at the areas tested is "essentially as-built."[306] It has explained that it ceased doing UT measurements in the inaccessible sand cushion region, based on satisfactory results from monitoring for leakage from the annulus air gap drains (which provide for drainage from the sand cushion area); satisfactory thickness at the 9-foot elevation sand cushion region (and upper drywell); the existence of high radiation in the areas where the sand cushion UT exams were performed; and the potential for damage to the drywell shell from the tools used to chip away concrete when UT testing of the sand cushion area was performed.[307] With no more specific information being provided to show that these are not acceptable reasons for ceasing the UT testing or that other measures taken by Applicant are unsatisfactory than that it "does not appear" that these satisfy the ISG, we see no genuine dispute being raised about the actions taken by the Applicant and whether they satisfy the ISG. Whether the Applicant's actions and procedures do or do not satisfy the ISG will be determined by the Staff in the course of their license renewal review, and Staff has indicated that it will assure compliance with the ISG.[308] In order for a petitioner to have a contention admitted on

[304] PW Reply to Entergy at 12.

[305] *See* Pilgrim License Renewal Application, Amendment 1 (May 11, 2006) at 3, ADAMS Accession No. ML061380549 [hereinafter Amendment].

[306] *Id.*

[307] *See id.* at 2-3.

[308] At oral argument, the Staff stated that they "intend to apply the elements of the draft ISG to the renewal application. The extent to which those amendments address the ISG is just going to be a matter of review." Tr. at 353. The Staff responded affirmatively to questioning from the Licensing Board Chair as to whether they would "make sure the ISG is complied with completely." *Id.* Entergy counsel stated that, although Entergy would "like to see the finalized ISG before I commit to say[,] I would assume that if it's along the lines of the proposed ISG that we would [commit to complying with the ISG]." Tr. at 356.

this subject, however, more information must be shown than has been shown here.[309]

D. Pilgrim Watch Contention 3: The Environmental Report Is Inadequate Because It Ignores the True Offsite Radiological and Economic Consequences of a Severe Accident at Pilgrim in Its Severe Accident Mitigation Alternatives (SAMA) Analysis

Pilgrim Watch here contends:

> The Environmental Report inadequately accounts for off-site health exposure and economic costs in its SAMA analysis of severe accidents. By using probabilistic modeling and incorrectly inputting certain parameters into the modeling software, Entergy has downplayed the consequences of a severe accident at Pilgrim and this has caused it to draw incorrect conclusions about the costs versus benefits of possible mitigation alternatives.[310]

Pilgrim Watch's argument that this contention is within the scope of license renewal[311] is not disputed;[312] severe accidents, and alternatives to mitigate severe accidents, are listed as a "Category 2" issue in 10 C.F.R. Part 51, Subpart A, Appendix B. Petitioner also cites Council on Environmental Quality (CEQ) regulatory authority for the proposition that environmental impacts that are "reasonably foreseeable" and have "catastrophic consequences, even if their probability of occurrence is low," must still be considered in an EIS;[313] and

[309] Reference may be made to the information provided by a petitioner in the *Oyster Creek* proceeding for comparison purposes. In that case, for example, among other facts shown by petitioners in their first contention relating to drywell corrosion, it was demonstrated that 60 out of 143 UT measurements at the 11-foot level of the sand cushion region indicated a reduction of more than 1/4 inch from the original design thickness of 1.154 inches at that point. *AmerGen Energy Co., LLC* (Oyster Creek Nuclear Generating Station), LBP-06-7, 63 NRC 188, 213 (2006). By contrast, no reason has been provided to doubt Entergy's statement that UT measurements in the sand cushion region indicated essentially no reduction in thickness.

In a second contention on drywell corrosion, admitted in part after the first contention on the subject was ruled moot based on actions taken by that Applicant to address a deficiency alleged in that contention, *see AmerGen Energy Co., LLC* (Oyster Creek Nuclear Generating Station), LBP-06-22, 64 NRC 229, 230-31 (2006), the Petitioners provided a relatively detailed argument in contrast to the contention before us. For example, that portion of the contention that was admitted concerned a very specific assertion that the drywell shell at Oyster Creek was "0.026 inches or less from violating AmerGen's acceptance criteria" in the sand bed region "due to prior corrosion." *Id.* at 240, 242.

[310] PW Petition at 26.

[311] *See id.*

[312] *See* Staff Response to PW Petition at 25; Entergy Answer to PW Petition at 25-46.

[313] PW Petition at 26 (quoting 40 C.F.R. § 1502.22(b)(1)).

NRC regulatory authority for the proposition that difficulty in quantification does not excuse inclusion in the EIS, because, "to the extent that there are important qualitative considerations that cannot be quantified, these considerations or factors will be discussed in qualitative terms."[314]

Petitioner argues that this contention is material because it alleges a deficiency in the Application that "could significantly impact health and safety"[315] — it is asserted that the use of "probabilistic modeling and incorrect parameters in its SAMA analysis" results in a downplaying of the likely consequences of a severe accident at Pilgrim, which "thus incorrectly discounts possible mitigation alternatives" that might prevent or reduce the impact of an accident.[316]

As basis for Contention 3, PW notes that the Appendix B requirement on SAMAs provides that, even though "[t]he probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts from severe accidents are small for all plants," alternatives to mitigate severe accidents must still be considered.[317] Petitioner suggests that by virtue of Entergy's use of probabilistic modeling, the deaths, injuries, and economic consequences of an accident can be underestimated, citing various legal and technical authority."[318]

Further, PW asserts, Applicant used outdated versions of the MACCS2[319] Code and MACCS2 User Guide, ignoring warnings about the code's limitations and using incorrect input parameters.[320] Citing criticisms of the code, PW points to, among other things, limitations on the code's failure to "model dispersion close to the source . . . or long range dispersion," and to a user's "ability to affect the output from the code by manipulating the inputs and choosing parameters."[321] Stating that it is impossible for PW to fully evaluate the SAMA conclusions of the Applicant, "[w]ithout knowing what parameters were chosen by the Applicant," PW posits several "reasons that Entergy's described consequences of a severe accident at Pilgrim look so small," based on the ER, and discusses several specific categories of what it contends are incorrect input data to the SAMA analysis.[322] These alleged errors relate to meteorological data (including wind speed, wind direction, and dispersion), demographic and emergency response data relating to evacuation delay time and speed, and economic data.[323] PW alleges that the Applicant's undercounting of the costs of a severe accident could have led to erroneous rejection of mitigation alternatives, and that further analysis is necessary.[324]

Pilgrim Watch challenges the modeling of the Application's atmospheric dispersion of a point release of radionuclides because it allegedly does not take into account meteorological conditions such as wind speed and direction changes, the sea breeze phenomenon, and coastal topography.[325] Citing various authority in support of its arguments, including a Massachusetts Department of Public Health report on the "Feasibility of Exposure Assessment for the Pilgrim Nuclear Power Plant," and NRC Regulatory Guide 1.194,[326] PW contends that the data used in the Application — taken from the reactor site and the Plymouth airport — should be replaced with more specific data that take into account the specific characteristics of the Plymouth area.[327]

Pilgrim Watch challenges the demographic and other data used in the Application, arguing that, because of the unpredictability and complexity of the winds at the Pilgrim site, a larger, more inclusive population, located "within rings around the plant," should be used when calculating offsite dose costs.[328] Noting that the sensitivity analysis used in the Application does not include the most current information on emergency evacuation needs,[329] and suggesting that it does include a faulty assumption "that the longest likely delay before residents begin to evacuate is 2 hours," PW proposes that the analysis should take into account phenomena such as the need for some who cannot evacuate to shelter in place, special events that bring large numbers of the public onto the roads at times, and "shadow evacuation," or voluntary evacuation by persons not within the formal evacuation area.[330] Petitioner suggests the need for greater realism and accuracy

---

[314] *Id.* at 27 (citing 10 C.F.R. § 51.71).

[315] *Id.* at 28 (citing *Millstone*, LBP-04-15, 60 NRC at 89).

[316] *Id.* at 28.

[317] *Id.* at 29-30 (citing 10 C.F.R. Part 51, Subpart A, Appendix B).

[318] *Id.* at 30-31.

[319] MACCS stands for "MELCOR Accident Consequence Code System"; *see* PW Petition at 31.

[320] *See* PW Petition at 31.

[321] *Id.* at 33; *see id.* at 31-34 & nn.13, 14 (citing D.E. Chanin and M.L. Young, *Code Manual for MACCS2: Vol. 1, User's Guide* (Sandia Nat. Lab., 1997); MACCS2 *Computer Code Application Guidance for Documented Safety Analysis* (DOE, 2004).

[322] PW Petition at 34.

[323] *See id.* at 34-45.

[324] *See id.* at 48-49.

[325] *See id.* at 34-38.

[326] *See id.* (citing J.D. Spengler and G.J. Keeler, Feasibility of Exposure Assessment for the Pilgrim Nuclear Power Plant (1988); NRC Regulatory Guide 1.194 (June 2003); Edwin S. Lyman, Union of Concerned Scientists, "Chernobyl on the Hudson? The Health and Economic Impact of a Terrorist Attack at the Indian Point Nuclear Plant," at 16 (2004)).

[327] *See id.* at 37-38.

[328] *Id.* at 38.

[329] PW indicates that a later report prepared for Entergy than that used in the Pilgrim SAMA analysis "relies on newer census data and newer roadway geometric data." PW Petition at 39-40 (citing "Pilgrim Nuclear Power Station Development of Evacuation Time Estimates," KLD TR-382, Rev. 6 (Oct. 2004)); *cf.* KLD, "Pilgrim Station Evacuation Time Estimates and Traffic Management. Plan Update," Rev. 5 (Nov. 1998).

[330] PW Petition at 41-43.

in the evacuation analysis, as well as assumption of "the worst case scenario."[331] PW supports these arguments with a factual discussion, along with references to specific sections of the Application and various other documents and studies.[332]

Noting "[o]ne of the cited criticisms of the MACCS2 Code — 'i.e., "that 'the economic model included in the code models only the economic cost of mitigative actions'" — PW points out that, although costs of decontamination, condemnation of property that cannot be sufficiently decontaminated, and compensation to persons forced to relocate as a result of an accident are included, not accounted for is any resulting loss of economic activity in Plymouth County or other neighboring counties with significant tourism (including the Cape Cod area), travel to which is through Plymouth County.[333] One example provided is that of Plimoth Plantation, which is "less than five miles from the plant [and] brings in almost $10 million per year."[334] PW also attaches as an exhibit to this contention a study on the economic impact of travel on Massachusetts counties, prepared for the Massachusetts Office of Travel and Tourism.[335]

Finally, PW provides an example of an alternative that it contends the Applicant wrongly dismissed as a result of its SAMA analysis — namely, adding a filter to the Direct Torus Vent.[336]

1. *Entergy Answer to Pilgrim Watch Contention 3*

The Applicant argues that Contention 3 is inadmissible "because (1) the Contention impermissibly challenges Commission regulation, and (2) the Contention provides no basis to establish a material dispute of fact regarding the adequacy of the SAMA analysis in the ER."[337] In its first argument, Applicant asserts that Pilgrim Watch has "misread," thus misapplied, and in effect challenged Commission regulations regarding SAMA analysis.[338] The root of this problem, according to the Applicant, is Pilgrim Watch's assertion that SAMA analysis should be focused on severe accident mitigation alternatives and not severe accident risks.[339] Pointing to the Third Circuit decision in *Limerick Ecology Action, Inc. v. NRC*,[340] and the Commission decision in *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-17,[341] the Applicant argues that the Commission and reviewing courts have endorsed the position that "the evaluation of risk is at the heart of a SAMA analysis," that "only by considering risk can one determine those alternatives that provide the greatest benefit for the dollars expended," and that PW is in error in suggesting that a SAMA analysis is "to focus solely on mitigation of consequences without regard to the likelihood of their occurrence."[342] Applicant emphasizes the centrality of the risk calculation by describing the Third Circuit's discussion of how the probability of a risk may change with population density,[343] and the Commission's statement that reductions in risk are "assessed in terms of the total *averted risk*: averted public exposure (health risk converted into dollars to estimate the cost of the public health consequence), averted onsite cleanup cost, averted offsite property damage costs, averted exposure costs, and averted power replacement costs."[344] Applicant also quotes from a Commission decision in the *McGuire/Catawba* license renewal proceeding:

> Whether a SAMA may be worthwhile to implement is based upon a cost-benefit analysis — a weighing of the cost to implement the SAMA with the *reduction in risks* to public health, occupational health, and offsite and onsite property.[345]

Applicant characterizes PW's argument as being that "risk is to be ignored [in a SAMA analysis] and that only consequences are to be considered," and argues that this approach is contrary to the SAMA rule.[346] Applicant concludes its argument that Contention 3 "impermissibly challenges Commission Regulation" with the following statement:

> In short, Pilgrim Watch's claim that the Pilgrim SAMA analysis erroneously focuses

[331] *Id.* at 40.

[332] *See id.* at 39-42 (citing KLD-TR-382, Rev. 6, Rev. 5; Calculation of Reactor Accident Consequences (CRAC-2) (Sandia Nat. Lab., 1982); NAS, *The Safety & Security of Commercial Spent Nuclear Fuel Storage Public Report* (2005); Donald Ziegler and James Johnson, Jr., Evacuation Behavior in Response to Nuclear Power Plant Accidents, *The Professional Geographer* (May 1984)).

[333] *Id.* at 43-44 (internal quotations omitted).

[334] *Id.* at 44.

[335] *See* PW Petition, Exhibit D, The Economic Impact of Travel on Massachusetts Counties, 2003, prepared for the Massachusetts Office of Travel and Tourism by the Research Department of the Travel Industry Association of America, Washington, D.C. (January 2005).

[336] PW Petition at 45-48.

[337] Entergy Answer to PW Petition at 25.

[338] *See id.*

[339] *Id.* at 25-26.

[340] 869 F.2d 719 (3d Cir. 1989).

[341] CLI-02-17, 56 NRC 1 (2002).

[342] Entergy Answer to PW Petition at 26.

[343] *Id.* at 27; *see Limerick*, 869 F.2d at 738-39.

[344] Entergy Answer to PW Petition at 27 n.15 (citing *McGuire/Catawba*, CLI-02-17, 56 NRC at 8 n.14). Applicant notes as well the Commission's prediction that it would be "unlikely that any site-specific consideration of severe accident mitigation alternatives for license renewal will identify *major plant design changes or modifications* that will prove to be cost-beneficial for reducing severe accident frequency or consequences." *Id.* at 28 (citing 61 Fed. Reg. 28,467, 28,481 (June 5, 1996) (emphasis added by Applicant)).

[345] Entergy Answer to PW Petition at 26 (quoting *McGuire/Catawba*, CLI-02-17, 56 NRC at 7-8).

[346] *Id.* at 27.

on risk so as to improperly minimize the consequences of a SAMA is not supported. The reduction of risk (likelihood of occurrence times severity of consequences) is *the* fundamental tenet of SAMA analysis. Moreover, because the impacts from severe accidents as determined by the Commission are "SMALL" the Commission does not expect a properly conducted SAMA analysis "to identify *significant* [plant] modifications that are cost-beneficial" . . . , which is exactly counter to the underlying premise of Contention 3.[347]

In its second argument, Applicant urges that Contention 3 fails to raise any material dispute of fact, insisting that it lacks any "factual basis to show that the different modeling assumptions and estimates that it claims should have been used in the SAMA analysis would have any material impact on the results of the analysis."[348] Asserting that the "contention rests on several faulty premises," Applicant reiterates its argument described above and claims that the "mischaracterization of the SAMA analysis" has tainted its contention and "provides no basis for an admissible contention."[349] Applicant notes that, "[a]s would be expected by the Commission," its SAMA analysis "does not identify any significant modification to mitigate severe accidents to be cost-beneficial," but does find five alternatives to be "potentially cost beneficial" and recommends further evaluation and consideration of these.[350] In addition, it points out that it identified benefits for more than fifty of the fifty-nine SAMAs it did evaluate, contrary to Petitioner's assertion of "zero" benefits identified.[351]

Applicant argues that "Contention 3 impermissibly presumes the materiality of its asserted deficiencies and pleads no facts to establish their materiality."[352] According to the Applicant, "the Contention sets forth nothing to establish that the asserted deficiencies would, if corrected as claimed by the Contention, alter the *result* of the SAMA evaluations."[353] Applicant suggests that:

> In light of the large conservatisms inherent in the [SAMA] analyses, the significant differences between the cost and benefit of implementing the various SAMAs, and the sensitivity analyses showing that the results are not sensitive to changes in assumptions, it is behoven for Pilgrim Watch to have pled facts to establish the materiality of its asserted deficiencies, [which is] necessary to avoid a meaningless "EIS editing session[ ]" of the type that the Commission has warned against.[354]

[347] *Id.* at 29.
[348] *Id.* at 29-30.
[349] *Id.* at 30.
[350] *Id.* (citing Application, ER at E.4-49).
[351] *Id.* at 30-31.
[352] *Id.* at 31.
[353] *Id.* (emphasis in original).
[354] *Id.* at 32-33 (citations omitted).

The Applicant also takes issue with the Contention's assertion that the "severe accident analysis should assume the worst case scenario."[355] Arguing that "NEPA's 'Rule of Reason' provides no exception for SAMA analysis," the Applicant claims that Pilgrim Watch has no legal basis for its proposition.[356] Therefore, according to the Applicant, only "reasonable scenarios" need be considered, " 'limited to effects which are shown to have some likelihood of occurring.' "[357] Applicant cites both Commission and Supreme Court case law suggesting that the SAMA analysis "requires no different level of consideration or evaluation than that employed for analyzing mitigation generally under NEPA,"[358] and quotes the Commission's statement in *McGuire/Catawba* that "[u]nder NEPA, mitigation (and the SAMA issue is one of mitigation) need only be discussed in 'sufficient detail to ensure that environmental consequences [of the proposed project] have been fairly evaluated.' "[359]

In the Applicant's view, PW has also failed to establish a factual basis for its challenges regarding (1) the Applicant's use of an "outdated" version of MACCS2 Code and User Guide and analysis performed with such tools; (2) the Applicant's meteorological data analysis; (3) the Applicant's demographic and emergency response data and analysis; or (4) its economic data and analysis.[360] With regard to the MACCS2, the Applicant asserts that the code is "state-of-the-art," and that "Pilgrim Watch [does not] provide any basis whatsoever for its allegations that Entergy 'ignored warnings about the limitations of the model,' "[361] or "any basis to show that any of the inherent limitations of the MACCS2 Code are of any significance and would in any way alter the outcome of the SAMA analysis with respect to determining potentially cost beneficial SAMAs."[362]

While Applicant agrees that "additional data may always be desirable," it again argues that Petitioner has not made any showing that the alleged deficiencies in any way materially affect the SAMA analysis.[363] In addition, Applicant suggests that Regulatory Guide 1.194 does not support the need for more than the year's

[355] *Id.* at 33.
[356] *Id.*
[357] *Id.* (quoting *Hydro Resources, Inc.* (P.O. Box 777, Crownpoint, New Mexico 87313), LBP-04-23, 60 NRC 441, 447 (2004)).
[358] *See id.* at 35 (citing *Robertson*, 490 U.S. at 344-47).
[359] *Id.* (citing *McGuire/Catawba*, CLI-03-17, 58 NRC at 431).
[360] *Id.* at 36-46.
[361] *Id.* at 36.
[362] *Id.* at 37.
[363] *Id.* at 38.

worth of meteorological data it utilized in its analysis,[364] and states that "[PW] makes *no* claim that the 12 month period of meteorological data used for the Pilgrim SAMA analysis is unrepresentative of the Pilgrim site's meteorology in any respect."[365] Noting PW's suggestion that " 'measurements from multiple sites in the field' are needed to '*better* characterize meteorological conditions,' " Applicant suggests that the "real thrust" of PW's claim is "an asserted need for an expanded radiological monitoring program for the Pilgrim plant, which is an operational issue beyond the scope of this license renewal proceeding," just as with Contention 1.[366]

The Applicant suggests a similar lack of basis to show that different data would materially affect the outcome of the SAMA analysis with respect to population demographics and emergency response data, noting that the latter were derived from the Pilgrim Emergency Plan, and suggesting that Petitioner has not shown that use of more recent data "would have exceeded the bounds of . . . sensitivity analyses [performed by Applicant] or altered the outcome of the analysis in any material way."[367] In addition, Applicant notes that it evaluated "a wide range of scenarios for which evacuation time estimates were developed," including varying weather conditions, times of day and year, and amounts of traffic.[368]

Finally, with regard to emergency response data, Applicant argues that these should not be subject to challenge in this proceeding, citing Commission precedent for the principle that "[e]mergency planning . . . is one of the safety issues that need not be re-examined within the context of license renewal."[369] Applicant suggests that it follows from this precedent that "assumptions that are consistent with the established emergency plan should be accepted as reasonable in this proceeding," and that PW's suggestion that the evacuation zone should be greater than the 10 miles provided for in "applicable NRC requirements" is "a direct, impermissible

[364] *Id.* Applicant notes that by its terms Regulatory Guide 1.194 does not apply for modeling offsite accident radiological consequences. Instead, according to Applicant, the applicable NRC guidance is found in Regulatory Guide 1.145, which points to Regulatory Guide 1.23, "which provides for the use of 'data gathered on a continuous basis for a representative 12 month period' (although '[t]wo full cycles of data are desirable')." *Id.* (citing Reg. Guide 1.194 at 1.194-1–1.194-3; Reg. Guide 1.145 at 1.145-2; Reg. Guide 1.23 at 23.2). Applicant also notes that Edwin Lyman, one of Petitioner's sources, has recognized that the MACCS2 Code cannot process more than a year's worth of data. *Id.* (citing Lyman, *supra*, at 26, 33).

[365] Entergy Answer to PW Petition at 38.

[366] *Id.* at 39.

[367] *Id.* at 41; *see id.* at 40-41.

[368] *Id.* at 42. Again, however, Applicant in its pleadings offers no quantification of either the range of scenarios investigated or the effects of the variation in assumptions.

[369] Entergy Answer to PW Petition at 43 (quoting *Turkey Point*, CLI-01-17, 54 NRC at 9); *see id.* at 42-43.

challenge to the Commission's emergency planning requirements."[370] In any event, according to Applicant, its analysis takes into account dose to the public within a 50-mile radius "and thus fully accounts for the risk beyond 10 miles."[371] With respect to "shadow evacuation," Applicant views this as a call by PW for an impermissible "worst case scenario," and asserted in oral argument that local law enforcement will assure absence of shadow evacuation[372]; and, with respect to the need of some to "shelter in place," Applicant points out that the existing emergency plan provides for state and local governments to provide assistance to immobile and handicapped persons in the evacuation zone.[373]

Applicant defends its sensitivity analysis as incorporating "large conservatisms" such as using the 2-hour time prior to beginning of evacuation rather than the 40-minute time in the base case, which it says "show a maximum change in the population dose estimates of 'less than 2%.' "[374] Applicant argues to the effect that using larger changes in the evacuation times would still produce only negligible changes in the result, and that the Contention provides no basis to show that its challenges would alter the outcome of the analysis.[375] Finally, Applicant asserts (without quantification of its sensitivity analysis results) that the same conclusion must be drawn regarding the economic data suggested by Petitioner, and that "even with its asserted limitations, the MACCS2 code is state-of-the-art and can be properly applied to yield valid results."[376]

2. *NRC Staff Response to Contention 3*

The Staff's position is that, while the subject of SAMAs is clearly within the scope of a license renewal proceeding, this contention is inadmissible.[377] The Staff challenges the contention as raising issues that are "not material to the findings that must be made in this matter" and "not supported by expert opinion

[370] *Id.* at 43.

[371] *Id.*

[372] *See* Tr. at 426-27.

[373] Entergy Answer to PW Petition at 44.

[374] *Id.* at 45 (internal quotation omitted).

[375] *See id.* at 45-46.

[376] *Id.* at 46. We also note Entergy's concession at oral argument that "the one insightful aspect of the petition was that we made a mistake in one of our SAMAs." Tr. at 399. With respect to the direct filtered vent, which was cited by PW as evidence of faulty SAMA analyses, the applicant stated that it made an "error in inputting the appropriate source term," but that the error was not indicative of code errors or incorrect economic inputs, evacuation time estimates, or meteorological data. Tr. at 400. Furthermore, according to the Applicant the error was corrected in a response to a Staff Request for Additional Information. *See id.*

[377] *See* Staff Response to PW Petition at 25.

or sufficient facts, as required by 10 CFR § 2.309(f)(1)(v)."[378] The Staff insists that SAMA analysis is a "technical area" and that a Petitioner "cannot rely on its own assertions."[379] The Staff also defends the use of "probability risk analysis" (PRA) as utilized in the SAMAs, arguing that "[u]se of the PRA in this manner is an essential and widely accepted part of the cost-benefit methodology as described in Section 5.6 of NUREG/BR-0184."[380]

Regarding Pilgrim Watch's assertion that probabilistic modeling can underestimate the true consequences of a severe accident, the Staff notes that the Applicant followed accepted NRC and industry practice by comparing the costs and benefits of each identified SAMA, used the correct definition of risk ("the product of consequence and frequency of accidental release"), and properly discarded SAMA candidates not found to be viable.[381] Staff suggests that the fact that the Applicant evaluated 281 SAMAs negates any implication that Applicant "did not consider a full range of SAMAs."[382]

The Staff dismisses PW's concerns regarding the alleged use of "an outdated version of the MACCS2 Code" as "mere speculation," citing PW's statement that "Entergy may have 'minimized consequences by using incorrect input parameters."[383] In addition, the Staff counters PW's suggestion that the Code and/or its user guide are out of date or contain known flaws, asserting that Pilgrim Watch has "insufficient basis" for its claims.[384] The Staff also argues that Pilgrim Watch's related claim that the applicant used incorrect input data in the models (including meteorological, demographic, emergency response, and regional economic data) is not supported and is not material in that it has not been "established that any of these alleged shortcomings of MACCS2 are, in fact,

[378] *Id.*

[379] *Id.*

[380] *Id.* at 26. The Staff explains that, in determining whether any of the 281 possible SAMAs Entergy identified for Pilgrim (from a number of sources, including the Pilgrim PRA analysis) should be implemented,

> the licensee performed a cost-benefit analysis using a methodology that is consistent with the NRC Regulatory Analysis Technical Evaluation Handbook (NUREG/BR-0184). This analysis is designed to identify and estimate the relevant values and impacts of a each proposed change, and provides a structured approach for balancing benefits and costs in determining whether implementation is justified. The PRA is used within this analysis to evaluate the reduction in probabilities (core damage frequency) and consequences (population dose) that would be associated with implementation of each alternative. Use of the PRA in this manner is an essential and widely accepted part of the cost-benefit methodology, as described in Section 5.6 of NUREG/BR-0184.

Id.

[381] *See* Staff Response to PW Petition at 27-28.

[382] *Id.* at 28.

[383] *Id.* at 28-29 (emphasis supplied by Staff).

[384] *Id.* at 29.

deficiencies, or that they impact the results of the SAMA analysis."[385] Noting that the MACCS2 code "has been previously evaluated and found to be sufficient to support regulatory analyses and cost-benefit analyses" in NUREG/BR-0184 and NUREG/CR-6853, Staff contends that PW's challenge of the use of the code is unsupported.[386]

The Staff also argues that there is "no legal support for the position that the Applicant should be required to provide the complete inputs," and that the failure to do so "is not a sufficient basis for asserting or concluding that the input is flawed, or that the applicant has inappropriately manipulated the input."[387] Noting that "a summary description of the site-specific input parameters in each of the major modeling areas is provided in Section E.1.5.2 of the ER," the Staff faults PW for "not [having] taken issue with any of these specific inputs, other than raising more general concerns . . . ."[388] The Staff states that the "request for a complete input listing appears to be designed to obtain discovery to be used as a basis for additional contentions, and as such, is specifically prohibited by the Commission."[389]

The Staff challenges PW's claims about the sea breeze phenomenon, asserting that PW has not sufficiently shown that:

> (1) the phenomenon is unique to the Pilgrim site and not present at many other coastal sites where MACCS2 has been utilized, (2) the Applicant did not, in fact, model this phenomenon, or (3) the claimed failure to fully characterize or model the phenomenon would result in any meaningful difference in results of the SAMA evaluation or render the site-specific MACCS2 data inadequate.[390]

Arguing in a vein similar to that of Entergy, the Staff maintains that Pilgrim Watch has not shown that Regulatory Guide 1.194, cited by PW as authority for the argument that more data may be required, is applicable to SAMA analysis, nor has it shown "that additional data is necessary or that the one year of data is insufficient."[391] Further, Staff insists:

[385] *Id.* at 31.

[386] *Id.* (citing NUREG/BR-0184, "NRC Regulatory Analysis Technical Evaluation Handbook," at 5.38; NUREG/CR-6853, "Comparison of Average Transport and Dispersion Among a Guassian, a Two-dimensional, and a Three-dimensional Model, Lawrence Livermore National Laboratory," at 5 (October 2004)).

[387] *Id.* at 30.

[388] *Id.*

[389] *Id.*

[390] *Id.* at 32.

[391] *Id.* (citing Regulatory Guide 1.194, § C.1 at 1.194-3, 1.194-5, and 6; NUREG/CR-6613, Vol. 1, App. A, § A.1 at a-1).

> [T]he Petition fails to establish why the applicant's approach is inadequate, and that the petitioner's "more realistic approach" would have any impact on SAMA results. . . . Nowhere does the petition establish why Entergy's approach is inadequate or that an alternative approach would have any impact on the SAMA results. Thus, Petitioner has failed to show that the issue is material to the findings or that a genuine dispute exists on a material issue of law or fact.[392]

Finally, regarding PW's suggestion that Entergy wrongly dismissed the SAMA of adding a filter to the Direct Torus Vent, the Staff argues that Petitioner "fails to establish that a more appropriate treatment of the benefits of the filtered vent would result in the filtered vent becoming cost-beneficial."[393]

3. *Pilgrim Watch Replies to Entergy and NRC Staff*

Pilgrim Watch states that Entergy has "misconstrued the substance of the Petitioner's contention completely."[394] PW denies that it challenges NRC regulations, noting that, to the contrary, it quoted and relied on the SAMA regulation.[395] PW notes that it does not argue that mitigation alternatives must be adopted, only that they must be "considered," as required in the regulation.[396] Regarding its argument that "multiplying the probability of an accident by the consequences of an accident . . . can distort the analysis by making even reasonable mitigation appear more costly than the costs of an accident," PW points out that this argument is "not central to [its] Contention, which focuses mainly on the input parameters used in the accident modeling software."[397]

Petitioner suggests further that some of Entergy's arguments actually support the contention, including its reliance on the *Limerick* decision.[398] It is asserted that the Third Circuit's recognition in *Limerick* of different risk profiles for plants in densely populated areas as compared to areas of low population actually supports PW's argument "that the consequences of a severe accident are the important consideration in evaluating the costs and benefits of implementing SAMAs," and posits that, because Pilgrim is in a densely populated area, the emergency response inputs used for Pilgrim "underestimate evacuation delay times."[399]

[392] *Id.* at 33 (footnote omitted).
[393] *Id.*
[394] Pilgrim Watch Reply to Entergy at 12.
[395] *Id.* at 13.
[396] *Id.*
[397] *Id.* at 14.
[398] *Id.* at 14-15.
[399] *Id.*

Petitioner questions Entergy's argument that significant plant modifications are not expected as a result of a SAMA analysis, suggesting that "this is not the 'hard look' required by NEPA," and reiterates that what it is calling for is "further analysis," not, as Entergy suggests, that NEPA requires implementation of particular SAMAs.[400] The bulk of the contention, PW emphasizes, highlights "input data that were incorrect, incomplete or inadequate."[401] Since it does not have access to the input parameters used by Entergy, it cannot show what impact any one defect might have on the results of the SAMA analysis, as Entergy argues it must do, but this is not, PW contends, the same as showing an impact on the outcome of a proceeding, which, along with showing that an alleged deficiency has "some independent health and safety significance," is the correct standard for materiality.[402] PW argues that it has met the requirement of materiality by demonstrating "that there are deficiencies in Applicant's SAMA analysis that, by minimizing the true consequences of severe accidents, could have independent health and safety significance."[403] It cites authority for the principle that "further analysis" is a "valid and meaningful remedy" to call for under NEPA, given that, "[w]hile NEPA does not require agencies to select particular options, it is intended to 'foster both informed decision-making and informed public participation, and thus to ensure the agency does not act on incomplete information, only to regret its decision after it is too late to correct.' "[404]

Petitioner further supports its arguments on the allegedly faulty assumptions in the Pilgrim SAMA analysis, including the sensitivity analysis, by referring to the significant underestimations of evacuation times with regard to Hurricane Katrina (also alluded to in its Petition[405]), suggesting that the Pilgrim assumptions "could be wrong by orders of magnitude."[406] "If the bounding assumption used by the Applicant in its sensitivity analysis underestimates the upper limits of the emergency response data," PW argues, "it is no wonder negligible differences were seen," and it is with regard to the sensitivity analyses that its argument regarding "worst case scenario" is made — not, PW argues, to flout NEPA's rule of reason or to "[distort] the decision making process by overemphasizing highly speculative harms," but "in order to get meaningful results [from] the modeling software and SAMA analysis."[407]

[400] *Id.* at 15-16.
[401] *Id.* at 16.
[402] *Id.* at 17.
[403] *Id.*
[404] *Id.* at 18 (citing *McGuire/Catawba*, CLI-02-17, 56 NRC at 10).
[405] *See* PW Petition at 39 n.16.
[406] PW Reply to Entergy at 19; *see also* PW Petition at 39 n.16.
[407] PW Reply to Entergy at 20 (internal quotations omitted).

With regard to the MACCS2 Code and its limitations, PW argues to the effect that this does not excuse ignoring real issues:

> Even though *the software* cannot include the impact of terrain effects, long range dispersion or economic costs beyond mitigative actions, this does not mean that the NRC Regulations allow a proper SAMA analysis to ignore these. If adding in the true economic costs of a severe accident, for example (as discussed in [PW Petition at 43-45] . . .), would result in a consequence cost several orders of magnitude greater than that from simply the costs of mitigative actions, these costs should be estimated and taken into account.[408]

Pilgrim Watch argues that it has supported its contention with a demonstration that significant input data (meteorological, economic, evacuation-related) that were used for the code may be materially in error, and with reports and other documents that back up the contention.[409]

With respect to Applicant's argument that data from the Pilgrim emergency plan should not be subject to challenge in this proceeding, PW argues that, without challenging the plan itself, "Petitioners can and do challenge the evacuation data used by Applicant in its SAMA analysis," noting a report cited in its original Petition, on the TMI accident, that found that the average distance traveled in evacuation was 85 miles, significantly more than the 10 miles utilized by Entergy in the Pilgrim SAMA analysis.[410] "While the emergency plan may not extend beyond 10 miles," PW suggests, "a realistic input for a SAMA analysis should."[411]

In response to Entergy's argument that PW has not provided any basis to show that the lack of certain economic data in the SAMA analysis would alter the outcome of the analysis, Petitioner notes that it provided a study showing "that tourism accounts for $11.2 billion in revenues for Massachusetts and the region within 50 miles of Pilgrim is highly dependent on tourism," which is asserted to demonstrate "that just the tourist sector alone would account for costs that dwarf those cited in Applicant's SAMA analysis and would very likely alter the determination of potentially cost beneficial SAMAs."[412]

Pilgrim Watch replies to the Staff's assertion that the contention is not material to these proceedings by insisting, again, that they "have highlighted a deficiency in the application that could have independent health and safety significance" in that "an insufficient SAMA analysis 'could have enormous implications for public heath and safety because a potentially cost effective mitigation alternative might not be considered that could prevent or reduce the impacts of that accident."[413] Arguing that the Staff has inappropriately focused its attention on PW's lack of an expert to support the admission of its contention, PW notes that it has supported the contention with "facts, sources, and documents," including "experts and reports in the fields of accident modeling, accident modeling software, meteorology, evacuations, and economics."[414] Emphasizing that "whether or not the contention is true is left to be decided at the hearing," PW argues that it has met the requirements of the contention admissibility rule.[415]

On the code, PW quotes the following language from NUREG/BR-0184, the NRC Regulatory Analysis Technical Evaluation Handbook:

> Formal methods cannot completely remove subjectivity, guarantee that all factors affecting an issue are considered, produce unambiguous results in the face of closely valued alternatives and/or large uncertainties, or be used without critical appraisal or results. *To use a decision analysis method as a black box decision-maker is both wrong and dangerous.*[416]

Noting that the handbook goes on to observe that the TMI core-damage scenario had not been specifically identified in the PRAs until it had actually occurred, and describes seven categories and levels of uncertainty, PW argues that it has raised areas of uncertainty in data input and modeling, and supported its arguments with expert reports and papers.[417]

PW further argues that Staff has misinterpreted Contention 3 in several respects, including characterizing PW's reference to not having all the Pilgrim SAMA input data as seeking discovery improperly, when PW was merely explaining "why a thorough evaluation by Petitioners of the MACCS2 conclusions is not possible"

---

[408] *Id.* at 21.

[409] *See id.* at 21-23. Noting that both a report offered by PW in the original contention and recent information on the Katrina evacuation suggest high rates of voluntary ("shadow") evacuation and greater distance evacuation than predicted, and noting further that "evacuation from a nuclear plant accident would likely be even more chaotic than evacuation from the path of a hurricane," PW again suggests that "[i]t is therefore very likely that the upper bounds of Applicant's evacuation data are optimistic," and "[t]he fact that a negligible effect was seen in the sensitivity analyses would seem to bear this out rather than confirm Applicant's assumptions." *Id.* at 23.

[410] *See id.* at 23-24.

[411] *Id.* at 24.

[412] *Id.*

[413] PW Reply to NRC Staff at 11-12 (quoting PW Petition at 28).

[414] *Id.* at 12-13. We note Petitioner's statement at oral argument that it intends to have an expert at a hearing on this contention, if admitted. *See* Tr. at 424.

[415] PW Reply to NRC Staff at 13; *see id.* at 12-13.

[416] *Id.* at 13 (citing NUREG/BR-0184 at 5.1) (emphasis added by PW).

[417] *See id.* at 13-14.

at this point.[418] Pointing out that it cannot be more specific in alleging "an error in the SAMA analysis without having all of the parameters that were used,"[419] and noting with regard to both Entergy's and the Staff's responses to Contention 3 that it is not required to prove its contention at this point in the proceeding, PW argues that it has shown "that the Applicant used incorrect meteorological, evacuation, and economic input data to analyze severe accident consequences in a way that caused it to ignore the true radiological and economic consequences of severe accidents and may have caused it to dismiss cost effective mitigation alternatives."[420]

4. *Licensing Board Ruling on Pilgrim Watch Contention 3*

We find this contention, as limited below, to be admissible, based upon the following analysis:

First, SAMAs are clearly within the scope of a license renewal proceeding. Next, to the extent we describe below regarding those portions of the contention we find admissible, PW has provided the required specific statement of the issue raised, along with a sufficient explanation of the basis for the contention, statement of alleged facts that support it, references to specific and relevant sources and documents, and information to show a genuine dispute with the Applicant on a material issue of combined law and fact. While it has not had the benefit of a detailed accounting of the input data used by Applicant in its SAMA analysis, PW has raised questions about certain specific input data to the analysis that are material in three areas, in that they raise significant health and safety issues that affect the outcome of this proceeding. PW seeks further analysis on these points, and if it is determined on the merits that such additional analysis is needed on these points, the renewed license would not be granted until and unless this were provided.

PW has supported its call for further analysis by raising relevant and significant questions about the input data that appears (from the Application) to have been used in the Pilgrim SAMA analysis regarding (1) the evacuation time estimates, (2) the meteorological data that govern the movement of the plume, and (3) the economic impact data; and it has supported arguments to the effect that including more realistic input data might change the SAMA analysis, with information indicating, to the level necessary for contention admissibility, that these particular data may be materially incorrect. Given the limited amount of detail presented in the Application regarding the actual input and assumptions for this analysis, PW cannot reasonably be expected to present specific error margins in computational results.[421] Instead, we find their contention, that use of more accurate input data in these three areas could materially impact the computed outcome, to be reasonable and the possibility intuitively obvious in the absence of actual computations definitively demonstrating otherwise.[422] That is not to say that we find PW has raised admissible challenges as to *all* input data. We do, however, find that the contention, insofar as it challenges the data on these three points and proposes the use of more accurate data relating to evacuation times, economic impacts, and meteorologic plume behavior has been sufficiently raised and supported for the purposes of contention admissibility. Whether or not Pilgrim Watch could ultimately prevail on the issues it raises, we find it has sufficiently supported them to admit this contention.

In particular, the evacuation and economic information provided by Pilgrim Watch would seem reasonably to indicate that different results might have been reached in the SAMA analysis, and the same applies, to an extent, to the

---

[418] *Id.* at 14. PW quotes from its Petition as follows:

> Without knowing what parameters were chosen by the Applicant, it is not possible to fully evaluate the correctness of the conclusion about [SAMAs]. However, from what is included in the ER, Petitioners have been able to piece together some possible reasons that Entergy's described consequences of a severe accident at Pilgrim look so small.

PW Petition at 34.

[419] *Id.* at 16.

[420] PW Reply to Entergy at 25; PW Reply to NRC Staff at 17.

[421] *See* Application, ER, Attachment E, § E.1.5.2. We disagree with the Staff that PW in noting the absence of all the input data is improperly seeking discovery, and do not permit, by this ruling, anything of the sort at this point. *See* Staff Response to PW Petition at 30. In noting this absence, PW is merely pointing out a relevant circumstance that explains its inability to describe to any significant extent the impacts of utilizing different input data.

[422] We note the Applicant's references to the "large conservatisms" in the SAMA analyses and to the results of sensitivity analyses. *See supra* text accompanying note 354. With regard to the former, we note further that the magnitude and effects of these conservatisms are not set out in other than summary fashion. *See, e.g.,* Pilgrim Application, ER at 4-33–4-49. The Applicant has described certain conservative assumptions with regard to the amount of core damage and concomitant release levels; however, the actual impacts of an accident would also be influenced by evacuation information, weather conditions, and the actual localized economic impacts, each of which we find has been appropriately challenged by Pilgrim Watch to a level and with support sufficient to admit this contention with regard to these three areas.

With regard to the sensitivity analyses, Entergy would have us believe that these demonstrate that variation in the input data would have no significant impact on the outcome of the alternatives evaluation. *See, e.g.,* Application, ER, Appendix E at E.1-66–1-68, E.2-11–2.12; Tr. at 378-79, 383-84, 428-29. Those sensitivity analyses, however, were performed only with respect to a few parameters, and the results thereof are only summarized in the Application, so as to make challenge or confirmation impossible in the absence of more detailed information. Moreover, these provide insufficient information or grounds to warrant a finding of no genuine dispute on a material fact, as Applicant urges. Finally, Applicant's assertion brings into play questions of how and to what extent the input used in various computations drive the results, in the context of a fairly complex analysis. These are factual matters inappropriate for determination in the contention admissibility stage of the proceeding.

meteorological data. The merits of these arguments will be tested at future points in the adjudication process; but the merits cannot be considered at this point. The support offered by PW, however, appears to raise reasonable factual questions.

That some of the information provided by PW with regard to evacuation times and related issues of new population numbers and traffic patterns, and the phenomena of "shadow evacuation" and "sheltering in place," is apparently in conflict with some of the data taken by Applicant from the Pilgrim emergency plan does not, we find, mean that it cannot be considered in the NEPA context in which it is raised in this proceeding. While "emergency planning . . . is one of the *safety issues* that need not be re-examined within the context of license renewal,"[423] what is challenged here is whether particular bits of information taken from such a plan are sufficiently accurate for use in computing the health and safety consequences of an accident, as an *environmental issue*. Such a challenge is not a challenge to existing emergency planning for this plant or to the plan itself, but is instead focused upon the accuracy of certain assumptions and input data used in the SAMA computations and how they affect the validity of the SAMA analysis under NEPA — and as such, we find PW's challenge to the accuracy of the input data to be appropriate, in the three areas we have noted.

With respect to Entergy's characterization of PW's contention as being that "risk is to be ignored [in a SAMA analysis]," to the extent that any part of the contention or basis may be construed as challenging on a generic basis the use of probabilistic techniques that evaluate risk, we find any such portion(s) to be inadmissible. The use of probabilistic risk assessment and modeling is obviously accepted and standard practice in SAMA analyses.[424] In any event, as PW points out in its Reply to Entergy,[425] the focus of the contention, and that part that we admit, is on what input data should be utilized in the SAMA analysis with regard to evacuation times, economic realities, and meteorological patterns, and whether the input data used by the Applicant accurately reflect the respective conditions at issue.

We find that Pilgrim Watch has provided sufficient alleged facts, supported by several expert studies and reports, to demonstrate a genuine dispute with the Applicant on the material factual issues of whether in its SAMA analysis the Applicant has adequately taken into account relevant and realistic data with respect to evacuation times in the area surrounding the Pilgrim plant, economic consequences of a severe accident in the area, and meteorological patterns that would carry the plume in the event of such an accident; and whether as a result the Applicant has drawn "incorrect conclusions about the costs versus benefits of

[423] *Turkey Point*, CLI-01-17, 54 NRC at 9.

[424] *See* Entergy Answer to PW Petition at 25-26 (citing *Limerick*, 869 F.2d at 738; *McGuire/Catawba*, CLI-02-17, 56 NRC at 7-8).

[425] *See* PW Reply to Entergy at 14.

000052

possible mitigation alternatives,"[426] such that further analysis is called for. These are factual questions appropriate for resolution in litigation of this contention.

Based upon the preceding, we admit that part of Contention 3 having to do with the input data for evacuation, economic, and meteorological information. As so limited, the admitted contention reads as follows:

> Applicant's SAMA analysis for the Pilgrim plant is deficient in that the input data concerning (1) evacuation times, (2) economic consequences, and (3) meteorological patterns are incorrect, resulting in incorrect conclusions about the costs versus benefits of possible mitigation alternatives, such that further analysis is called for.

E. Contention 5: New Information Shows That Another 20 Years of Operations at Pilgrim May Result in Greater Offsite Radiological Impacts on Human Health Than Were Previously Known

Pilgrim Watch in their final contention states as follows:

> New and significant information about cancer rates in the communities around Pilgrim and the demographics of these communities has become available. In addition, new studies show that even low doses of ionizing radiation can be harmful to human health. Epidemiological studies of cancer rates in the communities around Pilgrim show an increase of radiation-linked disease that can be attributed to past operations of the plant. The demographics of the population immediately surrounding the plant, including its age and geographical distribution, make this population more susceptible to radiation linked damage than was contemplated when the plant was licensed. Pilgrim does not currently have off-site monitoring capabilities that can properly track releases of radiation into the community.[427]

As with its Contention 4, Pilgrim Watch asserts that the Commission's regulations implementing NEPA, at 10 C.F.R. Part 51, require Entergy "to provide an analysis of the impacts on the environment that will result if it is allowed to continue beyond the initial license,"[428] thus bringing a contention challenging the Applicant's Environmental Report within the scope of a license renewal proceeding.[429] PW argues that "[t]he deficiency highlighted in this contention has enormous independent heath and safety significance," thus establishing the materiality of the contention.[430]

[426] *See* PW Petition at 26.

[427] *Id.* at 79.

[428] *Id.*

[429] *Id.* at 79-80.

[430] *Id.* at 80.

As bases for its contention PW insists that the contention presents new and significant information that additional years of operations will be harmful to public health.[431] PW refers to various alleged facts and sources, including an NAS report on low-dose radiation risk, *Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII Phase* 2 (June 2005) [BEIR VII]; information regarding radiation-linked diseases in communities around Pilgrim; projected demographic data suggesting that the population is at a greater risk; information suggesting that "the documented radionuclide releases from Pilgrim in the past have long half-lives and bioaccumulate in the environment"; and that "the current systems in place to monitor releases are inadequate and should be improved."[432]

Addressing changing demographics surrounding the Pilgrim Plant, PW argues that the population "abutting Pilgrim is increasing substantially and the population is older and thus more susceptible to radiation damage," and contends that it will demonstrate "that the dose effect on the population will be far greater than originally anticipated when the plant was licensed."[433] To support its allegation regarding a projected increase in total population and the population of the aging, PW cites "The Boston Metropolitan Area Planning Council Report on Population and Employment Projections 2010-2030."[434] An increase in the proportion of the population that is over 55 is relevant, according to PW, because "studies have shown an increased sensitivity to low levels of ionizing radiation in older populations," and PW has included citations to multiple scholarly works on the topic including a publication titled "Leukemia near nuclear power plant in Massachusetts."[435] Listed as a coauthor on that publication is Richard Clapp, who PW states could provide expert testimony to support its contention.[436]

PW points to the 1972 FEIS and the current application's environmental report (stating that radiological releases from PNPS are monitored and comply with NRC regulations), and challenges the proposition that releases do not pose a threat to the public health by insisting that it has "[brought] forward new and significant information that demonstrates that there has *already* been documented radiation linked disease in communities near PNPS."[437] PW argues that "new information since Pilgrim began operations in 1972 [] shows increases in radiation-linked diseases in the communities around Pilgrim," and states that the increases "were in part attributed to operating with defective fuel; operating without off-gas

[431] *Id.* at 81.
[432] *Id.*
[433] *Id.* at 82.
[434] *Id.* at 83.
[435] *Id.*
[436] *See id.* at 81.
[437] *Id.* at 84 (emphasis in original).

000053

treatment system in the first years; poor management and practices . . . ."[438] To support its assertion, PW cites studies performed by the Massachusetts Department of Health, an epidemiological study published in the scholarly journal *Lancet* in 1987, and additional analyses performed by Dr. Clapp, founder and former director of the Massachusetts Cancer Registry.[439] These studies, according to PW, demonstrate elevated rates of myelogenous leukemia, thyroid cancer, prostate cancer, and multiple myeloma.[440] Again, PW references the NAS BEIR VII study to insist that no amount of radiation is safe and thus "it is not surprising that radiation-linked disease rates are higher than expected in communities exposed to Pilgrim's past [radiation] releases."[441] Building on its claims that the BEIR VII study represents new information regarding the dangers of ionizing radiation at any exposure level, PW claims that the previous standards set by the NRC for offsite radiation do not protect the community surrounding Pilgrim.[442]

Petitioner insists that because the effects of radiation exposure are cumulative, because some radionuclides have extremely long half-lives, and because releases can enter biological food chains and accumulate in the environment, radioactive substances can "remain active in the local environment for the foreseeable future and should be taken into account when actual ongoing doses to the public are evaluated."[443] PW also argues that the use of allegedly "defective fuel" further exacerbates radiation exposure rates.[444] To support its position PW cites a 1990 report by the Massachusetts Department of Health, concerning the period 1978-1986, as well as statements made in 2005 by NRC Commissioner Merrifield and an NRC Information Notice regarding "Control of Hot Particle Contamination at Nuclear Plants."[445]

Concluding, PW states that "if Applicant disputes a causal link between the radiation released by Pilgrim and the cancers seen in its neighboring towns, the current systems in place to monitor release are inadequate and should be improved."[446] In an attached exhibit PW documents some of the perceived deficiencies in the monitoring system currently used by Pilgrim, and states that increased monitoring would allow "state and federal authorities to confidently measure radiation releases."[447]

[438] *Id.* at 85.
[439] *See id.* at 85-86.
[440] *See id.*
[441] *Id.* at 87.
[442] *See id.* at 88.
[443] *Id.* at 89.
[444] *Id.*
[445] *See id.* at 89-90.
[446] *Id.* at 90.
[447] *Id.* at 91.

1. *Entergy Answer to Pilgrim Watch Contention 5*

Entergy challenges the admission of Pilgrim Watch's Contention #5 by asserting that it is beyond the scope of the license renewal proceeding and challenges the license renewal rules. Further, Entergy insists that the contention fails to provide any "basis demonstrating the existence of a genuine dispute."[448]

At the outset, Entergy insists that the contention "represents a challenge to the scope of the environmental review in 10 C.F.R. § 51.53(c), and to the NRC's generic environmental findings in the GEIS and Appendix B to 10 C.F.R. Part 51," because it is attempting to litigate Category 1 issues for which the Commission has generically addressed in the GEIS.[449] Entergy points to the Commission's generic findings regarding "offsite radiological impacts" incorporated in the regulations in 10 C.F.R. Part 51, App. B, Table B-1, and argues that, absent a waiver, the Petitioner may not challenge these generic findings, regardless of the allegation of "new and significant information." As with PW's Contention 4 and the contention proffered by the Massachusetts Attorney General, Entergy directs the board to the Commission's decision in *Turkey Point,* CLI-01-17, 54 NRC at 17, to support its position that the contention is "excluded from consideration in this proceeding."[450]

Notwithstanding its argument that the contention is an impermissible challenge of Commission regulations, Entergy proceeds to dispute Pilgrim Watch's claims that new and significant information exists regarding the issue of offsite radiological impacts "that would alter the Commission's generic, Category 1 finding."[451] Addressing the BIER VII report, cited by Pilgrim Watch, Entergy claims that because the report "concludes that radiation protection decisions should be based on linear-no threshold hypothesis of dose relationship" and the NRC regulations addressing the issue are also based on the same linear-no threshold hypothesis, the report "provides no basis to alter the generic findings."[452] Turning to Pilgrim Watch's claims regarding a change in the demographics surrounding the plant since the original licensing, Entergy asserts that the argument is irrelevant because the radiological impacts for the period of extended operation are assessed in the GEIS, and thus, the EIS prepared when the plant was originally licensed is not at issue.[453] Next, Entergy asserts that because the 1990 Southeastern Massachusetts Health Study and the Meteorological Analysis of Radiation Releases for the Coastal Areas of the State of Massachusetts for June 3d to June 20th, 1982,

[448] *See* Entergy Answer to PW Petition at 56.
[449] *Id.*
[450] *Id.*
[451] *Id.* at 57.
[452] *Id.*
[453] *Id.*

both "predate the GEIS, they are obviously not new information."[454] Further, Entergy argues, "Pilgrim Watch provides no information suggesting that the studies support a [*sic*] risk estimates that are greater than those used by the NRC in the GEIS."[455] Continuing, Entergy insists that Pilgrim Watch has provided nothing more than speculation regarding its concerns about the bioaccumulation of radiation at Pilgrim or alleged failures in the Pilgrim radiation monitoring program.[456]

2. *NRC Staff Response to Contention 5*

The Staff contests the admission of Pilgrim Watch's Contention 5 on the same basic grounds as Entergy; specifically, the Staff argues that the contention is outside the scope of a license renewal proceeding and that the contention represents an impermissible challenge of the Commission's generic Category 1 findings with respect to public radiation exposure during the license renewal term.[457] As was the case in Entergy's Response, the Staff also argues that each alleged example of "new and significant information" listed as bases by Pilgrim Watch fails to satisfy the contention admissibility requirements of 10 C.F.R. § 2.309(f)(1).[458]

Although the Staff argues that the "overarching difficulty" with Contention 5 is that it presents a challenge that is outside the scope of the license renewal proceeding, the bulk of its response is focused on refuting each individually listed basis on other grounds.[459] The Staff argues that the PW's bases and their reliance on the NAS BEIR VII study to argue that "no amount of radiation is safe" represent challenges to the NRC regulations establishing radiation limits in violation of 10 C.F.R. § 2.335.[460] With respect to PW's arguments that the environmental report is inadequate in that it does not account for changing demographics in the surrounding population, the Staff claims that PW has failed to demonstrate that a genuine dispute exists, as required by 10 C.F.R. § 2.309(f)(1)(vi).[461] This is so, according to the Staff, because Pilgrim Watch's only *direct* reference to the environmental report is a statement that the ER fails to "highlight" the population and demographic data.[462] What is lacking, according to the Staff, is any direct

[454] *Id.* at 58.
[455] *Id.*
[456] *See id.*
[457] *See* NRC Staff Response to Pilgrim Watch at 40.
[458] *See id.* at 40-41.
[459] *Id.* at 40-49.
[460] *Id.* at 42, 44-45.
[461] *See id.* at 41.
[462] *Id.*

reference or challenge to a specific aspect of the ER.[463] A similar argument is made in regard to PW's discussion of radiation-linked diseases in communities near Pilgrim and allegations regarding defective fuel.[464]

3. *Pilgrim Watch Replies to Entergy and NRC Staff*

Pilgrim Watch reiterates its position that although the contention challenges findings that were part of a generic Category 1 issue, its challenge is not outside the scope of the license renewal proceeding or a challenge to Commission regulations because it has "submitted new information that casts doubt on the generic conclusions regarding off-site radiological exposure as they apply to Pilgrim."[465] Thus, according to Pilgrim Watch, the new information submitted — including the National Academies *Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII Phase II,* 2005 study, demographic changes in the Pilgrim area, and case-controlled and statistical studies of radiation-linked disease in communities around Pilgrim — obviates its obligation to petition for a waiver under 10 C.F.R. § 2.335(b) before it may challenge generic findings in the GEIS under NEPA.[466]

Next, Pilgrim Watch defends its asserted new and significant information bases.[467] Pilgrim Watch argues that its arguments are supported by "numerous scientific sources" including the NAS, Massachusetts Department of Public Heath Commission, epidemiologists from multiple universities, and even the NRC, and thus, the Staff's claims that it lacks a basis in fact or expert opinion are "groundless."[468] Pilgrim Watch argues that the BEIR VII report presents new information about cancer incidence risk figures and that the studies related to changing demographics and radiation risks demonstrate that the changing population around Pilgrim will have an increased sensitivity to low levels of ionizing radiation.[469] Further, Pilgrim Watch insists that the SMHS presents new information because it was published after the FEIS for Pilgrim, and that the methodology for the study — which Pilgrim Watch argues demonstrates an increased leukemia risk for those individuals with the highest potential for exposure to Pilgrim emissions — has been peer reviewed and approved.[470] Continuing, Pilgrim Watch argues that Entergy has failed to address all the data it has proffered regarding increased cancer incidences near Pilgrim, nor has Entergy satisfactorily disputed its assertions regarding bioaccumulation of radionuclides.[471] Addressing its claims regarding deficiencies in Pilgrim's radiation monitoring program, Pilgrim Watch states that it has provided "sufficient detail about deficiencies in Pilgrim's monitoring program and reports to demonstrate that Pilgrim cannot provide the necessary data to assure that public health and safety have been, or will be, protected."[472]

Turning to the BEIR VII report, and the Staff's assertion that PW's argument that the report demonstrates there is no safe level of radiation exposure is tantamount to a challenge of Commission regulations, Pilgrim Watch argues that the report was cited as a means to demonstrate "that the radiation that is released on a regular basis from Pilgrim Nuclear Power Plant cannot be assumed to be safe," not as a challenge of Commission regulations.[473] According to Pilgrim Watch, each of its asserted bases is relevant to whether there are greater offsite radiological impacts than previously assumed and whether the Applicant has adequately addressed the issues raised.[474] Thus, it argues, it has demonstrated that a genuine dispute exists and presented new and significant information that warrant NEPA review.

4. *Licensing Board Ruling on Pilgrim Watch Contention 5*

We find that this contention incorporates two related but distinct arguments, neither of which we find to be admissible.

First, Contention 5 reflects the same legal logic as its Contention 4 and the Massachusetts Attorney General's contention, in that it attempts to challenge generic findings made in the GEIS without a waiver by asserting that it has provided "new and significant information" on the issue. As we rule on Contention 4, such a contention is inadmissible without a waiver of the relevant rule. Here, PW admits that the contention's challenge regarding the offsite radiological consequences "presents a Category 1 issue,"[475] and we see no need to repeat our analysis regarding the scope of license renewal proceedings and challenges to generic findings for Category 1 issues here. Nor is there any need to reach the question whether PW has proffered "new and significant information" on the issue. For the same reasons as stated with regard to Contention 4 with regard to Category 1 issues, we find Pilgrim Watch Contention 5 to be inadmissible.

In addition to the NEPA-related issues, Contention 5 appears to challenge the

---

[463] *Id.*
[464] *See id.* 43-44, 47.
[465] PW Reply to Entergy at 30.
[466] *See id.* at 30-31; *see also* PW Reply to NRC Staff at 23.
[467] *See* PW Reply to NRC Staff at 22-26; PW Reply to Entergy at 31-34.
[468] PW Reply to NRC Staff at 22.
[469] *See* PW Reply to Entergy at 32.
[470] *See id.* at 32-33.
[471] *See id.*
[472] *Id.*
[473] PW Reply to NRC Staff at 23.
[474] PW Reply to Entergy at 34.
[475] *See id.* at 21.

NRC's dose limit rules found in 10 C.F.R. Part 20 as they apply to Pilgrim. PW's reliance on the BEIR VII conclusion that the all levels of ionizing radiation are harmful, along with its references to the increased vulnerability of the population surrounding Pilgrim, implicates an entirely different regulatory challenge than that found in Contention 4. This argument suggests that, as a matter of safety, the levels of radiation released by PNPS are inappropriate when considered in light of the findings in the BEIR VII report, the studies regarding cancer rates surrounding PNPS, and the increased susceptibility of a growing aged population surrounding PNPS. When pressed at the oral argument, PW conceded that it was not suggesting that radiological releases from Pilgrim are greater than are currently allowed by the NRC regulations.[476] In such circumstances, its contention regarding the radiological releases must necessarily be construed as a challenge to the current NRC dose limit regulations found in 10 C.F.R. Part 20. Again, without a waiver under 10 C.F.R. § 2.335, no request for which has been submitted, such a challenge is impermissible in an adjudication such as this one.

VI. CONCLUSION

In conclusion, although both Petitioners have established standing to participate in this proceeding, the Licensing Board finds that under current controlling law and regulation the Massachusetts Attorney General has not filed an admissible contention and therefore is not admitted as a party in this proceeding. The Licensing Board does, however, find that Pilgrim Watch has filed two admissible contentions and therefore admits it as a party to this proceeding. Should any further developments occur with respect to the pending rulemaking or any other matters that might lead to any different conclusion in this proceeding on the Attorney General's Petition, such that another petition may be timely filed regarding any such matters, any such petition will be considered as may be appropriate at such time.

VII. ORDER

Based, therefore, upon the preceding rulings, findings, and conclusion, it is, this 16th day of October 2006, ORDERED as follows:

A. Pilgrim Watch is admitted as a party and its Request for Hearing and Petition To Intervene is granted in part and denied in part. A hearing is granted with respect to Pilgrim Watch Contentions 1 and 3, as limited and modified in the following form:

[476] Tr. at 452.

1. The Aging Management program proposed in the Pilgrim Application for license renewal is inadequate with regard to aging management of buried pipes and tanks that contain radioactively contaminated water, because it does not provide for monitoring wells that would detect leakage.

2. Applicant's SAMA analysis for the Pilgrim plant is deficient in that the input data concerning (1) evacuation times, (2) economic consequences, and (3) meteorological patterns are incorrect, resulting in incorrect conclusions about the costs versus benefits of possible mitigation alternatives, such that further analysis is called for.

B. The hearing will be conducted in accordance with the informal adjudicatory procedures prescribed in Subpart L of 10 C.F.R. Part 2. Our ruling in this regard is based on the absence of any request or demonstration, pursuant to 10 C.F.R. § 2.309(g) and in reliance on the provisions of 10 C.F.R. § 2.310(d), that resolution of any admitted contention necessitates the utilization of the procedures set forth in Subpart G of 10 C.F.R. Part 2. Upon an appropriate request, pursuant to 10 C.F.R. § 2.1204(b) and in accordance with the schedule to be set as indicated below, the Licensing Board will allow cross-examination as necessary to ensure the development of an adequate record for decision.[477]

C. The Massachusetts Attorney General's Request for Hearing and Petition To Intervene is denied.

D. The Town of Plymouth may participate in the hearing pursuant to 10 C.F.R. § 2.315(c), through its designated representative, Sheila S. Hollis. The Town shall identify the contention or contentions on which it will participate within twenty (20) days of this Memorandum and Order, or by *November 6, 2006.*

E. Any other interested State, local governmental body, and affected, federally recognized Indian Tribe that wishes to participate in the hearing pursuant to 10 C.F.R. § 2.315(c) shall file a Request and Notice of such intent within twenty (20) days, or by *November 6, 2006.* Any such notice shall, as required by section 2.315(c), contain a designation of a single representative for the hearing, and an identification of the contention or contentions on which it will participate.

F. In the near future the Licensing Board will issue a Memorandum setting forth a schedule of deadlines and events for this proceeding.

G. This Order is subject to appeal to the Commission in accordance with the provisions of 10 C.F.R. § 2.311. Any petitions for review meeting applicable

[477] *See CAN v. NRC,* 391 F.3d at 351, wherein the First Circuit upheld the validity of the Subpart L regulations on the basis of NRC's representation that the opportunity for cross-examination under 10 C.F.R. § 2.1204(b)(3) of Subpart L is equivalent to the opportunity for cross-examination under the Administrative Procedure Act (APA), 5 U.S.C. § 556(d), i.e., that cross-examination is available whenever it is "required for a full and fair adjudication of the facts."

requirements set forth in that section must be filed within ten (10) days of service of this Memorandum and Order.

THE ATOMIC SAFETY AND
LICENSING BOARD

Ann Marshall Young, Chair
ADMINISTRATIVE JUDGE

Dr. Paul B. Abramson
ADMINISTRATIVE JUDGE

Dr. Richard F. Cole
ADMINISTRATIVE JUDGE

Rockville, Maryland
October 16, 2006[478]

[478] Copies of this Order were sent this date by Internet e-mail transmission to all participants or counsel for participants.

000057

APPENDIX

SUMMARY OF GOVERNING CASE LAW ON CONTENTION ADMISSIBILITY STANDARDS

We address herein how the contention admissibility standards now found in 10 C.F.R. § 2.309(f)(1)[1] have been interpreted by a number of licensing boards and by the Commission, in various NRC adjudicatory proceedings. As indicated in the body of our Memorandum and Order, because a petitioner-intervenor must submit at least one contention meeting these requirements in order to be admitted as a party in an NRC proceeding, how the standards have been interpreted in various NRC case law can be of central, and often determinative, importance in deciding whether petitioners are granted evidentiary hearings in NRC adjudicatory proceedings. Failure of a contention to meet any of the requirements of section 2.309(f)(1) is grounds for its dismissal, and failure of a petitioner — even one found to have standing to proceed under the criteria discussed above — to submit an admissible contention will result in dismissal of its petition and request for hearing.[2] Thus a full understanding of the standards and how they have been applied in prior cases can be critical in any NRC proceeding.

Although we do not represent the following to be an exhaustive consideration of all relevant case law addressing the contention admissibility standards, it does

[1] Section 2.309(f)(1) states that:

(1) A request for hearing or petition for leave to intervene must set forth with particularity the contentions sought to be raised. For each contention, the request or petition must:

(i) Provide a specific statement of the issue of law or fact to be raised or controverted;

(ii) Provide a brief explanation of the basis for the contention;

(iii) Demonstrate that the issue raised in the contention is within the scope of the proceeding;

(iv) Demonstrate that the issue raised in the contention is material to the findings the NRC must make to support the action that is involved in the proceeding;

(v) Provide a concise statement of the alleged facts or expert opinions which support the requestor's/petitioner's position on the issue and on which the petitioner intends to rely at hearing, together with references to the specific sources and documents on which the requestor/petitioner intends to rely to support its position on the issue; and

(vi) Provide sufficient information to show that a genuine dispute exists with the applicant/licensee on a material issue of law or fact. This information must include references to the specific portions of the application (including the applicant's environmental report and safety report) that the petitioner disputes and the supporting reasons for each dispute, or, if the petitioner believes that the application fails to contain information on a relevant matter as required by law, the identification of each failure and the supporting reasons for the petitioner's belief.

[2] *See Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), CLI-99-10, 49 NRC 318, 325 (1999); *Arizona Public Service Co.* (Palo Verde Nuclear Generating Station, Units 1, 2, and 3), CLI-91-12, 34 NRC 149, 155-56 (1991).

provide a summary of some of the more significant principles that licensing boards are to apply in making determinations on the admission of contentions.

As indicated above, the origin of the current contention admissibility standards was the Commission's determination in 1989 that licensing boards prior to that time had "admitted and litigated numerous contentions that appeared to be based on little more than speculation.' "[3] On this basis the Commission amended its rules to "raise the threshold for the admission of contentions."[4] More recently the Commission again revised the rules, with a version that became effective in February 2004. These rules contain essentially the same substantive admissibility standards for contentions, but no longer incorporate provisions, formerly found in 10 C.F.R. § 2.714(a)(3), (b)(1), that permitted the amendment and supplementation of petitions and the filing of contentions after the original filing of petitions.[5] The new 10 C.F.R. Part 2 NRC Rules of Practice also contain various changes to provisions relating to the hearing process.[6]

The underlying purposes of the contention admissibility requirements include, as we note above, focusing the adjudication process on disputes "susceptible of resolution" in such context, providing notice of the "specific grievances" of petitioners, and "ensur[ing] that full adjudicatory hearings are triggered only by those able to proffer at least some minimal factual and legal foundation in support of their contentions.[7] In its Statement of Considerations adopting the latest revision of the rules, the Commission reiterated that the standards are "necessary to ensure that hearings cover only genuine and pertinent issues of concern and that the issues are framed and supported concisely enough at the outset to ensure that the proceedings are effective and focused on real, concrete issues."[8]

Considering the various standards individually, along with a section at the end relating to limitations on the content of petitioners' replies to applicant and NRC Staff responses to their contentions, we provide the following summary of some of the case law interpreting subsections (i) through (vi) of 10 C.F.R. § 2.309(f)(1).

[3] *Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Units 2 and 3), CLI-01-24, 54 NRC 349, 358 (2001) (citing *Duke Energy Corp.* (Oconee Nuclear Station, Units 1, 2, and 3), CLI-99-11, 49 NRC 328, 334 (1999).

[4] Rules of Practice for Domestic Licensing Proceedings — Procedural Changes in the Hearing Process, 54 Fed. Reg. 33,168, 33,168 (Aug. 11, 1989); *see also Oconee*, CLI-99-11, 49 NRC at 334.

[5] Under the current rules, contentions must be filed with the original petition, within 60 days of notice of the proceeding in the *Federal Register* (unless another period is specified). *See* 10 C.F.R. § 2.309(b)(3)(iii).

[6] As noted above, the First Circuit denied a challenge to the new rules by several public interest groups (supported by several states including Massachusetts) in *CAN v. NRC*, 391 F.3d 338 (1st Cir. 2004), finding that the new procedures "comply with the relevant provisions of the APA and that the Commission has furnished an adequate explanation for the changes." *Id.* at 343.

[7] *Oconee*, CLI-99-11, 49 NRC at 334.

[8] 69 Fed. Reg. 2182, 2189-90 (Jan. 14, 2004).

10 C.F.R. § 2.309(f)(1)(i), (ii)

Sections 2.309(f)(1)(i) and (ii) require that a petitioner must, for each contention, "[p]rovide a specific statement of the issue of law or fact to be raised or controverted," and "[p]rovide a brief explanation of the basis for the contention." The Commission has stated that an "admissible contention must explain, with specificity, particular safety or legal reasons requiring rejection of the contested [application]."[9] It has also been observed that a contention must demonstrate "that there has been sufficient foundation assigned for it to warrant further exploration."[10] The contention rules "bar contentions where petitioners have only 'what amounts to generalized suspicions, hoping to substantiate them later.' "[11]

In other words, a petitioner must "provide some sort of minimal basis indicating the potential validity of the contention."[12] This "brief explanation" of the logical underpinnings of a contention does not, however, require a petitioner "to provide an exhaustive list of possible bases, but simply to provide sufficient alleged factual or legal bases to support the contention."[13] The brief explanation helps define the scope of a contention — "[t]he reach of a contention necessarily hinges upon its terms coupled with its stated bases."[14] However, it is the contention, not "bases," whose admissibility must be determined.[15]

10 C.F.R. § 2.309(f)(1)(iii)

Petitioners must also, as required by section 2.309(f)(1)(iii), "[d]emonstrate that the issue raised in the contention is within the scope of the proceeding." A contention must allege facts "sufficient to establish that it falls directly within the scope" of a proceeding.[16] Contentions are necessarily limited to issues that are germane to the application pending before the Board,[17] and are not cognizable unless they are material to matters that fall within the scope of the proceeding

[9] *Millstone*, CLI-01-24, 54 NRC at 359-60.

[10] *See Public Service Co. of New Hampshire* (Seabrook Station, Units 1 and 2), ALAB-942, 32 NRC 395, 428 (1990) (footnote omitted).

[11] *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-03-17, 58 NRC 419, 424 (2003) (citing *Oconee*, CLI-99-11, 49 NRC at 337-39).

[12] 54 Fed. Reg. at 33,170.

[13] *Louisiana Energy Services, L.P.* (National Enrichment Facility), CLI-04-35, 60 NRC 619, 623 (2004).

[14] *Public Service Co. of New Hampshire* (Seabrook Station, Units 1 and 2), ALAB-899, 28 NRC 93, 97 (1988), *aff'd sub nom. Massachusetts v. NRC*, 924 F.2d 311 (D.C. Cir. 1991).

[15] *See* 10 C.F.R. § 2.309(a).

[16] *Arizona Public Service Co.* (Palo Verde Nuclear Generating Station, Units 1, 2, and 3), LBP-91-19, 33 NRC 397, 412 (1991), *appeal denied on other grounds*, CLI-91-12, 34 NRC 149 (1991).

[17] *See Yankee*, CLI-98-21, 48 NRC at 204 & n.7.

for which the licensing board has been delegated jurisdiction as set forth in the Commission's notice of opportunity for hearing and order referring the proceeding to the Board.[18] A discussion of relevant regulatory and case law on the scope of license renewal proceedings is found in section IV.B, *supra*.

A contention that challenges a Commission rule or regulation is outside of the scope of the proceeding because, absent a waiver, "no rule or regulation of the Commission . . . is subject to attack . . . in any adjudicatory proceeding."[19] Also, any contention that amounts to an attack on applicable statutory requirements must be rejected by a licensing board as outside the scope of the proceeding.[20] A petitioner may, however, within the adjudicatory context submit a request for waiver of a rule under 10 C.F.R. § 2.335. Outside the adjudicatory context, one may also file a petition for rulemaking under 10 C.F.R. § 2.802, or a request that the NRC Staff take enforcement action under 10 C.F.R. § 2.206.

10 C.F.R. § 2.309(f)(1)(iv)

With regard to the requirement now stated in section 2.309(f)(1)(iv), that a petitioner must "[d]emonstrate that the issue raised in the contention is material to the findings the NRC must make to support the action that is involved in the proceeding," the Commission has defined a "material" issue as meaning one in which "resolution of the dispute would make a difference in the outcome of the licensing proceeding."[21] This means that there must be some link between the claimed error or omission regarding the proposed licensing action and the NRC's role in protecting public health and safety or the environment.[22] The standards defining the "findings the NRC must make to support" a license renewal in this proceeding are set forth at 10 C.F.R. § 54.29.[23]

---

[18] *See Duke Power Co.* (Catawba Nuclear Station, Units 1 and 2), ALAB-825, 22 NRC 785, 790-91 (1985); *Public Service Co. of Indiana* (Marble Hill Nuclear Generating Station, Units 1 and 2), ALAB-316, 3 NRC 167, 170-71 (1976); *see also Commonwealth Edison Co.* (Zion Station, Units 1 and 2), ALAB-616, 12 NRC 419, 426-27 (1980); *Commonwealth Edison Co.* (Carroll County Site), ALAB-601, 12 NRC 18, 24 (1980).

[19] 10 C.F.R. § 2.335(a).

[20] *Philadelphia Electric Co.* (Peach Bottom Atomic Power Station, Units 2 and 3), ALAB-216, 8 AEC 13, 20 (1974).

[21] 54 Fed. Reg. at 33,172.

[22] *Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Units 2 and 3), LBP-04-15, 60 NRC 81, 89 (2004), *aff'd*, CLI-04-36, 60 NRC 631 (2004).

[23] Section 54.29 provides:

§ 54.29 Standards for issuance of a renewed license.

A renewed license may be issued by the Commission up to the full term authorized by § 54.31 if the Commission finds that:

(Continued)

10 C.F.R. § 2.309(f)(1)(v)

Contentions must also, as now stated in section 2.309(f)(1)(v):

> [p]rovide a concise statement of the alleged facts or expert opinions which support the requestor's/petitioner's position on the issue and on which the petitioner intends to rely at hearing, together with references to the specific sources and documents on which the requestor/petitioner intends to rely to support its position on the issue[.]

The requirements of section 2.309(f)(1)(v) have been interpreted to require a petitioner "to provide the analyses and expert opinion showing why its bases support its contention,"[24] and to "provide documents or other factual information or expert opinion that set forth the necessary technical analysis to show why the proffered bases support its contention."[25] Mere " 'notice pleading' is insufficient under these standards. A petitioner's issue will be ruled inadmissible if the petitioner 'has offered no tangible information, no experts, no substantive affidavits,' but instead only 'bare assertions and speculation.' "[26] Further, a licensing board "may not make factual inferences on [a] petitioner's behalf," or supply information that is lacking,[27] but must examine the information, alleged facts, and expert opinion proffered by the petitioner to confirm that it does indeed supply adequate support for the contention.[28] Any supporting material provided by a

---

(a) Actions have been identified and have been or will be taken with respect to the matters identified in paragraphs (a)(1) and (a)(2) of this section, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB, and that any changes made to the plant's CLB in order to comply with this paragraph are in accord with the Act and the Commission's regulations. These matters are:

(1) managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under § 54.21(a)(1); and

(2) time-limited aging analyses that have been identified to require review under § 54.21(c).

(b) Any applicable requirements of subpart A of 10 CFR part 51 have been satisfied.

(c) Any matters raised under § 2.335 have been addressed.

[24] *Georgia Institute of Technology* (Georgia Tech Research Reactor, Atlanta, Georgia), LBP-95-6, 41 NRC 281, 305, *vacated in part and remanded on other grounds*, CLI-95-10, 42 NRC 1, *and aff'd in part*, CLI-95-12, 42 NRC 111 (1995).

[25] *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), LBP-98-7, 47 NRC 142, 180, *aff'd*, CLI-98-13, 48 NRC 26 (1998).

[26] *Fansteel, Inc.* (Muskogee, Oklahoma Site), CLI-03-13, 58 NRC 195, 203 (2003) (quoting *GPU Nuclear, Inc.* (Oyster Creek Nuclear Generating Station), CLI-00-6, 51 NRC 193, 208 (2000)).

[27] *Georgia Tech*, LBP-95-6, 41 NRC at 305 (citing *Palo Verde*, CLI-91-12, 34 NRC 149); *Duke Cogema Stone & Webster* (Savannah River Mixed Oxide Fuel Fabrication Facility), LBP-01-35, 54 NRC 403, 422 (2001).

[28] *Vermont Yankee Nuclear Power Corp.* (Vermont Yankee Nuclear Power Station), ALAB-919, 30 NRC 29, 48 (1989), *vacated in part on other grounds and remanded*, CLI-90-4, 31 NRC 333 (1990).

petitioner, including portions of the material that are not relied upon, is subject to Board scrutiny.[29]

It is the obligation of the petitioner to present the factual information or expert opinions necessary to support its contention adequately, and failure to do so requires that the contention be rejected.[30] A contention is not to be admitted "where an intervenor has no facts to support its position and where the intervenor contemplates using discovery or cross-examination as a fishing expedition which might produce relevant supporting facts."[31] As the Commission has explained:

> It is surely legitimate for the Commission to screen out contentions of doubtful worth and to avoid starting down the path toward a hearing at the behest of Petitioners who themselves have no particular expertise — or expert assistance — and no particularized grievance, but are hoping something will turn up later as a result of NRC Staff work.[32]

The Commission has also, however, explained that the requirement of section 2.309(f)(1)(v) "does not call upon the intervenor to make its case at [the contention] stage of the proceeding, but rather to indicate what facts or expert opinions, be it one fact or opinion or many, of which it is aware at that point in time which provide the basis for its contention."[33] A petitioner does not have to provide a complete or final list of its experts or evidence or prove the merits of its contention at the admissibility stage.[34] And, as with a summary disposition motion, the support for a contention may be viewed in a light that is favorable to the petitioner — so long as the admissibility requirements are found to have been met.[35] The requirement "generally is fulfilled when the sponsor of an otherwise acceptable contention provides a brief recitation of the factors underlying the contention or references to documents and texts that provide such reasons."[36]

[29] *Yankee Atomic Electric Co.* (Yankee Nuclear Power Station), LBP-96-2, 43 NRC 61, 90 (1996), *rev'd in part on other grounds*, CLI-96-7, 43 NRC 235 (1996).

[30] *Yankee Atomic Electric Co.* (Yankee Nuclear Power Station), CLI-96-7, 43 NRC 235, 262 (1996); *Arizona Public Service Co.* (Palo Verde Nuclear Generating Station, Units 1, 2, and 3), CLI-91-12, 34 NRC 149, 155 (1991).

[31] 54 Feg. Reg. at 33,171.

[32] *Oconee*, CLI-99-11, 49 NRC at 342.

[33] 54 Fed. Reg. at 33,170.

[34] *Louisiana Energy Services, L.P.* (National Enrichment Facility), CLI-04-35, 60 NRC 619, 623 (2004); *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), CLI-04-22, 60 NRC 125, 139 (2004).

[35] *See Palo Verde*, CLI-91-12, 34 NRC at 155; 10 C.F.R. § 2.710(c).

[36] 54 Fed. Reg. at 33,170 (citing *Texas Utilities Electric Co.* (Comanche Peak Steam Electric Station, Unit 1), ALAB-868, 25 NRC 912, 930 (1987)).

090060

10 C.F.R. § 2.309(f)(1)(vi)

Finally, Petitioners must, as stated at 10 C.F.R. § 2.309(f)(1)(vi), with each contention:

> [p]rovide sufficient information to show that a genuine dispute exists with the applicant/licensee on a material issue of law or fact. This information must include references to specific portions of the application (including the applicant's environmental report and safety report) that the petitioner disputes and the supporting reasons for each dispute, or, if the petitioner believes that the application fails to contain information on a relevant matter as required by law, the identification of each failure and the supporting reasons for the petitioner's belief.

A petitioner must "read the pertinent portions of the license application, including the Safety Analysis Report and the Environmental Report, state the applicant's position and the petitioner's opposing view," and explain why it disagrees with the applicant.[37] If a petitioner does not believe these materials ad-

[37] 54 Fed. Reg. at 33,170; *Millstone*, CLI-01-24, 54 NRC at 358. Also, under 10 C.F.R. § 2.309(f)(2):

> Contentions must be based on documents or other information available at the time the petition is to be filed, such as the application, supporting safety analysis report, environmental report or other supporting document filed by an applicant or licensee, or otherwise available to a petitioner. On issues arising under the National Environmental Policy Act, the petitioner shall file contentions based on the applicant's environmental report. The petitioner may amend those contentions or file new contentions if there are data or conclusions in the NRC draft or final environmental impact statement, environmental assessment, or any supplements relating thereto, that differ significantly from the data or conclusions in the applicant's documents. Otherwise, contentions may be amended or new contentions filed after the initial filing only with leave of the presiding officer upon a showing that —
>
> (i) The information upon which the amended or new contention is based was not previously available;
>
> (ii) The information upon which the amended or new contention is based is materially different than information previously available; and
>
> (iii) The amended or new contention has been submitted in a timely fashion based on the availability of the subsequent information.

Other portions of 10 C.F.R. § 2.309 address late-filing and other criteria for contentions and petitions to intervene. Section 2.309(c) provides as follows:

> (c) Nontimely filings. (1) Nontimely requests and/or petitions and contentions will not be entertained absent a determination by the Commission, the presiding officer or the Atomic Safety and Licensing Board designated to rule on the request and/or petition and contentions that the request and/or petition should be granted and/or the contentions should be admitted based upon a balancing of the following factors to the extent that they apply to the particular nontimely filing:
>
> (i) Good cause, if any, for the failure to file on time;

(Continued)

dress a relevant issue, the petitioner is to "explain why the application is deficient."[38]

In contrast to subparagraph (v) of section 2.309(f)(1), which focuses on the need for some factual support for the contention, subparagraph (vi) requires that there be a concrete and genuine dispute appropriate for litigation. A contention that does not directly controvert a position taken by the applicant in the application is subject to dismissal.[39] For example, an allegation that some aspect of a license application is "inadequate" or "unacceptable" does not give rise to a genuine dispute unless it is supported by facts and a reasoned statement of why the application is unacceptable in some material respect.[40] Similarly, an expert opinion that " 'merely states a conclusion (e.g., the application is 'deficient,' 'inadequate,' or 'wrong') without providing a reasoned basis or explanation for that conclusion is inadequate because it deprives the Board of its ability to make the necessary, reflective assessment of the opinion.' "[41]

Although it has been stated that "technical perfection is not an essential element of contention pleading,"[42] and that the "[s]ounder practice is to decide issues

(ii) The nature of the requestor's/petitioner's right under the Act to be made a party to the proceeding;

(iii) The nature and extent of the requestor's/petitioner's property, financial or other interest in the proceeding;

(iv) The possible effect of any order that may be entered in the proceeding on the requestor's/petitioner's interest;

(v) The availability of other means whereby the requestor's/petitioner's interest will be protected;

(vi) The extent to which the requestor's/petitioner's interests will be represented by existing parties;

(vii) The extent to which the requestor's/petitioner's participation will broaden the issues or delay the proceeding; and

(viii) The extent to which the requestor's/petitioner's participation may reasonably be expected to assist in developing a sound record.

[38] 54 Fed. Reg. at 33,170; *Palo Verde*, CLI-91-12, 34 NRC at 156.

[39] *See Texas Utilities Electric Co.* (Comanche Peak Steam Electric Station, Unit 2), LBP-92-37, 36 NRC 370, 384 (1992).

[40] *See Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), LBP-90-16, 31 NRC 509, 521 & n.12 (1990).

[41] *USEC Inc.* (American Centrifuge Plant), CLI-06-10, 63 NRC 451, 472 (2006) (citation omitted) (affirming Licensing Board holding that quotations from an unintelligible correspondence with purported expert, with no explanation or analysis of how the expert's statements relate to an error or omission in the application, are insufficient to support a contention).

[42] *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), LBP-01-3, 53 NRC 84, 99 (2001) (citing *Houston Lighting and Power Co.* (South Texas Project, Units 1 and 2), ALAB-549, 9 NRC 644, 649 (1979), in which it is stated that "[i]t is neither Congressional nor Commission policy to exclude parties because the niceties of pleading were imperfectly observed").

on their merits, not to avoid them on technicalities,"[43] it has also been observed that "a protestant does not become entitled to an evidentiary hearing merely on request, or on a bald or conclusory allegation that . . . a dispute exists. The protestant must make a minimal showing that material facts are in dispute, thereby demonstrating that an 'inquiry in depth' is appropriate."[44] Nonetheless, the strict contention admissibility requirements for a sufficient factual basis "do[ ] not shift the ultimate burden of proof from the applicant to the petitioner."[45] Explaining the level of support necessary for an admissible contention, the Commission observed in *Yankee*:

> Nor [do the contention admissibility rules] require a petitioner to prove its case at the contention stage. For factual disputes, a petitioner need not proffer facts in "formal affidavit or evidentiary form," sufficient "to withstand a summary disposition motion." . . . On the other hand, a petitioner "must present sufficient information to show a genuine dispute" and reasonably "indicating that a further inquiry is appropriate."[46]

Scope of Petitioner's Reply Brief

The Commission has indicated that, under the most recent revision of the contention admissibility rule, a petitioner that fails to satisfy the requirements of the admissibility standards in its initial contention submission may not use its reply to rectify the inadequacies of its petition or to raise new arguments.[47] A petitioner may, however, respond to and focus on any legal, logical, or factual arguments presented in the answers, and the "amplification" of statements provided in an initial petition is legitimate and permissible.[48]

[43] *South Texas*, ALAB-549, 9 NRC at 649.

[44] *Connecticut Bankers Ass'n v. Board of Governors*, 627 F.2d 245, 251 (D.C. Cir. 1980); *see* 54 Fed. Reg. at 33,171.

[45] *Yankee Atomic Electric Co.* (Yankee Nuclear Power Station), CLI-96-7, 43 NRC 235, 249 (1996) (citing 54 Fed. Reg. at 33,171).

[46] *Id.* (citing *Georgia Tech*, CLI-95-12, 42 NRC at 118); *see also Gulf States Utilities Co.* (River Bend Station, Unit 1), CLI-94-10, 40 NRC 43, 51 (1994).

[47] *See Louisiana Energy Services, L.P.* (National Enrichment Facility), CLI-04-25, 60 NRC 223, 225 (2004) (quoting Final Rule: "Changes to the Adjudicatory Process," 69 Fed. Reg. 2182, 2203 (Jan. 14, 2004) (reply must be "narrowly focused on the legal or logical arguments presented in the applicant/licensee or NRC Staff answer")); *Nuclear Management Co., LLC* (Palisades Nuclear Plant), CLI-06-17, 63 NRC 727, 732 (2006). *See* text accompanying note 5 *supra*.

[48] *Louisiana Energy Services, L.P.* (National Enrichment Facility), LBP-04-14, 60 NRC 40, 58, *aff'd*, CLI-04-25, 60 NRC 223 (2004).

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

Alex S. Karlin, Chairman
Dr. Richard E. Wardwell
Dr. Thomas S. Elleman

In the Matter of

Docket No. 50-271-LR
(ASLBP No. 06-849-03-LR)

ENTERGY NUCLEAR VERMONT YANKEE, LLC, and ENTERGY NUCLEAR OPERATIONS, INC.
(Vermont Yankee Nuclear Power Station)

September 22, 2006

LICENSE RENEWAL: ENVIRONMENTAL REPORT (NEW AND SIGNIFICANT INFORMATION REGARDING CATEGORY 1 MATTERS)

In construing 10 C.F.R. § 51.53(c)(3)(i) and (iv), the Commission has stated: "even where the GEIS has found that a particular impact applies generically (Category 1), the applicant must still provide additional analysis in its Environmental Report if new and significant information may bear on the applicability of the Category 1 finding at its particular plant." *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 NRC 3, 11 (2001) (emphasis added). Likewise, "the applicant must provide additional analysis of even a Category 1 issue if new and significant information has surfaced." *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-14, 55 NRC 278, 290 (2002).

ATTACHMENT 1

(NEW AND SIGNIFICANT INFORMATION REGARDING CATEGORY 1 MATTERS)

When preparing the Supplemental EIS, the Staff must consider any significant new information related to Category 1 issues. *See* 10 C.F.R. §§ 51.92(a)(2), 51.95(c)(3); Final Rule: "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses," 61 Fed. Reg. 28,467, 28,470 (June 5, 1996).

LICENSE RENEWAL: ENVIRONMENTAL IMPACT STATEMENTS (NEW AND SIGNIFICANT INFORMATION REGARDING CATEGORY 1 MATTERS)

The Commission has stated that the Staff's final Supplemental EIS must take account of public comments concerning new and significant information on Category 1 findings. *See Turkey Point,* CLI-01-17, 54 NRC at 12; *McGuire/Catawba,* CLI-02-14, 55 NRC at 290-91.

LICENSE RENEWAL: ENVIRONMENTAL REPORT (LITIGABILITY OF FAILURE TO PROVIDE NEW AND SIGNIFICANT INFORMATION REGARDING CATEGORY 1 MATTERS)

Even assuming that the petitioner's information regarding the dangers of high-density racking of spent fuel constitutes known "new and significant information," the Commission's decision in *Turkey Point,* CLI-01-17, 54 NRC 3, compels the Board to conclude that the failure of an applicant to include such new and significant information concerning a Category 1 issue in its environmental report, in violation of 10 C.F.R. § 51.53(c)(3)(iv), does not give rise to an admissible contention.

LICENSE RENEWAL: ENVIRONMENTAL REPORT (LITIGABILITY OF FAILURE TO PROVIDE NEW AND SIGNIFICANT INFORMATION REGARDING CATEGORY 1 MATTERS)

Even assuming that petitioner's information regarding the risks of terrorism related to the high-density racking of spent fuel in pools is "new and significant information" concerning a Category 1 matter and the failure of the applicant to include the information violates 10 C.F.R. § 51.53(c)(3)(iv), the same result obtains — the contention is not adjudicable under *Turkey Point.* If the petitioner

wants to raise its concerns on this issue, it should pursue one of the three paths specified by the Commission. *See Turkey Point,* CLI-01-17, 54 NRC at 12.

RULES OF PRACTICE: CONTENTIONS (ADMISSIBILITY; "BALD AND CONCLUSORY")

The State of Vermont's citation to specific and potentially inconsistent portions of Entergy's documents, together with the declaration of its unchallenged expert, the State's official nuclear engineer, that "the concrete surface behind the steel shell will closely match the drywell ambient temperature" provide us with alleged "facts or expert opinion," which are "sufficient" to meet the requirements of 10 C.F.R. § 2.309(f)(1)(v) and (vi). The fact that Mr. Sherman's opinion is simple, straightforward, and fact-based does not mean that it is bald or conclusory.

RULES OF PRACTICE: CONTENTIONS (ADMISSIBILITY)

At the contention admission stage, which is a lesser threshold than a merits determination or even a summary disposition ruling, the Board's purpose in applying 10 C.F.R. § 2.309(f)(1) is only to "ensure that the adjudicatory process is used to address real, concrete, specific issues that are appropriate for litigation." Final Rule: "Changes to the Adjudicatory Process," 69 Fed. Reg. 2182, 2202 (Jan. 14, 2004). The State of Vermont's Contention 1 meets this criterion, and its factual allegations and attached expert opinion suffice under 10 C.F.R. § 2.309(f)(1)(v) and (vi).

LICENSE RENEWAL: ENVIRONMENTAL REPORT (NEW AND SIGNIFICANT INFORMATION REGARDING CATEGORY 1 MATTERS)

The State of Vermont's contention, presenting what it characterizes as "new and significant information" related to the timeline for the opening of a federal high-level waste geologic repository such as Yucca Mountain, is inadmissable because, although 10 C.F.R. § 51.53(c)(3)(iv) requires an applicant to include any new and significant information concerning Category 1 issues that it is aware of, the failure of an applicant to do so is simply not litigable, absent a waiver under 10 C.F.R. § 2.335. We need not, and do not, decide whether the information proffered by the State of Vermont is indeed "new and significant," or whether Entergy was, or should have been, aware of it.

LICENSE RENEWAL: ENVIRONMENTAL REPORT (NEW AND SIGNIFICANT INFORMATION REGARDING CATEGORY 1 MATTERS; WASTE CONFIDENCE RULE)

Issues related to the environmental impact of onsite spent fuel storage after the license renewal term are covered by NRC's Waste Confidence Rule, 10 C.F.R. § 51.23(a) which specifies that the "Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor to dispose of the commercial high-level waste and spent fuel originating in such reactor and generated up to that time." Such issues are outside the scope of a license renewal proceeding because under 10 C.F.R. § 2.335(a) contentions may not challenge a regulation. *See Duke Energy Corp.* (Oconee Nuclear Station, Units 1, 2, and 3), CLI-99-11, 49 NRC 328, 344-45 (1999).

LICENSE RENEWAL: SAFETY (SECURITY AND TERRORISM ISSUES)

The State of Vermont contention that the applicant has failed to identify non-safety-related systems, structures, and components in the security area whose failure could prevent satisfactory accomplishment of the functions of safety-related systems, structures, and components under 10 C.F.R. § 54.4(a)(2) is not admissible because, under controlling Commission rulings, security-related issues are not within the scope of a license renewal proceeding under 10 C.F.R. § 2.309(f)(1)(iii). *See Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-26, 56 NRC 358, 364 (2002), and *Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Units 1 and 2), CLI-04-36, 60 NRC 631, 638 (2004).

RULES OF PRACTICE: CONTENTIONS (NEW OR AMENDED)

A petitioner has no right or need to request a "reservation of rights" to file additional contentions later. To the extent that the draft or final SEIS contains data or conclusions that differ significantly from the data or conclusions in the applicant's environmental report or in the GEIS, a petitioner is entitled to use 10 C.F.R. § 2.309(f)(2) as the grounds to file a new or amended contention. However, should the petitioner later file an environmental contention that is *not* based on new information, the contention can only be admitted upon a favorable balancing of the factors found in 10 C.F.R. § 2.309(c).

000064

NEPA: RELATION TO OTHER REQUIRED PERMITS

NRC will consider the fact that an applicant is subject to, and compliant with, other environmental laws and permits, such as a RCRA permit, Clean Air Act permit, or NPDES permit, but this does not obviate the NEPA mandate that, prior to any major federal action significantly affecting the environment, NRC must perform an environmental impact statement assessing these subjects under 10 C.F.R. § 51.71(d).

NEPA: RELATION TO FEDERAL WATER POLLUTION CONTROL ACT § 511

We reject the assertion that section 511(c) of the Federal Water Pollution Control Act bars a contention alleging that the applicant or NRC failed to adequately assess water quality impacts of a proposed license amendment. While section 511(c) bars NRC from imposing or second-guessing effluent limitations or water quality certification requirements imposed by EPA or an authorized state, it does not bar NRC from addressing water quality matters in its assessment of the environmental impact of the license renewal. To the contrary, NEPA requires the NRC to do so.

NEPA: LICENSE RENEWAL (20-YEAR PERIOD)

The contention, which raises the question as to whether an NPDES permit that will expire before the proposed 20-year NRC license renewal would even take effect satisfies the requirements of 10 C.F.R. § 51.53(c)(3)(ii)(B), raises an admissible and material issue of law and fact.

NEPA: CONTENTIONS (LICENSE RENEWAL)

The contention, which raises the question as to whether requirements of 10 C.F.R. § 51.53(c)(3)(ii)(B) supplement the more general requirements of 10 C.F.R. §§ 51.45(c) and 51.53(c), or instead displace and supplant the latter requirements, raises an admissible and material issue of interpretation and construction of the regulations.

LICENSE RENEWAL: DEMONSTRATING THAT AGING WILL BE ADEQUATELY MANAGED

The contention, which alleges that the applicant's plan to manage metal fatigue is too vague and is really only a "plan to develop a plan," raises an admissible and material issue as to whether the applicant has met the 10 C.F.R. § 54.21(c)(1)(iii)

and (a)(3) requirement to "demonstrate that the effects of aging . . . will be adequately managed."

RULES OF PRACTICE: CONTENTIONS (SUFFICIENT EVIDENCE OF DISPUTE)

The contention alleging that the applicant's proposed monitoring techniques are not adequate because they are based on computer models that were not benchmarked, which is supported by a sworn statement by an unchallenged expert who described his professional reasoning, satisfies the requirement that the petitioner provide sufficient evidence to show that there is a genuine dispute concerning a material issue, as required by 10 C.F.R. § 2.309(f)(1)(vi) and is not "bald or conclusory."

RULES OF PRACTICE: CONTENTIONS (SCOPE OF REPLY)

A reply may respond to any legal, logical, or factual arguments presented in an answer. While a petitioner who fails to satisfy the requirements of 10 C.F.R. § 2.309(f)(1) in its initial contention submission may not use its reply to rectify those inadequacies or to raise new arguments, a petitioner may use the reply to flesh out contentions that have already met the pleading requirements.

RULES OF PRACTICE: CONTENTIONS (SUFFICIENT EVIDENCE OF DISPUTE)

At the contention admissibility stage, the petitioner is not required to prove its contention or to provide all the evidence for its contention that may be required later in the proceeding. Rather, a petitioner is only required to provide sufficient information that "the Applicants are sufficiently put on notice so that they will know at least generally what they will have to defend against or oppose, and that there has been sufficient foundation assigned to warrant further exploration of [the] contention." *Kansas City Gas & Electric Co.* (Wolf Creek Generating Station, Unit 1), LBP-84-1, 19 NRC 29, 34 (1984).

RULES OF PRACTICE: CONTENTIONS (SCOPE OF REPLY)

The portions of the reply that respond to legal, logical, and factual arguments raised in the answers, such as Entergy's allegation that the treatment and resolution of the flow-accelerated corrosion issue during NRC's separate review of the extended power uprate application, are appropriate and the motion to strike them is denied.

000065

LICENSE RENEWAL: EMERGENCY PLANNING CONTENTIONS NOT ADMISSIBLE

Emergency planning concerns are not within the scope of a license renewal proceeding and therefore any such contention is not admissible under 10 C.F.R. § 2.309(f)(1)(iii). *See, e.g., Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Units 2 and 3), CLI-05-24, 62 NRC 551, 560-61 (2005).

SELECTION OF HEARING PROCEDURES

The selection of appropriate hearing procedures under 10 C.F.R. § 2.310 is a contention-by-contention matter, dependent on the nature of the specific issues involved in the contention. Thus, for example, a single adjudicatory proceeding may include some contentions litigated under Subpart L and others litigated under Subpart G or N.

SELECTION OF HEARING PROCEDURES: STATE RIGHT TO CROSS-EXAMINATION UNDER SECTION 274(*l*) OF THE AEA

Section 274(*l*) of the AEA does not give a state an absolute right of cross-examination, but states only that "the Commission . . . shall afford *reasonable opportunity* for State representatives to . . . interrogate witnesses." 42 U.S.C. § 2021(*l*) (emphasis added).

SELECTION OF HEARING PROCEDURES: STATE RIGHT TO CROSS-EXAMINATION UNDER SECTION 274(*l*) OF THE AEA

The Commission's statement in *Citizens Awareness Network, Inc. v. United States*, 391 F.3d 338 (1st Cir. 2004), that a petitioner's right to cross-examination (in Subpart L proceedings) whenever it "is necessary to ensure the development of an adequate record for decision," 10 C.F.R. § 2.1204(b)(3), is equivalent to a party's right to cross-examination under 5 U.S.C. § 556(d), leads the Board to conclude that Subpart L proceedings satisfy the AEA requirement that State representatives be given a "reasonable opportunity . . . to . . . interrogate witnesses." 42 U.S.C. § 2021(*l*).

SELECTION OF HEARING PROCEDURES: BOARD DISCRETION

Subpart L is not the automatic default procedure for adjudicatory hearings. If the provisions of 10 C.F.R. § 2:310(c)-(j) do not mandate the use of a specific procedure, then 10 C.F.R. § 2.310(b) specifies that the Board "may" use the Subpart L procedures. In this circumstance the Board, in its sound discretion,

must determine the type of hearing procedures most appropriate for the specific contentions before it.

SELECTION OF HEARING PROCEDURES: STATE RIGHT TO CROSS-EXAMINATION UNDER SECTION 274(*l*) OF THE AEA

We reject the assertion that section 247(*l*) of the AEA gives a state a right to offer evidence and interrogate witnesses, even if no hearing is otherwise being held and no party has submitted an admissible contention.

RULES OF PRACTICE: CONTENTIONS (ADOPTION)

It is sufficient for our purposes to hold that if a notice of adoption of a contention is filed under 10 C.F.R. § 2.309(f)(3) within a reasonable time (such as 20 days) after the contention has been filed *and* admitted, then it is deemed timely and is not subject to the nontimely factors specified in 10 C.F.R. § 2.309(c). Accordingly, we find that the DPS and NEC adoption notices were timely and the adoptions are granted.

RULES OF PRACTICE: CONTENTIONS (ADOPTION; PROOF OF INDEPENDENT ABILITY TO LITIGATE NOT REQUIRED)

We have serious reservations about requiring the adopting party to demonstrate an independent ability to litigate a contention. No such requirement is imposed under new 10 C.F.R. § 2.309(f)(3). No such requirement is imposed on the original petitioner under 10 C.F.R. § 2.309(f)(1). Further, it is not clear how a Board could determine, in advance, whether an adopter has the "independent ability to litigate a contention" without impermissibly inquiring into the party's finances and membership list. Any such requirement may not comport with section 189a of the AEA.

INTERESTED STATE PARTICIPATION

As provided in 10 C.F.R. § 2.315(c), any interested state, local governmental body, and affected, federally recognized Indian Tribe that has not been admitted as a party under 10 C.F.R. § 2.309 will be given a reasonable opportunity to participate in any hearing conducted in this proceeding. The only timing requirement for giving notice of such participation states that a "representative shall identify those contentions on which it will participate in advance of any hearing held."

990000

TABLE OF CONTENTS

MEMORANDUM AND ORDER

(Ruling on Standing, Contentions, Hearing Procedures, State Statutory Claim, and Contention Adoption)

Before the Licensing Board are four petitions to intervene and requests for hearing regarding the application of Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc. (collectively, Entergy), to renew the operating license for the Vermont Yankee Nuclear Power Station in Windham County, Vermont. Entergy seeks to extend its license for an additional 20 years beyond the current expiration date of March 21, 2012. Three of the petitions were filed by governmental entities — the Vermont Department of Public Service (DPS), the Massachusetts Attorney General (AG), and the Town of Marlboro, Vermont (Marlboro). The fourth petition was filed by a nonprofit organization, the New England Coalition (NEC).

For the reasons set forth below, we find that each of the four Petitioners has standing to intervene, but only DPS and NEC have submitted an admissible contention. Accordingly, we admit DPS and NEC as parties to this proceeding. Further, we address four issues related to the petitions and hearing requests and find that (1) the informal hearing procedures of 10 C.F.R. Part 2, Subpart L are the most appropriate procedures for the admitted contentions; (2) DPS's statutory hearing rights under section 274(*l*) of the Atomic Energy Act of 1954, as amended (AEA), 42 U.S.C. § 2021(*l*), are satisfied under the Subpart L hearing procedures; (3) DPS and NEC have adopted one another's admitted contentions; and (4) any notice of participation by an interested state or local governmental entity may be filed within 20 days of the date of this ruling.

I. BACKGROUND

On January 25, 2006, Entergy filed an application pursuant to 10 C.F.R. Part 54 to renew Operating License No. DPR-28 for its Vermont Yankee Nuclear Power

Station.[1] Entergy seeks to extend the current operating license for the Vermont Yankee facility, which expires on March 21, 2012, for an additional 20 years. On March 27, 2006, the Commission published a notice of acceptance for docketing of the Entergy renewal application and a notice of opportunity to request a hearing on the application. 71 Fed. Reg. 15,220 (Mar. 27, 2006).

Several entities filed hearing requests/intervention petitions asking to be admitted as parties to any proceeding conducted on the application. Marlboro filed a letter requesting a hearing on its exclusion from the emergency planning zone.[2] The AG, DPS, and NEC each submitted a request for a hearing, a petition to intervene, and one or more contentions.[3] The AG proposed one contention challenging Entergy's application and also submitted a 10 C.F.R. § 50.109 petition for a backfit order. DPS proposed three contentions and NEC proposed six contentions.

Following the establishment of this Board, *see* 71 Fed. Reg. 34,397 (June 14, 2006), Entergy and the NRC Staff (Staff) submitted answers to the four hearing requests.[4] Although Entergy does not oppose the standing of the four Petitioners, it argues that none of the Petitioners submitted an admissible contention. The Staff agrees that each of the Petitioners has standing, but takes the position that, except for two of NEC's contentions, the proposed contentions fail to meet NRC regulatory requirements. The AG, DPS, and NEC filed replies to the Entergy

[1] Vermont Yankee Nuclear Power Station License Renewal Application (Jan. 25, 2006), ADAMS Accession No. ML060300085 [Application]. Entergy has since supplemented and amended its application several times.

[2] Letter from Dan MacArthur, Director of Emergency Management, Town of Marlboro, to Office of the Secretary, NRC (dated Apr. 27, 2006, but postmarked on May 15, 2006) [Marlboro Hearing Request].

[3] [AG] Request for a Hearing and Petition for Leave To Intervene with Respect to [Entergy]'s Application for Renewal of the Vermont Yankee Nuclear Power Plant Operating License and Petition for Backfit Order Requiring New Design Features To Protect Against Spent Fuel Pool Accidents (May 26, 2006) [AG Petition]; [DPS] Notice of Intention To Participate and Petition To Intervene (May 26, 2006) [DPS Petition]; Petition for Leave To Intervene, Request for Hearing, and Contentions (May 26, 2006) [NEC Petition].

[4] Entergy's Answer to the [AG]'s Request for a Hearing, Petition for Leave To Intervene, and Petition for Backfit Order (June 22, 2006) [Entergy Answer to AG]; Entergy's Answer to [DPS] Notice of Intention To Participate and Petition To Intervene (June 22, 2006) [Entergy Answer to DPS]; Entergy's Answer to [NEC]'s Petition for Leave To Intervene, Request for Hearing, and Contentions (June 22, 2006) [Entergy Answer to NEC]; Entergy's Answer to the Town of Marlboro's Request for Hearing (June 14, 2006) [Entergy Answer to Marlboro]; NRC Staff Answer Opposing [AG]'s Request for Hearing and Petition for Leave To Intervene and Petition for Backfit (June 22, 2006) [Staff Answer to AG]; NRC Staff Answer to [DPS] Notice of Intention To Participate and Petition To Intervene (June 22, 2006) [Staff Answer to DPS]; NRC Staff Answer to Request for Hearing of [NEC] (June 22, 2006) [Staff Answer to NEC]; NRC Staff Answer to Town of Marlboro's Request for Hearing [Staff Answer to Marlboro].

and Staff answers.[5] Entergy then filed a motion to strike portions of the DPS and NEC replies, asserting that both replies sought to raise new arguments that were not included in the original petitions, while failing to address the criteria for nontimely filings.[6] DPS and NEC each filed an opposition to Entergy's motions to strike.[7] The Staff filed an answer generally supporting Entergy's motions.[8]

On June 5, 2006, DPS filed a notice of intent to adopt all the contentions filed by the AG and NEC, or in the alternative, moved for leave to be allowed to adopt the contentions.[9] On the same day, NEC made a similar filing, giving notice that it was adopting the contentions filed by the AG and DPS.[10] Entergy opposed both filings because DPS and NEC failed to address the criteria for nontimely contentions.[11] The Staff did not oppose the DPS and NEC notices, but asserted that an adopting party must demonstrate an independent ability to litigate any adopted contention.[12] NEC filed a motion for leave to file a reply to Entergy and

[5] [AG]'s Reply to Entergy's and NRC Staff's Responses to Hearing Request and Petition To Intervene with Respect to Vermont Yankee License Renewal Proceeding (June 30, 2006) [AG Reply]; [DPS] Reply to Answer of Applicant and NRC Staff to Notice of Intention To Participate and Petition To Intervene (June 30, 2006) [DPS Reply]; [NEC]'s Reply to Entergy and NRC Staff Answers to Petition for Leave To Intervene, Request for Hearing, and Contentions (June 29, 2006) [NEC Reply]. Prior to the submission of its reply, the AG filed a letter notifying the Board of a recent decision by the U.S. Court of Appeals for the Ninth Circuit, which the AG maintains "has a direct bearing on the contention." Letter from Diane Curran, Counsel for the AG, to Alex S. Karlin et al., ASLB (June 16, 2006).

[6] Entergy's Motion To Strike Portions of [DPS]'s Reply (July 10, 2006) [Entergy Motion To Strike DPS Reply]; Entergy's Motion To Strike Portions of [NEC]'s Reply (July 10, 2006) [Entergy Motion To Strike NEC Reply].

[7] [DPS] Reply to Entergy's Motion To Strike Portions of [DPS]'s Reply (July 20, 2006) [DPS Reply to Entergy Motion To Strike DPS Reply]; [NEC]'s Opposition to Entergy's Motion To Strike Portions of [NEC]'s Reply (July 20, 2006) [NEC Opposition to Entergy Motion To Strike NEC Reply].

[8] NRC Staff Answer to Entergy's Motion To Strike Portions of [DPS] Reply (July 20, 2006) [Staff Answer to Entergy Motion To Strike DPS Reply]; NRC Staff Answer to Entergy Motion To Strike Portions of [NEC]'s Intervention Reply (July 20, 2006) [Staff Answer to Entergy Motion To Strike NEC Reply].

[9] Notice of Intent To Adopt Contentions and Motion for Leave To Be Allowed To Do So (June 5, 2006) [DPS Notice of Intent To Adopt Contentions].

[10] [NEC]'s Notice of Adoption of Contentions, or in the Alternative, Motion To Adopt Contentions (June 5, 2006) [NEC Notice of Adoption of Contentions].

[11] Entergy's Answer to [DPS] Notice and Motion To Adopt Contentions (June 15, 2006) [Entergy Answer to DPS Notice of Intent To Adopt Contentions]; Entergy's Answer to [NEC]'s Notice and Motion To Adopt Contentions (June 20, 2006) [Entergy Answer to NEC Notice of Adoption of Contentions].

[12] NRC Staff Answer to Vermont DPS Notice of Intent To Adopt Contentions and Motion for Leave (June 21, 2006) [Staff Answer to DPS Notice of Intent To Adopt Contentions]; NRC Staff Answer to [NEC] Notice of Adoption of Contentions or Alternative Motion To Adopt Contentions (June 15, 2006) [Staff Answer to NEC Notice of Adoption of Contentions].

the Staff answers.[13] Both Entergy and the Staff opposed NEC's motion for leave to file a reply.[14]

On August 1 and 2, 2006, the Board conducted an oral argument with the Petitioners,[15] Entergy, and the Staff in Brattleboro, Vermont, where we heard arguments relating to the admissibility of the proposed contentions. Tr. at 40-452.

In order for a request for hearing and petition to intervene to be granted, a petitioner must (1) establish that it has standing and (2) propose at least one admissible contention. 10 C.F.R. § 2.309(a). We address each of these two requirements in turn and find that while all of the Petitioners have standing, only DPS and NEC submitted an admissible contention.

II. STANDING ANALYSIS

A. Standards Governing Standing

A petition for leave to intervene must provide certain basic information supporting the petitioner's claim to standing. The required information includes (1) the nature of the petitioner's right under a relevant statute to be made a party to the proceeding; (2) the nature and extent of the petitioner's property, financial, or other interest in the proceeding; and (3) the possible effect of any decision or order that may be issued in the proceeding on the petitioner's interest. 10 C.F.R. § 2.309(d)(1)(ii)-(iv). Judicial concepts of standing are generally followed in NRC proceedings. *Nuclear Management Co., LLC* (Monticello Nuclear Generating Plant), CLI-06-6, 63 NRC 161, 163 (2006). These require that a petitioner establish that "(1) it has suffered a distinct and palpable harm that constitutes injury-in-fact within the zone of interests arguably protected by the governing statute; (2) the injury can fairly be traced to the challenged action; and (3) the injury is likely to be redressed by a favorable decision." *Yankee Atomic Electric Co.* (Yankee Nuclear Power Station), CLI-96-1, 43 NRC 1, 6 (1996). In the context of a license renewal application, relevant governing statutes include the

[13] NEC's Motion for Leave To File a Reply to NRC Staff Answer to [NEC]'s Notice and Motion To Adopt Contentions; to Entergy's Answer to [NEC]'s Notice and Motion To Adopt Contentions; and to Entergy's Answer to [DPS]'s Notice and Motion To Adopt Contentions (June 22, 2006) [NEC Motion for Leave To File Reply].

[14] Entergy's Answer to NEC's Motion for Leave To File a Reply (July 3, 2006) [Entergy Answer to NEC Motion for Leave To File Reply]; NRC Staff Answer Opposing NEC's Motion for Leave To File Replies (July 3, 2006) [Staff Answer to NEC Motion for Leave To File Reply].

[15] The Board did not hear oral argument from the Town of Marlboro, but did allow the representative from Marlboro to make an opening statement addressing whether the Town is an "interested . . . local governmental body" within the meaning of 10 C.F.R. § 2.315(c). Tr. at 72-74 (Aug. 1, 2006).

Atomic Energy Act of 1954, 42 U.S.C. §§ 2011 *et seq.* (AEA) and the National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321 *et seq.* (NEPA).

An organization seeking to intervene in an NRC proceeding must allege that the challenged action will cause a cognizable injury to the organization's interests or to the interests of its members. *Yankee Atomic Electric Co.* (Yankee Nuclear Power Station), CLI-94-3, 39 NRC 95, 102 n.10 (1994). If the organization seeks standing on its own behalf, it must demonstrate a discrete institutional injury to the organization itself. *International Uranium (USA) Corp.* (White Mesa Uranium Mill), CLI-01-21, 54 NRC 247, 252 (2001). When seeking to intervene in a representational capacity, an organization must identify (by name and address) at least one member who is affected by the licensing action and show that it is authorized by that member to request a hearing on his or her behalf. *Vermont Yankee Nuclear Power Corp.* (Vermont Yankee Nuclear Power Station), CLI-00-20, 52 NRC 151, 163 (2000).

In determining whether a petitioner has met the requirements for establishing standing, the Commission has directed us to "construe the petition in favor of the petitioner." *Georgia Institute of Technology* (Georgia Tech Research Reactor, Atlanta, Georgia), CLI-95-12, 42 NRC 111, 115 (1995). To this end, in proceedings involving nuclear power reactors, the Commission has recognized a proximity presumption, whereby a petitioner is presumed to have standing to intervene without the need to specifically plead injury, causation, and redressability if the petitioner lives within 50 miles of the nuclear power reactor.[16] Meanwhile, a state or local governmental body that wishes to be a party in a proceeding that involves a facility located within its boundaries is automatically deemed to have standing. 10 C.F.R. § 2.309(d)(2)(i)-(ii).

B. Rulings on Standing

1. *Vermont Department of Public Service*

DPS satisfies the requirement for standing to intervene under section 2.309(d)(2) because the proceeding concerns the Vermont Yankee Nuclear Power Station, which is located within the boundaries of the State of Vermont. *See* DPS Petition at 3. Therefore, DPS is deemed to have standing for purposes of this proceeding and no further showing is required. 10 C.F.R. § 2.309(d)(2)(ii).

[16] *See, e.g., Florida Power & Light Co.* (St. Lucie Nuclear Power Plant, Units 1 and 2), CLI-89-21, 30 NRC 325, 329 (1989) (observing that the presumption applies in proceedings for nuclear power plant "construction permits, operating licenses, or significant amendments thereto"); *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), LBP-01-6, 53 NRC 138, 146-50 (2001) (applying the presumption in an operating license renewal proceeding).

2. *Massachusetts Attorney General*

Although the AG is a representative of a state within the meaning of 10 C.F.R. § 2.309(d)(2), the Vermont Yankee facility is not located within the boundaries of the Commonwealth of Massachusetts and therefore the AG does not qualify for standing under 10 C.F.R. § 2.309(d)(2)(ii). The AG must meet the standing requirements in some other way. The AG's petition states that the Vermont Yankee Nuclear Power Station is located within 10 miles of the Commonwealth of Massachusetts and that an accident during the license renewal period could affect the residents, the environment, and the economy of the Commonwealth. AG Petition at 5 n.1. Under the proximity presumption, a petitioner within the zone of possible harm from a reactor need not specifically plead injury, causation, and redressability. *See supra* note 16. Because the Vermont Yankee Nuclear Power Station is located within 10 miles of the Commonwealth of Massachusetts, we find that the AG has demonstrated standing to participate in this license renewal proceeding.

3. *New England Coalition*

NEC claims both organizational and representational standing. NEC Petition at 2. To claim standing on its own behalf, an organization must demonstrate a discrete institutional injury that is unique to the organization. *White Mesa,* CLI-01-21, 54 NRC at 252. In its petition, NEC states that its headquarters, which houses its offices, technical library, business records, and equipment, is within 10 miles of the Vermont Yankee facility, that the purpose of the organization is to oppose nuclear hazards, and that the proposed license renewal could increase the risk of an offsite radiological release, which would affect the value of its property and its ability to conduct normal operations. NEC Petition at 2-3; *id.*, Exh. 1, Decl. of Pamela Long, Clerk of the Corporation [NEC] (May 24, 2006). We find that, given the close proximity of NEC's headquarters to the Vermont Yankee plant, these interests are sufficient to demonstrate organizational standing.

With respect to its claim of representational standing, NEC's petition includes declarations from four of its members authorizing the organization to represent their interests in any proceeding regarding Entergy's license renewal application.[17] Each member declares that he or she lives within close proximity to the plant (at distances ranging from 4 to 25 miles of the nuclear facility) and is concerned that the proposed license extension could increase the potential for an accident and the harmful consequences resulting from an offsite radiological release from the

[17] *See* NEC Petition, Exh. 2, Decl. of Sarah Kotkov (May 24, 2006); Exh. 3, Decl. of Sally Shaw (May 24, 2006); Exh. 4, Decl. of David L. Deen (May 24, 2006); Exh. 5, Decl. of Mary King (May 23, 2006).

plant.[18] Based on these declarations and the proximity presumption, we find that NEC satisfies the requirements for representational standing.

4. *Town of Marlboro*

Although Marlboro is a governmental body within the meaning of 10 C.F.R. § 2.309(d)(2), the Vermont Yankee Nuclear Power Station is not located within the Town's boundaries. Thus, Marlboro must meet the standing pleading requirements in some other way. Marlboro states that it is located within the 10-mile radius of the Vermont Yankee facility. Marlboro Hearing Request at 1. Under the proximity presumption, we find that Marlboro has standing to participate in this proceeding.

III. CONTENTION ADMISSIBILITY ANALYSIS

A. Standards Governing Contention Admissibility

Under 10 C.F.R. § 2.309(f)(1)[19] a hearing request or petition to intervene "must set forth with particularity the contentions sought to be raised." To satisfy this requirement, section 2.309(f)(1) specifies that each contention must:

> (i) Provide a specific statement of the issue of law or fact to be raised or controverted;
>
> (ii) Provide a brief explanation of the basis for the contention;
>
> (iii) Demonstrate that the issue raised in the contention is within the scope of the proceeding;
>
> (iv) Demonstrate that the issue raised in the contention is material to the findings the NRC must make to support the action that is involved in the proceeding;
>
> (v) Provide a concise statement of the alleged facts or expert opinions which support the requestor's/petitioner's position on the issue and on which the petitioner intends to rely at hearing, together with references to the specific sources and documents on which the requestor/petitioner intends to rely to support its position on the issue; and
>
> (vi) Provide sufficient information to show that a genuine dispute exists with the applicant/licensee on a material issue of law or fact. This information must include references to specific portions of the application (including the applicant's environmental report and safety report) that the petitioner disputes and the supporting reasons for each dispute, or, if the petitioner believes that the application fails to contain information on a relevant matter as required by law, the identification of each failure and the supporting reasons for the petitioner's belief.

[18] *See, e.g.*, NEC Petition, Exh. 2, Decl. of Sarah Kotkov ¶ 4 (May 24, 2006).

[19] In 2004 the Commission revised and reordered its procedural rules. *See* Final Rule: "Changes to Adjudicatory Process," 69 Fed. Reg. 2182, 2217 (Jan. 14, 2004). Much of the case law regarding contention admissibility focuses on the pre-2004 rule, 10 C.F.R. § 2.714(b)(2) (2004).

10 C.F.R. § 2.309(f)(1)(i)-(vi).

The purpose of the contention rule is to "focus litigation on concrete issues and result in a clearer and more focused record for decision." 69 Fed. Reg. at 2202. The Commission has stated that it "should not have to expend resources to support the hearing process unless there is an issue that is appropriate for, and susceptible to, resolution in an NRC hearing." *Id.* The Commission has emphasized that the rules on contention admissibility are "strict by design." *Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Units 2 and 3), CLI-01-24, 54 NRC 349, 358 (2001). Failure to comply with any of these requirements is grounds for the dismissal of a contention. *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), CLI-99-10, 49 NRC 318, 325 (1999). These requirements have been further developed by NRC case law, as summarized below.

1. *Brief Explanation of the Basis of the Contention — 10 C.F.R. § 2.309(f)(1)(ii)*

A "brief explanation of the basis for the contention" is a necessary prerequisite of an admissible contention. 10 C.F.R. § 2.309(f)(1)(ii). "[A] petitioner must provide some sort of minimal basis indicating the potential validity of the contention." Final Rule: "Rules of Practice for Domestic Licensing Proceedings — Procedural Changes in the Hearing Process," 54 Fed. Reg. 33,168, 33,170 (Aug. 11, 1989). This "brief explanation" of the logical underpinnings of a contention does not require a petitioner "to provide an exhaustive list of possible bases, but simply to provide sufficient alleged factual or legal bases to support the contention." *Louisiana Energy Services, L.P.* (National Enrichment Facility), CLI-04-35, 60 NRC 619, 623 (2004). The brief explanation helps define the scope of a contention — "[t]he reach of a contention necessarily hinges upon its terms coupled with its stated bases." *Public Service Co. of New Hampshire* (Seabrook Station, Units 1 and 2), ALAB-899, 28 NRC 93, 97 (1988), *aff'd sub nom. Massachusetts v. NRC*, 924 F.2d 311 (D.C. Cir. 1991). However, it is the contention, not "bases," whose admissibility must be determined. *See* 10 C.F.R. § 2.309(a).

2. *Within the Scope of the Proceeding — 10 C.F.R. § 2.309(f)(1)(iii)*

A petitioner must demonstrate that the issue it seeks to raise is within the scope of the proceeding. 10 C.F.R. § 2.309(f)(1)(iii). The scope of a proceeding is defined by the Commission in its initial hearing notice and order referring

the proceeding to the licensing board. *Duke Power Co.* (Catawba Nuclear Station, Units 1 and 2), ALAB-825, 22 NRC 785, 790-91 (1985). In addition, the Commission has provided a detailed regulatory framework setting forth the safety and environmental issues that fall within the scope of a license renewal proceeding.

Safety contentions in license renewal proceedings must focus on topics related to the detrimental effects of aging and related time-limited issues dealt within 10 C.F.R. Part 54. *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 NRC 3, 7 (2001); 10 C.F.R. § 54.29(a)(1)-(2). Contentions that focus on safety issues that were thoroughly reviewed when the plant was initially licensed and are continually monitored as part of the NRC's ongoing oversight programs are outside of the scope of license renewal proceedings because "the Commission did not believe it necessary or appropriate to throw open the full gamut of provisions in a plant's current licensing basis to re-analysis during the license renewal review." *Turkey Point,* CLI-01-17, 54 NRC at 9; *see also* Final Rule: "Nuclear Power Plant License Renewal," 56 Fed. Reg. 64,943, 64,946 (Dec. 13, 1991). Thus, issues that are continually assessed, such as emergency planning, are not within the scope of a license renewal proceeding, *Turkey Point,* CLI-01-17, 54 NRC at 9-10. However, issues that concern age-related degradation, such as metal fatigue, corrosion, and thermal and radiation embrittlement, are within the scope of a license renewal proceeding, *id.* at 7-8. *See also* Final Rule: "Nuclear Power Plant License Renewal; Revisions," 60 Fed. Reg. 22,461, 22,464 (May 8, 1995).

Environmental contentions in license renewal proceedings are similarly limited in scope. Under 10 C.F.R. Part 51, the Commission's procedural regulations for complying with NEPA, environmental topics in license renewal proceedings are divided into two groups: (1) generic issues based on the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS, NUREG-1437, May 1996), or (2) plant-specific issues. The GEIS is an extensive study of potential environmental impacts of extending the operating licenses for nuclear power plants for 20 years. *Turkey Point,* CLI-01-17, 54 NRC at 11. Generic issues, or "Category 1" issues as they are referred to in Part 51, generally need not be assessed in a license renewal application because the Commission has already concluded that they involve environmental effects that are similar at all existing plants. *Id.* (citing 10 C.F.R. § 51.53(c)(3)(i)). An applicant, however, "must still provide additional analysis in its Environmental Report if new and significant information may bear on the applicability of the Category 1 finding at its particular plant." *Id. See also* 10 C.F.R. § 51.53(c)(3)(iv). Plant-specific issues, or "Category 2" issues, must also be addressed in a license renewal applicant's Environmental Report. *Turkey Point,* CLI-01-17, 54 NRC at 11-12; 10 C.F.R. § 51.53(c)(3)(ii)-(iii). The Staff must then independently assess the applicant's Environmental Report, setting out its conclusions in a site-specific

draft Supplemental Environmental Impact Statement (SEIS). *Turkey Point,* CLI-01-17, 54 NRC at 12 (citing 10 C.F.R. §§ 51.70, 51.73-.74). The draft SEIS must address "significant new circumstances or information relevant" to the license renewal, 10 C.F.R. § 51.72(a)(2), including new and significant information relating to Category 1 issues. *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-14, 55 NRC 278, 290 (2002). After considering public comments on the draft SEIS, covering both plant-specific Category 2 issues and new and significant information on Category 1 issues, the Staff weighs the expected environmental impacts of license renewal and sets forth its conclusions in the final SEIS. *Id.* (citing Final Rule: "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses," 61 Fed. Reg. 28,467, 28,470 (June 5, 1996)). As with the applicant's Environmental Report and the draft SEIS, the final SEIS must consider new and significant information on Category 1 issues. *McGuire/Catawba,* CLI-02-14, 55 NRC at 290-91; *Turkey Point,* CLI-01-17, 54 NRC at 12.

A contention that challenges a Commission rule or regulation is outside of the scope of the proceeding because, absent a waiver, "no rule or regulation of the Commission . . . is subject to attack . . . in any adjudicatory proceeding." 10 C.F.R. § 2.335(a). Any contention that amounts to an attack on applicable statutory requirements must be rejected by a licensing board as outside the scope of the proceeding. *Philadelphia Electric Co.* (Peach Bottom Atomic Power Station, Units 2 and 3), ALAB-216, 8 AEC 13, 20 (1974). A petitioner that seeks to express a personal view regarding the direction of regulatory policy is not, however, without remedy, and may submit a petition under 10 C.F.R. § 2.802 for rulemaking, or a request under 10 C.F.R. § 2.206 that the NRC Staff take enforcement action.

3. *Materiality — 10 C.F.R. § 2.309(f)(1)(iv)*

For a contention to be admissible, a petitioner must show "that the issue raised in the contention is material to the findings the NRC must make to support the action that is involved in the proceeding." 10 C.F.R. § 2.309(f)(1)(iv). An issue is only "material" if "the resolution of the dispute would make a difference in the outcome of the licensing proceeding." 54 Fed. Reg. at 33,172. This means that there must be some link between the claimed error or omission regarding the proposed licensing action and the NRC's role in protecting public health and safety or the environment. *Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Units 2 and 3), LBP-04-15, 60 NRC 81, 89 (2004), *aff'd,* CLI-04-36, 60 NRC 631 (2004).

4. *Concise Statement of Supporting Facts or Expert Opinion — 10 C.F.R. § 2.309(f)(1)(v)*

Contentions must be supported by "a concise statement of the alleged facts or expert opinions which support the . . . petitioner's position on the issue . . . together with references to the specific sources and documents on which [it] intends to rely to support its position." 10 C.F.R. § 2.309(f)(1)(v). It is the obligation of the petitioner to present the factual information or expert opinions necessary to support its contention adequately. *Yankee Atomic Electric Co.* (Yankee Nuclear Power Station), CLI-96-7, 43 NRC 235, 262 (1996). Failure to do so requires that the contention be rejected. *Arizona Public Service Co.* (Palo Verde Nuclear Generating Station, Units 1, 2, and 3), CLI-91-12, 34 NRC 149, 155 (1991).

Determining whether a contention is adequately supported by a concise allegation of the facts or expert opinion, however, "does not call upon the intervenor to make its case at [the contention admissibility] stage of the proceeding, but rather to indicate what facts or expert opinions, be it one fact or opinion or many, of which it is aware at that point in time which provide the basis for its contention." 54 Fed. Reg. at 33,170. A petitioner does not have to provide an exhaustive list of its experts or evidence or prove the merits of its contention at the admissibility stage.[20] As with a summary disposition motion, the support for a contention may be viewed in a light that is favorable to the petitioner and inferences that can be drawn from evidence may be construed in favor of the petitioner. *See Palo Verde,* CLI 91-12, 34 NRC at 155; 10 C.F.R. § 2.710(c).

Nevertheless, "[m]ere 'notice pleading' is insufficient under these standards. A petitioner's issue will be ruled inadmissible if the petitioner 'has offered no tangible information, no experts, no substantive affidavits,' but instead only 'bare assertions and speculation.' " *Fansteel, Inc.* (Muskogee, Oklahoma Site), CLI-03-13, 58 NRC 195, 203 (2003) (quoting *GPU Nuclear, Inc.* (Oyster Creek Nuclear Generating Station), CLI-00-6, 51 NRC 193, 208 (2000)). And if a petitioner neglects to provide the requisite support for its contentions, the Board should not make assumptions of fact that favor the petitioner, or supply information that is lacking. *Georgia Institute of Technology* (Georgia Tech Research Reactor, Atlanta, Georgia), LBP-95-6, 41 NRC 281, 305 (1995); *Duke Cogema Stone & Webster* (Savannah River Mixed Oxide Fuel Fabrication Facility), LBP-01-35, 54 NRC 403, 422 (2001). Any supporting material provided by a petitioner, including those portions of the material that are not relied upon, is subject to Board scrutiny. *Yankee Atomic Electric Co.* (Yankee Nuclear Power Station), LBP-96-2, 43 NRC 61, 90 (1996), *rev'd in part on other grounds,* CLI-96-7, 43 NRC 235 (1996).

[20] *National Enrichment Facility,* CLI-04-35, 60 NRC at 623; *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), CLI-04-22, 60 NRC 125, 139 (2004).

In short, the information, facts, and expert opinion alleged by the petitioner will be examined by the Board to confirm that it does indeed supply adequate support for the contention. *Vermont Yankee Nuclear Power Corp.* (Vermont Yankee Nuclear Power Station), ALAB-919, 30 NRC 29, 48 (1989), *vacated in part on other grounds and remanded,* CLI-90-4, 31 NRC 333 (1990). But at the contention admissibility stage, all that is required is that the petitioner provide "some alleged fact or facts in support its position." 54 Fed. Reg. at 33,170.

5. *Sufficient Information To Show a Genuine Dispute — 10 C.F.R. § 2.309(f)(1)(vi)*

A properly pled contention must contain "sufficient information to show that a genuine dispute exists with the applicant/licensee on a material issue of law or fact." 10 C.F.R. § 2.309(f)(1)(vi). Specifically, a contention "must include references to specific portions of the application . . . that the petitioner disputes and the supporting reasons for each dispute, or, if the petitioner believes that the application fails to contain information on a relevant matter as required by law, the identification of each failure and the supporting reasons for the petitioner's belief." *Id.* In contrast to subparagraph (v), which focuses on the need for some factual support for the contention, subparagraph (vi) requires that there be a concrete and genuine dispute worth litigating. Making a "bald or conclusory allegation that such a dispute exists" is not sufficient, as a petitioner "must make a minimal showing that material facts are in dispute, thereby demonstrating that an 'inquiry in depth' is appropriate." 54 Fed. Reg. at 33,171 (quoting *Connecticut Bankers Ass'n v. Board of Governors,* 627 F.2d 245, 251 (D.C. Cir. 1980)). For example, " 'an expert opinion that merely states a conclusion (e.g., the application is 'deficient,' 'inadequate,' or 'wrong') without providing a reasoned basis or explanation for that conclusion is inadequate because it deprives the Board of its ability to make the necessary, reflective assessment of the opinion.' " *USEC Inc.* (American Centrifuge Plant), CLI-06-10, 63 NRC 451, 472 (2006) (citation omitted) (affirming Licensing Board holding that quotations from an unintelligible correspondence with purported expert, with no explanation or analysis of how the expert's statements relate to an error or omission in the application, are insufficient to support a contention).

Although a petitioner must demonstrate that a "genuine dispute exists" at the contention admissibility stage, it need not demonstrate that it will prevail on the merits. *See* 54 Fed. Reg. at 33,170-71. Similarly, "at the contention filing stage the factual support necessary to show that a genuine dispute exists need not be in affidavit or formal evidentiary form and need not be of the quality necessary to withstand a summary disposition motion." *Id.* at 33,171.

6. *New Issues Raised in a Petitioner's Reply Brief*

A petitioner that fails to satisfy the requirements of 10 C.F.R. § 2.309(f)(1) in its initial contention submission may not use its reply to rectify the inadequacies of its petition or to raise new arguments. But the reply may respond to and focus on any legal, logical, or factual arguments presented in the answers.[21] The amplification of statements provided in an initial petition is legitimate and permissible. *Louisiana Energy Services, L.P.* (National Enrichment Facility), LBP-04-14, 60 NRC 40, 58, *aff'd*, CLI-04-25, 60 NRC 223 (2004).

B. Ruling on Massachusetts Attorney General Contention

1. *AG Contention 1*

The Environmental Report for Renewal of the Vermont Yankee Nuclear Power Plant Fails to Satisfy NEPA Because it Does Not Address the Environmental Impacts of Severe Spent Fuel Pool Accidents.[22]

The essence of this contention is the AG's assertion that Entergy's environmental report (ER) "does not satisfy 10 C.F.R. § 51.53(c)(3)(iv) and NEPA . . . because it fails to address new and significant information regarding the reasonably foreseeable potential for a severe accident involving nuclear fuel stored in high-density storage racks in the Vermont Yankee fuel pool." *Id.* at 21. The AG's logic or "basis" is straightforward. First, the AG points out that NEPA and 10 C.F.R. § 51.53(c)(3)(iv) require that "new and significant information" not previously considered by the NRC in an environmental impact statement (EIS) be included in the ER.[23] More specifically, the AG argues that the regulation requires the ER to include new and significant information even if it concerns a Category 1 matter that was otherwise covered in the GEIS. AG Reply at 8. Second, the AG

[21] *See Louisiana Energy Services, L.P.* (National Enrichment Facility), CLI-04-25, 60 NRC 223, 225 (2004) (quoting Final Rule: "Changes to the Adjudicatory Process," 69 Fed. Reg. 2182, 2203 (Jan. 14, 2004) (reply must be "narrowly focused on the legal or logical arguments presented in the applicant/licensee or NRC Staff answer")); *Nuclear Management Co., LLC* (Palisades Nuclear Plant), CLI-06-17, 63 NRC 727, 732 (2006) ("Replies must focus narrowly on the legal or factual arguments first presented in the original petition or raised in the answers to it").

[22] AG Petition at 21. Unless otherwise noted, our statement of each contention is a direct quote from the text of the relevant petition.

[23] The AG acknowledges that the NRC issued a generic EIS (GEIS) to evaluate many of the common environmental impacts of license renewals, and therefore NRC regulations do not require the preparation of a complete ER and EIS for all aspects of each license renewal application. AG Petition at 12-13 (citing 10 C.F.R. §§ 51.53(c)(3)(i), 51.71(d)). However, the AG points to 10 C.F.R. § 51.53(c)(3)(iv), which, consistent with *Marsh v. Oregon Natural Resources Council*, 490 U.S. 360, 374 (1989), requires that an ER "contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware." AG Petition at 15.

asserts that such new and significant information exists concerning the potential impact of an accident involving a high-density spent fuel pool storage facility. Third, the AG says that the ER is defective because it fails to include such new and significant information. Therefore, fourth, the AG concludes that its contention is admissible and is within the proper scope of this license renewal proceeding. AG Petition at 21-23.

The AG summarizes the key elements of his "new and significant information" relating to the risks of a spent fuel pool fire, as follows:

> (a) if the water level in a fuel storage pool drops to the point where the tops of the fuel assemblies are uncovered, the fuel will burn, (b) the fuel will burn regardless of its age, (c) the fire will propagate to other assemblies in the pool, and (c) [*sic*] the fire may be catastrophic.

Id. at 22. The AG supports his allegation that such new and significant information exists with five "facts or expert opinions," *see* 10 C.F.R. § 2.309(f)(1)(v): (1) the expert declaration and report of Dr. Gordon Thompson,[24] (2) the expert declaration and report of Dr. Jan Beyea,[25] (3) excerpts from NUREG-1738, (4) the 2006 "Safety and Security of Commercial Spent Nuclear Fuel Storage" report of the National Academy of Sciences,[26] and (5) the terrorist attacks of September 11, 2001. AG Petition at 22.

The AG argues that NRC never considered this information in its original EIS for Vermont Yankee or in the GEIS for license renewals, and thus that Entergy's failure to include this new and significant information in its ER contravenes 10 C.F.R. § 51.53(c)(3)(iv) and *Marsh. Id.* at 23. The AG also contends that the environmental impacts of a spent fuel pool accident must be considered by the Staff in the SEIS in order for the Staff to comply with its obligation to consider significant new information relevant to the environmental impacts of license renewal because this information has yet to be considered by the NRC in a previous EIS. *Id.* at 14-15. The AG further asserts that, when the likelihood of

[24] Gordon R. Thompson, "Risks and Risk-Reducing Options Associated with Pool Storage of Spent Nuclear Fuel at the Pilgrim and Vermont Yankee Nuclear Power Plants" (May 25, 2006); AG Petition, Exh. 1, Decl. of Dr. Gordon Thompson in Support of [AG]'s Contention and Petition for Backfit Order (May 25, 2006).

[25] Jan Beyea, "Report to the Massachusetts Attorney General on the Potential Consequences of a Spent-Fuel-Pool Fire at the Pilgrim or Vermont Yankee Nuclear Plant" (May 25, 2006)); AG Petition, Exh. 2, Decl. of Dr. Jan Beyea in Support of [AG]'s Contention and Petition for Backfit Order (May 25, 2006).

[26] Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, Board on Radioactive Waste Management, National Research Council, *Safety and Security of Commercial Spent Nuclear Fuel Storage: Public Report* (2006).

a terrorist attack is taken into account, the estimated probability of this type of accident is within the range that must be discussed in an ER and EIS. *Id.* at 33-41.

In addition to its argument regarding new and significant information, the AG also contends that the ER is deficient because it does not consider reasonable alternatives for avoiding or mitigating the environmental impacts of a severe spent fuel pool fire. *Id.* at 23, 47. Under 10 C.F.R. § 51.53(c)(3)(ii)(L), an ER must contain severe accident mitigation alternatives (SAMAs) for some issues. *See also* 10 C.F.R. § 51.53(c)(3)(iii). According to the AG, potential SAMAs for a spent fuel pool fire are ignored, including the alternative of replacing the high-density spent fuel pool racks with low-density racks and transferring any remaining spent fuel to dry storage. AG Petition at 47.

Entergy opposes the AG's contention, claiming that the environmental impacts of spent fuel storage are codified as Category 1 environmental issues, and thus are beyond the scope of this license renewal proceeding. Entergy Answer to AG at 11-12 (citing 10 C.F.R. Part 51, App. B, Table B-1; 10 C.F.R. §§ 51.53(c) and 51.95(c)). According to Entergy, the AG's attempt to bring these issues within the scope of the proceeding by invoking section 51.53(c)(3)(iv) falls short because the generic Category 1 findings resulting from the analysis of the GEIS are NRC rules and, as such, may only be challenged or altered upon the granting of a waiver or rulemaking petition. *Id.* at 12-13. Moreover, Entergy argues that the recent decision in *San Luis Obispo Mothers for Peace v. NRC*, 449 F.3d 1016 (9th Cir. 2006), is inapplicable here because Commission case law establishes that, even if terrorism issues require analysis under NEPA, the GEIS concluded that "if such an event were to occur, the resultant core damage and radiological release would be no worse than those expected from internally initiated events." Entergy Answer to AG at 25-26 (quoting *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-26, 56 NRC 358, 365 n.24 (2002)). Entergy also challenges the AG's claim that new and significant information exists, arguing that the risks associated with high-density racking in spent fuel pools were known and considered by NRC long ago and that nothing new is contained in the AG's exhibits. *See id.* at 13-25.

The Staff likewise argues that Category 1 environmental issues are outside of the scope of license renewal proceedings, citing 10 C.F.R. § 51.53(c)(2) and *Turkey Point*, CLI-01-17, 54 NRC at 6-13, for the proposition that a license renewal ER need not provide information regarding the storage of spent fuel. Staff Answer to AG at 11-12. The Staff also relies on *Turkey Point*, CLI-01-17, 54 NRC at 21-22, in arguing that an ER need not address SAMAs for mitigating spent fuel pool accidents. Staff Answer to AG at 12-13. According to the Staff, by asking the Board to address a spent fuel storage issue, the AG is essentially seeking to have the Board treat spent fuel pool issues as a Category 2 issue, which runs counter to the prohibition against challenging a regulation in an adjudicatory proceeding without seeking a waiver. *Id.* at 14. The Staff also argues that the

information in the AG petition is not new and, therefore, need not be included in the Entergy's ER as it has already been presented to the NRC. *Id.* at 16-22. Finally, the Staff asserts that, to the extent the AG's contention attempts to raise terrorism issues, these issues are also outside of the scope of the proceeding. *Id.* at 22-23.

In its reply, the AG argues that the case law and regulatory history make clear that "Category 1 impacts are included in the scope of the new and significant impacts that must be discussed in an ER pursuant to 10 C.F.R. § 51.53(c)(3)(iv)." AG Repy at 8. The AG maintains that the alternative procedures suggested in *Turkey Point* (e.g., the filing of a waiver petition or a rulemaking petition) are inconsistent with NEPA as construed by the Supreme Court in *Marsh*. *Id.* at 9-10. Further, the AG asserts that *Turkey Point* is inapposite because it did not deal with a contention alleging new and significant information, and that its discussion of issues relating to new and significant information is dicta. *Id.* at 11. The AG goes on to explain that the information in its petition is indeed "new and significant." *Id.* at 12-27. Finally, the AG asks the Board to rule that NEPA requires that Entergy and the Staff consider the environmental impacts of an intentional attack on the Vermont Yankee spent fuel pool, and then to refer its ruling to the Commission to determine the applicability of the *Mothers for Peace* decision. *Id.* at 27-28.

The Board rules that, even if the AG has presented new and significant information related to the risks and environmental impacts of high-density racking in spent fuel pools, as a matter of law the contention is not admissible because the Commission has already decided, in *Turkey Point*, that licensing boards cannot admit an environmental contention regarding a Category 1 issue.

Starting from the proposition that onsite spent fuel management is a Category 1 issue,[27] the first step in our reasoning is to confront the apparent conflict between 10 C.F.R. § 51.53(c)(3)(i) and (iv). Subsection (i) states that an applicant's ER "is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in Appendix B." Meanwhile, subsection (iv) specifies that the ER must include "any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware." What if there is "new and significant" information regarding a Category 1 issue? Must the ER include it? The answer, provided by the Commission, is clearly yes.

In construing 10 C.F.R. § 51.53(c)(3) the Commission has stated: "even where the GEIS has found that a particular impact applies generically (Category 1), the applicant *must* still provide additional analysis in its Environmental Report if new and significant information may bear on the applicability of the Category 1 finding

[27] 10 C.F.R. Part 51, App. B, Table B-1.

at its particular plant." *Turkey Point,* CLI-01-17, 54 NRC at 11 (emphasis added). Likewise, "the applicant must provide additional analysis of even a Category 1 issue if new and significant information has surfaced." *McGuire/Catawba,* CLI-02-14, 55 NRC at 290. Both Entergy, Tr. at 95, and the NRC Staff, Tr. at 113-14 and 168, acknowledge that the ER *must* include any new and significant information (that the applicant is aware of) regarding the environmental impacts of *Category 1 issues.*

Similarly, when preparing the SEIS, the Staff must consider any significant new information related to Category 1 issues. *See* 10 C.F.R. §§ 51.92(a)(2), 51.95(c)(3); Final Rule: "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses," 61 Fed. Reg. 28,467, 28,470 (June 5, 1996). "The final SEIS also takes account of public comments, including . . . new information on generic findings." *Turkey Point,* CLI-01-17, 54 NRC at 12; *see also McGuire/Catawba,* CLI-02-14, 55 NRC at 290-91. Therefore, if the information that the AG presents is indeed new and significant, the Staff's SEIS needs to address it.

The second step in our reasoning confronts a more problematic issue: assuming *arguendo* that an ER fails to include new and significant information (known to the applicant) relating to a Category 1 environmental issue and thus fails to comply with 10 C.F.R. § 51.53(c)(3)(iv), does this give rise to an admissible contention? Normally, the answer would be yes. Indeed, the essence of virtually all admissible contentions is an allegation that the applicant has failed to address, or has inadequately addressed, some legally required matter. In this case, however, the Commission has answered this question in the negative. The AG's contention is therefore inadmissible.

Our conclusion — that the failure of an ER to include known new and significant information concerning a Category 1 issue as required in 10 C.F.R. § 51.53(c)(3) cannot give rise to an admissible contention — derives from the Commmission's ruling in *Turkey Point.* First, the Commission identified three options for addressing new and significant information that might arise after the GEIS on Category 1 issues was finalized:

> The Commission recognizes that even generic findings sometimes need revisiting in particular contexts. Our rules thus provide a number of opportunities for individuals to alert the Commission to new and significant information that might render a generic finding invalid, either with respect to all nuclear power plants or for one plant in particular. In the hearing process, for example, petitioners with new information showing that a generic rule would not serve its purpose at a particular plant may seek a waiver of the rule. Petitioners with evidence that a generic finding is incorrect for all plants may petition the Commission to initiate a fresh rulemaking. Such petitioners may also use the SEIS notice-and-comment process to ask the NRC to forgo use of the suspect generic finding and to suspend license renewal proceedings, pending a rulemaking or updating of the GEIS.

Turkey Point, CLI-01-17, 54 NRC at 12 (citations omitted).

The implication of this passage is that a citizen does *not* have the (fourth) option of filing a contention to challenge the ER's failure to include new and significant information concerning a Category 1 issue. The Commission confirmed this later in the *Turkey Point* ruling when it stated that "Part 51 treats all spent fuel pool accidents, whatever their cause, as generic, Category 1 events not suitable for case-by-case adjudication." *Id.* at 22. The Commission added that "[a]s we hold in the text, it is Part 51, with its underlying GEIS, that precludes the litigation of that issue." *Id.* at 23 n.14. As the NRC Staff pointed out, the fourth option (e.g., filing a contention) would obviate the other three, because a logical petitioner would always opt for it and skip the extra burdens associated with the other three (e.g., requesting a waiver of the regulations from the Commission). Tr. at 165.

Our reading of *Turkey Point* is consistent with the regulatory history of section 51.53(c)(3)(iv). This requirement — that the ER include any new and significant information — was not part of the proposed rule.[28] It was added in the final rule in response to objections from the Council on Environmental Quality (CEQ), the U.S. Environmental Protection Agency (EPA), and members of the public, as follows:

> Federal and State agencies questioned how new scientific information could be folded into the GEIS findings because the GEIS would have been performed so far in advance of the actual renewal of an operating license. . . . A group of commenters, including CEQ and EPA noted that the rigidity of the proposed rule hampers the NRC's ability to respond to new information or to different environmental issues not listed in the proposed rule.

61 Fed. Reg. at 28,470.

In response, NRC added 10 C.F.R. § 51.53(c)(3)(iv) to expand "the framework for consideration of significant new information." *Id.* The Statement of Considerations to the final rule refers to SECY-93-032, a Staff memorandum to the Commission reporting that the addition of section 51.53(c)(3)(iv) resolved the CEQ and EPA concerns.[29] The memorandum explained that the addition of section 51.53(c)(3)(iv) would have little impact on license renewal adjudications because "[l]itigation of environmental issues in a hearing will be limited to unbounded

[28] *See* Proposed Rule: "Environmental Review for Renewal of Operating Licenses," 56 Fed. Reg. 47,016, 47,027-28 (Sept. 17, 1991).

[29] SECY-93-032, Memorandum from James M. Taylor, EDO, to the Commissioners (Feb. 9, 1993), ADAMS Accession No. ML051660667.

category 2 and category 3 issues unless the rule is suspended or waived." SECY-93-032 at 4. (Category 2 and 3 issues were eventually combined into Category 2. *See* 61 Fed. Reg. at 28,474.) The Commission approved the modifications in the proposed rule and specifically endorsed SECY-93-032.[30] Commission approval of SECY-93-032 demonstrates that, when the Commission adopted the final rule, it contemplated that Category 1 issues could only be litigated after the granting of a waiver petition pursuant to 10 C.F.R. § 2.335.

The Commission's intent is also demonstrated by the dialogue that occurred when the Commission was deliberating the final rule and discussing SECY-93-032. The briefing covered the resolution of the CEQ and EPA objections and included an exchange between Commissioner James R. Curtiss and Martin Malsch, the Deputy General Counsel for Licensing and Regulation. Twice the Commissioner asked whether, under 10 C.F.R. § 51.53(c)(3)(iv) or any other part of the license renewal regulations, a petitioner could litigate a Category 1 issue on the claim that there was new and significant information on the issue. Twice the Deputy General Counsel of NRC answered no, not without first obtaining a waiver or other approval from the Commission itself.[31] With this understanding of the regulations, the Commission approved and finalized section 51.53(c)(3)(iv). Given this regulatory history, it is clear that an allegation of new and significant

[30] Memorandum from Samuel J. Chilk, Secretary, to James M. Taylor, EDO (Apr. 22, 1993), ADAMS Accession No. ML003760802.

[31] Commissioner Curtiss: "[A]ssume for the sake of discussion that the staff says, 'This is not significant new information,' is that kind of issue subsequently one that can be or you intend to be cognizable before the board?"

Mr. Malsch: "Well, it would depend. If the information is — the basic answer is they have to come to the Commission first. If the information is considered significant by the interested party and staff says, 'Now, this is not significant.' If it's generic information, then the remedy is a petition for rulemaking and that usually comes to the Commission. Before the Commission would grant a petition for rulemaking, it would consider the merits of the information. If the information is site specific, then they'd need to petition for a waiver. But after being screened by the board, the board is referred to the Commission and only the Commission can grant waivers. So, again it comes before the Commission.

So, the procedural route is somewhat different, but no matter how it gets there, the Commission would be looking at the staff judgment, looking at what other parties say about it, and making its own determination about significance."

. . . .

Commissioner Curtiss: "So, there's no circumstance, in other words, where you envision that once a determination is made under the procedures that you've described with regard to the significance of the information by the Commission upon the Staff's recommendation, that we would then in turn need to litigate before the board the significance of that information, whether it was or wasn't significant?"

Mr. Malsch: "Not without the Commission's approval."

Public Meeting, "Briefing on Status of Issues and Approach to GEIS Rulemaking for Part 51" (Feb. 19, 1993), at 14-15, ADAMS Accession No. ML051660665.

information relating to a Category 1 issue may not form the basis of a contention in a license renewal proceeding, absent a waiver.

Based on *Turkey Point* and the regulatory history that underlies it, the Board must rule that a petitioner may not challenge an ER's failure to consider new and significant information for a Category 1 environmental impact without first seeking a waiver of the generic rule. The environmental impacts of onsite spent fuel storage are codified in Appendix B to Subpart A of Part 51 and listed as a Category 1 issue. 10 C.F.R. Part 51, App. B, Table B-1. As the Commission has stated, if a party such as the AG believes that there is significant new information relating to Category 1 license renewal issues, the AG has several options, including filing a petition for rulemaking, providing the information to the NRC Staff (which can then seek Commission approval to suspend the application of the rules or delay the license renewal proceeding), or petitioning the Commission to waive the application of the rule. 61 Fed. Reg. 28,740. The Commission has ruled that its reliance on such GEIS tiering comports with NEPA. *Turkey Point*, CLI-01-17, 54 NRC at 13-14 (citing *Baltimore Gas & Electric Co. v. Natural Resources Defense Council, Inc.*, 462 U.S. 87 (1983)). Thus, absent a waiver, a contention seeking to litigate an ER's failure to include required new and significant information is not admissible.[32]

Before concluding this section of the analysis, we note that the parties have expended substantial effort in debating the factual question as to whether "new and significant information" exists concerning the risks and impacts of high-density spent fuel pool storage. The AG cites to the declarations from Dr. Thompson and Dr. Beyea, NUREG 1738, the NAS 2006 Report, and the events of September 11, 2001, as providing such new and significant information. Entergy and the Staff respond, at length, that there is nothing new in these reports. Staff Answer at 16-21; Entergy Answer at 13-25.

The Board has three general responses to this factual debate. First, we note that the risks and effects of high-density racking of spent fuel in pools have been studied and debated since 1979, *see* AG Petition at 21 (acknowledging that the

[32] The Commission's ruling in *Turkey Point* (that an applicant's failure to provide new and significant information relating to a Category 1 issue cannot be adjudicated in a license renewal proceeding) seems inconsistent with its statement that "[a]djudicatory hearings in individual license renewal proceedings will share the *same scope of issues as our NRC Staff review.*" *Turkey Point*, CLI-01-17, 54 NRC at 10 (emphasis added). On the one hand, the ER must include new and significant information relating to Category 1 issues, 10 C.F.R. § 51.53(c)(3)(iv), the Staff must review this information and include any "significant new circumstances or information" relating to Category 1 issues in supplements to the draft SEIS, 10 C.F.R. § 51.72(a)(2), and the Staff's final SEIS will cover any "significant new circumstances or information" relating to Category 1 issues, 10 C.F.R. § 51.92(a)(2). On the other hand, absent a waiver of the regulations, those issues cannot be heard in an adjudicatory hearing. Under the *Turkey Point* holding, the permissible scope of a license renewal adjudicatory hearing is *narrower* than the scope of the Staff's review.

issue was recognized as early as 1979), and have been the subject of substantial litigation. *See Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant) LBP-00-19, 52 NRC 85 (2000), *aff'd*, CLI-01-11, 53 NRC 370 (2001), and other cases cited in Staff Answer at 16 n.10. This ground is well trod. Second, we note that, for purposes of admissibility, the AG need not prove that the various documents actually contain new and significant information, but instead need only "[p]rovide a concise statement of the alleged facts or expert opinions which support" the contention and "[p]rovide sufficient information to show that a genuine dispute exists" on this point. 10 C.F.R. § 2.309(f)(1)(v) and (vi). A contention may be plausible enough to meet the admission standards even if it is ultimately denied on the merits. *See* Final Rule: "Rules of Practice for Domestic Licensing Proceedings — Procedural Changes in the Hearing Process," 54 Fed. Reg. 33,168, 33,170 (Aug. 11, 1989). Third, because we conclude that, as a matter of law, the failure of an ER to include new and significant information relating to a Category 1 issue is not litigable,[33] we need not determine whether the multiple declarations and documents proffered by the AG in fact provide sufficient information to at least support the admissibility of this contention.

In addition to basing its contention on new and significant information relating to the risks of high-density racking of spent fuel in pools, the AG alleges that the ER is defective because it fails to address new and significant information relating to the risks of terrorism (e.g., the terrorist attacks of September 11, 2001). Although this is a different category of "new and significant information," the same result obtains — the contention is not adjudicable under *Turkey Point*. If the AG wants to raise its concerns that new and significant information relating to terrorism needs to be considered, it should pursue one of the three paths specified by the Commission. *See Turkey Point*, CLI-01-17, 54 NRC at 12.

We also note that in *McGuire/Catawba*, the Commission held that there is no need to address terrorism issues in license renewal proceedings because "it is sensible not to devote resources to the likely impact of terrorism during the license renewal period, but instead to concentrate on how to prevent a terrorist attack in the near term at the already licensed facilities." *McGuire/Catawba*, CLI-02-26, 56 NRC at 365. We agree with the AG that this holding is undercut by the Ninth Circuit's decision in *Mothers for Peace*, 449 F.3d at 1016. The Commission, however, gave another reason for rejecting terrorism contentions in license renewal proceedings. In holding that the GEIS adequately addresses terrorism issues generically, the Commission stated:

[33] We also note that 10 C.F.R. § 51.53(c)(3)(iv) only requires the ER to include such new and significant information "of which the applicant is aware." Given our legal conclusion, we need not delve into the mind of Entergy to determine the factual question as to whether it was aware of, or should have been aware of, the information proffered by the AG.

000077

> Even if we were required by law to consider terrorism under NEPA, the NRC has already issued a . . . GEIS that considers sabotage in connection with license renewal. . . . The GEIS concluded that, if such an event were to occur, the resultant core damage and radiological releases would be no worse than those expected for internally initiated events.

McGuire/Catawba, 56 NRC at 365 n.24 (citations omitted). This component of *McGuire/Catawba*, combined with *Turkey Point*, leads us to conclude that terrorism concerns, even assuming new and significant information is presented, are not litigable in a license renewal proceeding and must be handled via rulemaking or a waiver petition.

Finally, we note that the AG's arguments regarding severe accident mitigation alternatives (SAMAs) also fail to establish an admissible issue. The requirement for a SAMA analysis is found in 10 C.F.R. § 51.53(c)(3)(ii)(L), which states that "[i]f the staff has not previously considered severe accident mitigation alternatives for the applicant's plant in an environmental impact statement or related supplement or in an environmental assessment, a consideration of alternatives to mitigate severe accidents must be provided." An applicant, however, only needs to provide this analysis "for those issues identified as Category 2 issues in Appendix B to subpart A of this part." 10 C.F.R. § 51.53(c)(3)(ii). Spent fuel pool storage issues are Category 1 issues. 10 C.F.R. Part 51, App. B, Table B-1. Therefore, the regulations clearly indicate that in a license renewal, SAMAs are not required for spent fuel pool accidents and this challenge is not admissible. *See Turkey Point*, CLI-01-17, 54 NRC at 21-22.

For the reasons discussed above, AG Contention 1 is inadmissible and the AG's hearing request is denied.[34] We also note in passing that the AG has already filed a Petition for Rulemaking under 10 C.F.R. § 2.802 to address this issue.[35] In this petition, the AG argues that

> [r]evocation of 10 C.F.R. §§ 51.53(c)(2) and 51.95(c) and Table B-1 of Appendix A to 10 C.F.R. Part 51 will be necessary to ensure NEPA compliance in the Pilgrim and Vermont Yankee license renewal cases if the ASLB or the Commission interprets those regulations to bar the consideration of significant new information . . . .

Id. at 7. In this petition, the AG repeats his claims that new and significant information justifies revisiting the issue at this time. *Id.* at 8-10. Thus we see that the AG has already begun to pursue the alternative remedies specified in *Turkey Point*. CLI-01-17, 54 NRC at 12.

[34] Although the AG is not admitted to the proceeding as a party, it may still participate as an interested state. *See* Section VI.B.

[35] [AG] Petition for Rulemaking To Amend 10 C.F.R. Part 51 (Aug. 25, 2006).

2. *AG Backfit Petition Under 10 C.F.R. § 50.109*

In addition to its intervention petition, the AG submitted a petition requesting the imposition of a backfit order pursuant to 10 C.F.R. § 50.109(a). AG Petition at 48-50. According to the AG, when the Vermont Yankee facility was initially licensed, it used open low-density racks that stored smaller quantities of spent fuel and thus there was no need to consider or design against pool fire accidents. *Id.* at 49. Now, however, the Vermont Yankee pool includes high-density storage racks which, the AG asserts, pose an undue safety risk of pool fire. *Id.* Based on this undue risk, the AG asserts that the Commission should require a backfit order returning the Vermont Yankee spent fuel pool to its original low-density storage configuration and using dry storage for any excess fuel. *Id.* Entergy opposes the backfit order because such a request is beyond the scope of a license renewal proceeding. Entergy Answer to AG at 26-27. The Staff contends that the petition for backfit should be dismissed because the petition is still properly before the Commission, not the Board, and because NRC regulations do not permit an adjudicatory hearing on backfit issues. Staff Answer to AG at 24. In its reply, the AG acknowledges that non-aging-related safety issues are outside the scope of license renewal proceedings, and it was for this reason that the AG separately petitioned the Commission for the backfit order. AG Reply at 31. Thus, according to the AG, the backfit petition is still before the Commission. *Id.*

We conclude that the backfit petition is not currently before the Board. The Commission's referral says nothing regarding the backfit petition and only mentions the hearing requests "submitted in response to a notice issued by the NRC staff that provided an opportunity for hearing on the license renewal application." Letter from Annette L. Vietti-Cook, Secretary, NRC, to G. Paul Bollwerk, III, Chief Administrative Judge, ASLBP (June 7, 2006). All parties agree that the backfit petition is before the Commission and not this Board. Entergy Answer to AG at 26-27; Staff Answer to AG at 24; AG Reply at 31. Therefore, we take no action on the AG's petition for backfit.

C. Ruling on DPS Contentions

1. *DPS Contention 1 (Safety)*

> The Application must be denied because the Applicant has failed to provide the necessary information with regard to age management of primary containment concrete in accordance with 10 C.F.R. § 54.21 such that the Commission cannot find that 10 C.F.R. § 54.29(a) is met.[36]

[36] DPS Petition at 10.

This contention questions whether Entergy has shown that it should be exempt from management of the aging of the primary containment concrete wall that surrounds most of the reactor steel containment vessel or "drywell." DPS states, as the "basis" for this contention, that Entergy's aging management program improperly excludes the "reduction of strength and modulus of the primary [concrete] containment structure due to elevated temperature" even though the "primary containment normal operating temperature limit is above the limit for excluding this attribute." *Id.* at 10. As supporting evidence, DPS points to an alleged conflict within the application. First, DPS notes that the application states that the relevant ASME[37] code specifies that "aging due to elevated temperature exposure is not significant as long as concrete general area temperatures do not exceed 150°F." *Id.* (citing Application at 3.5-8). The application goes on to state that "[d]uring normal operation, areas within primary containment are within [this] temperature limit[]" and therefore, the application concludes that aging management of primary containment concrete is not needed. *Id.* at 10-11 (citing Application at 3.5-8). DPS then points out that, elsewhere in the application, Entergy states that the "[n]ormal environment in the drywell during plant operation is . . . an ambient temperature of about 135°F to 165°F." *Id.* at 11 (citing Application at 2.4-3, which references the VYNPS Updated Final Safety Analysis Report (UFSAR) at 5.2-8). DPS notes that the application states that the steel drywell containment shell is enclosed in the reinforced concrete. *Id.* at 11 (citing UFSAR at 5.2-7).

In further evidentiary support, DPS provides the declaration of the Vermont State Nuclear Engineer, Mr. William K. Sherman, who states:

> Since the normal environmental maximum of 165°F is above the cut off limit of 150°F, and since the concrete surface behind the steel shell will closely match the drywell ambient temperature, the statement at 3.5-8 of the LRA is not accurate, and reduction of strength and modulus of concrete structures due to elevated temperatures is an aging effect requiring management.

DPS Petition, Decl. of William K. Sherman (May 26, 2006) ¶ 8 [Sherman Decl.]. In sum, DPS contends that the application must be denied because it fails to provide the information (showing that the primary containment concrete "general area temperatures" do not exceed 150°F) necessary to prove that Entergy should be excused from managing the aging of the primary containment concrete. DPS Petition at 10-11.

[37] The American Society of Mechanical Engineers (ASME) is an association that develops codes and standards related to materials performance that are commonly accepted by designers and regulatory bodies.

Entergy responds that DPS Contention 1 is "inadmissible because it is vague and unsupported by an adequate basis" and because it "fails to demonstrate the existence of a genuine dispute concerning a material issue." Entergy Answer to DPS at 11. Entergy asserts that there is no inconsistency between the UFSAR statement that the normal drywell temperature will be between 135°F and 165°F and the application statement that "[d]uring normal operation, [general] areas within the primary containment" do not exceed 150°F. *Id.* at 12. This, says Entergy, is because the drywell is cooled by four cooling units. *Id.* at 13. Entergy concludes that DPS provides "no basis" for the "bald claim" by Mr. Sherman that "the concrete surface behind the steel shell will closely match the drywell ambient temperature." *Id.* at 14. Entergy does not challenge Mr. Sherman's expertise and does not provide declarations or documentation to rebut Mr. Sherman's assessment.

The Staff agrees with Entergy that Mr. Sherman's declaration that "the concrete surface behind the steel shell will closely match the drywell ambient temperature" is an "assumption" and is "impermissibly speculative and conclusory and, as such, cannot provide an adequate basis for a contention." Staff Answer to DPS at 11. The Staff complains that Mr. Sherman provides "no data or detailed opinion on heat profile changes." *Id.* The Staff cites a prior Licensing Board case that states that "neither mere speculation nor bare or conclusory assertions, even by an expert, alleging that a matter should be considered will suffice to allow the admission of a proffered contention."[38]

This Board concludes that DPS Contention 1 satisfies the 10 C.F.R. § 2.309(f)(1) requirements for an admissible contention. First, DPS has provided us with a "specific statement of the issue of law or fact to be raised or controverted." 10 C.F.R. § 2.309(f)(1)(i). In short, DPS asserts that Entergy has failed to show that the "general area temperatures" of the primary containment concrete do not exceed 150°F, and thus fails to show that it qualifies for an exemption from aging management. There is nothing "vague" about this contention.

Second, DPS has certainly provided us with a "brief explanation of the basis" for this contention. DPS's logic is that Entergy's decision not to establish an aging management program for the primary containment concrete is not justified because Entergy has not shown that the concrete general area temperatures do not exceed 150°F. This explanation is based on an alleged inconsistency within the license renewal application, together with the simple logic that when one material is in close proximity to another, the temperature of one may be similar to the temperature of the other. This rationale, whether ultimately shown to be true in

[38] *Id.* at 12 (citing *Exelon Generation Co., LLC* (Early Site Permit for Clinton ESP Site), LBP-04-17, 60 NRC 229, 241 (2004), which cites *Fansteel*, CLI-03-13, 58 NRC at 203). In both of the cited cases, the quoted statement was dicta.

this case or not, provides a sufficient explanation of the basis for the contention. *See* 10 C.F.R. § 2.309(f)(1)(ii).

Third, there is no doubt that this safety contention, which alleges that Entergy fails to supply information that is related to the effects of aging and that is required by the license renewal regulations (10 C.F.R. § 54.21), is within the scope of a license renewal proceeding. *See* 10 C.F.R. § 2.309(f)(1)(iii). Likewise, DPS has demonstrated that this contention is material to the findings that Staff must make under 10 C.F.R. § 54.29(a) in evaluating the license renewal application. *See* 10 C.F.R. § 2.309(f)(1)(iv).

The real dispute over the admissibility of DPS Contention 1 relates to whether Mr. Sherman's declaration, including the statement that "the concrete surface behind the steel shell will closely match the drywell ambient temperature" is "bald" or "conclusory." *See* Entergy Answer to DPS at 14; Staff Answer to DPS at 11. It is not entirely clear to the Board whether this alleged defect is purported to constitute a failure of DPS to provide "a concise statement of the alleged facts or expert opinions" that support its position, 10 C.F.R. § 2.309(f)(1)(v), or a failure to provide "sufficient information to show that a genuine dispute exists with applicant/licensee on a material issue of law or fact." 10 C.F.R. § 2.309(f)(1)(vi). *See* Tr. at 191-92, 202-04 (Aug. 1, 2006). In any event, Entergy and the Staff agree that Mr. Sherman's statement is bald and conclusory and therefore that the contention cannot stand.

We disagree, and find that DPS's citation to specific and potentially inconsistent portions of Entergy's documents, together with the declaration of Mr. Sherman that "the concrete surface behind the steel shell will closely match the drywell ambient temperature" provide us with alleged "facts or expert opinion," which are "sufficient" to meet the requirements of 10 C.F.R. § 2.309(f)(1)(v) and (vi). Mr. Sherman's opinion is supported by a simple, fact-based argument. DPS points out that the concrete surrounding the primary steel containment would require an aging management when the "general areas" of concrete exceed 150°F. DPS Petition at 10-11. DPS then points to another portion of the application stating that the ambient temperature in the drywell is between 135°F and 165°F. *Id.* at 11. Given that the concrete is separated from the steel drywell by a relatively small gap, Mr. Sherman concludes that "the concrete surface behind the steel shell will closely match the drywell ambient temperature." Sherman Decl. ¶ 8. Given the simple logical inference on which this argument rests, no more explanation is required to raise a dispute, and clearly a genuine one, regarding the general area temperature of the primary containment concrete.

This is not a case of "mere speculation nor bare or conclusory assertions, even by an expert, alleging that a matter *should be considered.*" Staff Answer to DPS at 12 (citing the dicta in *Clinton*, LBP-04-17, 60 NRC at 241, and *Fansteel*, CLI-03-13, 58 NRC at 203) (emphasis added). Instead, DPS has clearly pointed out specific portions of the application that show temperatures higher

than 150°F and that reveal a potential inconsistency. DPS's expert does not make bare assertions that the contention "should be considered." Instead, Mr. Sherman, whose expertise is never questioned, provides a "concise statement," identifying relevant portions of the application and USFAR and indicating that "the temperature of the concrete surface behind the steel shell will closely match the drywell ambient temperatures." This is a facially reasonable proposition that warrants the review of supporting and opposing evidence that an adjudicatory hearing will provide.

Nor is this case like the situation in *USEC*, which was cited by the Staff at oral argument. Tr. at 280 (citing *American Centrifuge*, CLI-06-10, 63 NRC at 472). In that case the petitioner cited garbled and virtually incomprehensible statements by one Sergio Edwardovich Pashenko,[39] such as "I think that officials information about radiation situation is very poor and very unconcrete," and "It's a very bad model. We must know what wind velocity and what condition in atomospheric (it about 6*8 = 48) were in this model. The work (play as little children) only with average result — very bad!! We must understood it!"[40] In response, the Commission noted, with some understatement, that "it is unclear just what Mr. Pashenko reviewed," that "Mr. Pashenko's brief remarks are difficult to comprehend" and that even PRESS, the sponsor of this witness, did not seem to understand Mr. Pashenko's statements. *American Centrifuge*, CLI-06-10, 63 NRC at 472.

In contrast, the factual material provided by DPS is clear, concise, and sufficient to create a reasonable (and litigable) concern that the "general area" temperatures of the Vermont Yankee Nuclear Power Station primary containment concrete may exceed 150°F. The facts proffered by DPS include several relevant sections of the Application and UFSAR and a careful declaration by the Nuclear Engineer of the State of Vermont that, due to the proximity of the drywell shell and the primary containment concrete, the temperature of the latter will closely match the temperature of the former (135°F–165°F). At the contention admission stage, which is a lesser threshold than a merits determination or even a summary disposition ruling, the Board's purpose in applying 10 C.F.R. § 2.309(f)(1) is only to "ensure that the adjudicatory process is used to address real, concrete, specific issues that are appropriate for litigation." Final Rule: "Changes to the Adjudicatory Process," 69 Fed. Reg. 2182, 2202 (Jan. 14, 2004). DPS Contention

[39] The expertise of Mr. Pashenko was never clear. He labeled himself as an "ecologist." The total statement of his education (in his resume) specified "Highest level of education with a degree in both Nuclear Physics and Atomospheric Aerosols." Petition To Intervene by Portsmouth/Piketon Residents for Environmental Safety and Security (PRESS) at 71.

[40] Petition To Intervene by Portsmouth/Piketon Residents for Environmental Safety and Security (PRESS) (Feb. 28, 2006) at 37.

1 meets this criterion, and its factual allegations and attached expert opinion suffice under 10 C.F.R. § 2.309(f)(1)(v) and (vi).[41]

2. *DPS Contention 2 (Environmental)*

> The Application must be denied because Applicant has failed to comply with the requirements of 10 CFR § 51.53(c)(3)(iv) by failing to include new and significant information regarding the substantial likelihood that spent fuel will have to be stored at the Vermont Yankee site longer than evaluated in the GEIS and perhaps indefinitely and thus has failed to provide the necessary environmental information with regard to onsite land use in accordance with 10 C.F.R. § 54.23 such that the Commission cannot find that the applicable requirements of Subpart A of 10 C.F.R. Part 50 have been satisfied (10 C.F.R. § 54.29(b)).[42]

As the "basis" for this contention, DPS cites 10 C.F.R. § 51.53(c)(3)(iv) for the proposition that the ER must contain any "new and significant information" regarding the environmental impacts of the license renewal and alleges that although the GEIS indicates that the (Category 1) impacts of onsite land use are "small," this allegation is based on assumptions that are no longer valid due to new and significant information that DPS proffers. DPS Petition at 13-14. DPS argues that such new and significant information shows that "the commitment of onsite land for storage/disposal of spent nuclear fuel from license renewal will be substantially longer than assumed in the GEIS, and may be indefinite," resulting "in an irretrievable commitment of onsite land with a moderate or large impact." *Id.* at 15. According to DPS, the GEIS finding of a small impact is based on "the assumption that the land used for storage of nuclear waste at the reactor site will not exceed 30 years after the end of the license term," i.e., the spent fuel at the Vermont Yankee facility will be removed by 2062. *Id.* at 13 (citing GEIS at 3-1 to 3-2). DPS asserts that this "assumption, in turn, relies upon the assumption that a permanent high level waste repository, and perhaps even a second repository, will be in place by that time to receive the reactor wastes." *Id.* (citing GEIS at 6-79 to 6-81).

DPS presents six points as new and significant information that it claims invalidate the assumption that spent fuel will be removed from the Vermont Yankee facility by 2062. These are: (1) technical problems at Yucca Mountain and changes in national policy make it unlikely that a permanent high-level waste

[41] In admitting this contention, we find it unnecessary to rely on the portions of the DPS reply that Entergy argues improperly raise new arguments or claims not found in the original petition. *See* Entergy Motion To Strike DPS Reply at 10, 14. Therefore, we deny Entergy's motion to strike the portions of the DPS reply that relate to DPS Contention 1.

[42] DPS Petition at 12-13.

repository will be in place by 2062; (2) Yucca Mountain cannot accommodate the quantity of spent fuel expected to be produced through the end of the Vermont Yankee license renewal term; (3) there are currently no plans to build a second high-level waste repository; (4) current changes in the national high-level waste disposal policy make prior schedules unreliable; (5) the federal government (or a third party) is unlikely to take title for and remove spent fuel generated during the license renewal term; and (6) given these uncertainties, it is reasonable to assume that spent fuel generated during the license renewal term will remain at the Vermont Yankee facility past 2062, and perhaps indefinitely. *Id.* at 14.

As "supporting evidence" for this allegedly new and significant information, DPS provides references to the Bush Administration's Global Nuclear Energy Partnership (GNEP) initiative; to the comments of a U.S. Senator concerning the relationship between GNEP and Yucca Mountain; to a Department of Energy presentation concerning technical problems with Yucca Mountain; to evidence of the Western Governors' Association opposition to Yucca Mountain; to an NRC news release addressing the added security threat following the terrorist attacks of September 11, 2001; to the statutory waste limit for Yucca Mountain; and to past failures in establishing an interim waste storage facility. *Id.* at 15-21. DPS points out that these delays have a special impact in Vermont because the State places a high value on its land use. *Id.* at 21-24. DPS also asserts that its prior attempts to comment on the impropriety of the small impact conclusion in the GEIS were either ignored or were not adequately addressed by the NRC. *Id.* at 24-30.

Entergy argues against admitting DPS Contention 2, saying that it impermissibly challenges the Commission's regulations and raises issues that are outside the scope of a license renewal proceeding. Entergy Answer to DPS at 14. Specifically, Entergy views this contention as a direct challenge to the Waste Confidence Rule (10 C.F.R. § 51.23(a)-(b)), the license renewal regulations, and the generic findings of the GEIS. *Id.* at 14-15. According to Entergy, challenges such as these are barred by 10 C.F.R. § 2.335. *Id.* at 16. Entergy asserts that the requirement that it provide new and significant information in accordance with 10 C.F.R. § 51.53(c)(3)(iv) is inapposite because that regulation only requires Entergy to provide information "of which the applicant is aware" and does not require that it provide information that some other party believes is new or significant. *Id.* at 16. If some other party, such as DPS, is aware of new and significant information bearing on a generic finding, Entergy asserts that the party may raise that information in a hearing only by seeking a waiver of the generic rule pursuant to 10 C.F.R. § 2.335(b). *Id.* at 17. However, because DPS has not complied with section 2.335, Entergy concludes that the Board may not consider this contention. *Id.* at 18. Additionally, Entergy attempts to refute DPS's claim that the information supporting its contention is new and significant by showing that the Commission already considered these issues when promulgating the Waste Confidence Rule. *Id.* at 19-23.

The Staff also views this contention as a challenge to the Waste Confidence Rule and thus opposes its admission. Staff Answer to DPS at 14-15. According to the Staff, the Waste Confidence Rule eliminates the need to discuss the environmental impacts of spent fuel storage following the license renewal period in the GEIS, an SEIS, or an ER, meaning these issues are beyond the scope of a license renewal proceeding. *Id.* at 15-16. The Staff contends that the requirement to address new and significant information pursuant to 10 C.F.R. § 51.53(c)(3)(iv) only applies to issues within the scope of a license renewal proceeding, and that this regulation therefore does not require an applicant to provide new and significant information relating to the long-term storage of spent fuel. *Id.* at 16-17. If a petitioner wishes to challenge issues covered by the Waste Confidence Rule, the Staff argues that the petitioner must seek a waiver of that regulation pursuant to 10 C.F.R. § 2.335. *Id.* at 17. The Staff points out, however, that DPS has not filed a petition for waiver, and thus the Waste Confidence Rule must stay in effect in this proceeding. *Id.*

In its reply, DPS argues that its contention properly focuses on Entergy's failure to provide information that is required to be included in the ER. DPS Reply at 18. DPS points out that there is no dispute that Entergy failed to address the environmental impacts of indefinitely storing spent fuel at the Vermont Yankee facility. *Id.* Further, DPS asserts the "real issue at this stage of the proceeding is whether [Entergy] is legally required to provide such new and significant information regarding on-site land use." *Id.* DPS rejects the suggestion by Entergy and the Staff that it can only raise a contention alleging new and significant information if it files a petition for waiver pursuant to 10 C.F.R. § 2.335(b) because that position "ignores the extensive administrative history confirming that the Commission intends that claims of the existence of new and significant information warranting modifications to the GEIS are to be part of the SEIS and ASLB decision-making process." *Id.* at 39.

We find that DPS Contention 2 is inadmissable for the same reason that the AG contention is inadmissible. While 10 C.F.R. § 51.53(c)(3)(iv) requires an applicant to include any new and significant information concerning Category 1 issues that it is aware of, the failure of an applicant to do so is simply not litigable, absent a waiver under 10 C.F.R. § 2.335. *See* Section III.B.1. We need not, and do not, decide whether the information proffered by DPS is indeed "new and significant," or whether Entergy was, or should have been, aware of it.[43]

[43] The storage of spent nuclear fuel is discussed in the GEIS at 6-70 to 6-86 and is listed as a Category 1 issue in Appendix B to Part 51. Specifically, Table B-1 of the regulation states that "[t]he expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects through dry or pool storage at all plants if a

(Continued)

We also conclude that issues related to the environmental impact of onsite spent fuel storage after the license renewal term are outside the scope of a license renewal proceeding because contentions may not challenge the NRC's Waste Confidence Rule. *Duke Energy Corp.* (Oconee Nuclear Station, Units 1, 2, and 3), CLI-99-11, 49 NRC 328, 344-45 (1999). In relevant part, the Waste Confidence Rule states:

> The Commission has made a generic determination that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin or at either onsite or offsite independent spent fuel storage installations. Further, the Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor to dispose of the commercial high-level waste and spent fuel originating in such reactor and generated up to that time.

10 C.F.R. § 51.23(a). Under 10 C.F.R. §§ 51.53(c)(2) and 51.95(c)(2), in a license renewal, the ER and the SEIS do not need to discuss spent fuel storage issues related to this generic determination. DPS's attempt to challenge the storage of spent fuel after the license renewal term amounts to an impermissible attack on these regulations. Therefore, for the above-stated reasons, we find that DPS Contention 2 is inadmissible.[44]

3. *DPS Contention 3 (Safety)*

> The Application must be denied because the Applicant has failed to fully identify plant systems, structures and components that are non-safety-related systems, structures, and components in the security area whose failure could prevent satisfactory accomplishment of any of the functions of safety-related systems, structures and components in accordance with 10 C.F.R. § 54.4(a)(2), such that the Commission cannot find that 10 C.F.R. § 54.29(a) is met.[45]

As the "basis" of this contention, DPS states that Entergy did not include "security systems, structures and components required by 10 C.F.R. Part 73," which "provide physical security and protect against terrorist activities" as part of Entergy's aging management review. DPS Petition at 31. DPS acknowledges that these security systems, structures, and components (SSCs) are not safety SSCs, but explains that their failure "could result in the prevention of safety [SSCs] to perform their safety functions" and therefore asserts that the security SSCs require aging management review. *Id.* According to DPS, the absence "of this screening and aging management review prevents the Commission from completing its review of the requested license renewal in accordance with 10 C.F.R. § 54.29(a)." *Id.*

Under the heading "supporting evidence,"[46] DPS alleges that the application fails to identify security-related SSCs for screening despite the fact that the SSCs of 10 C.F.R. Part 73 fit within the scope of a license renewal as defined in 10 C.F.R. § 54.4(a)(2).[47] *Id.* at 31-32. DPS asserts that the failure of these physical security SSCs could allow terrorists to successfully enter the Vermont Yankee facility and to disable safety-related SSCs.[48] *Id.* at 32. Accordingly, DPS contends that Entergy must perform a screening and an aging management review for these systems. *Id.*

Entergy opposes the admission of DPS Contention 3, asserting that security issues are not within the scope of a license renewal proceeding. *See* Entergy Answer to DPS at 24-28. Entergy points out that the Commission has repeatedly stated that security issues are not among the aging-related questions that are relevant in license renewal review. *Id.* at 24 (citing *Millstone*, CLI-04-36, 60 NRC at 638, and *McGuire/Catawba*, CLI-02-26, 56 NRC at 364). Given the Commission's clear intent regarding the exclusion of security issues from the scope of license renewal proceedings, Entergy contends that it is inappropriate to interpret Part 73 SSCs as being covered by 10 C.F.R. § 54.4(a)(2). *Id.* at 25. Entergy further argues that, while some nonsafety SSCs are included under

---

permanent repository or monitored retrievable storage is not available." 10 C.F.R. Part 51, App. B, Table B-1. Therefore, issues related to the environmental impact of onsite spent fuel storage during the license renewal term are outside of the scope of this license renewal proceeding.

[44] Entergy filed a motion to strike portions of the DPS reply, claiming it seeks to raise new arguments that were not included in the original petition but fails to address the criteria for nontimely filings. *See* Entergy Motion To Strike DPS Reply at 11-12, 14. Even if we were to consider the purported illicit information relating to the reply that relates to DPS Contention 2, it would not change our conclusion that the issues DPS seeks to raise in this contention are outside of the scope of this proceeding. Therefore, we deny Entergy's motion to strike the portions of the DPS reply that relate to DPS Contention 2 because the motion is now moot.

[45] DPS Petition at 30-31.

[46] The supporting information regarding DPS Contention 3 is taken essentially verbatim from the statements appearing in Mr. Sherman's declaration. *See* Sherman Decl. ¶¶ 44-50.

[47] Section 54.4(a)(2) states that plant SSCs within the scope of Part 54 include "[a]ll nonsafety-related [SSCs] whose failure could prevent satisfactory accomplishment of any of the functions identified in paragraphs (a)(1)(i), (ii), or (iii) of this section." Paragraphs (a)(1)(i), (ii), and (iii) identify the safety-related SSCs that must remain functional during and following design-basis events.

[48] In an effort to avoid a safeguards information designation, DPS does not identify specific SSCs that are problematic at the Vermont Yankee facility, but instead cites several general provisions in Part 73 that involve SSCs.

section 54.4(a)(2), security SSCs are not included because a security SSC failure would not directly prevent proper functioning of safety SSCs. Rather Entergy asserts such a failure could only impact safety SSCs as the result of an intervening act (e.g., a terrorist intrusion). *Id.* at 25-27.

Citing the same case law as Entergy, the Staff also argues against the admission of this contention on the ground that it is outside the scope of a license renewal proceeding. Staff Answer to DPS at 19. The Staff asserts that, even if some security SSCs are within the scope of section 54.4(a)(2), Commission precedent establishes that these SSCs are not subject to aging management review and therefore, by the terms of 10 C.F.R. § 54.21, are beyond the scope of a license renewal. *Id.* at 20-21. Additionally, the Staff argues that by failing to identify specific SSCs that fit the definition of section 54.4(a)(2), DPS fails to provide the necessary factual support for its contention. *Id.* at 21.

In its reply, DPS reiterates that Part 73 physical barriers and structures are within the scope of section 54.4(a)(2). DPS Reply at 40-42. Giving the examples of vehicle barriers and bullet-resistant enclosures, DPS maintains that security equipment is directly linked to safety functions. *Id.* DPS also argues that the terrorist attacks of September 11, 2001, and the decision by the U.S. Court of Appeals for the Ninth Circuit in *San Luis Obispo Mothers for Peace v. NRC*, 449 F.3d 1016 (9th Cir. 2006), have made the regulatory history for the license renewal rules stale. Therefore, says DPS, the 10 C.F.R. § 73.55(g) maintenance rule does not adequately manage the effects of aging for security SSCs, as the Commission maintained in the 1991 Statement of Considerations. *Id.* at 43-47.

The Board concludes that DPS Contention 3 is not admissible because, under controlling Commission rulings, security-related issues are not within the scope of a license renewal proceeding under 10 C.F.R. § 2.309(f)(1)(iii). The Commission has repeatedly stated that security-related issues are beyond the scope of a license renewal review. In *McGuire/Catawba*, the Commission examined whether terrorism contentions are "sufficiently related to the effects of plant aging to fall within the scope of the" safety portion of a license renewal proceeding. CLI-02-26, 56 NRC at 364. Upon examining the regulatory history to the license renewal rules,[49] the Commission concluded that "[t]errorism contentions are, by

[49] In addressing this issue, the Commission examined the regulatory history for the license renewal regulations and focused on two key rulemakings. First, the Statement of Considerations for the 1995 license renewal rule states:

> [T]he portion of the CLB that can be impacted by the detrimental effects of aging is limited to the design-bases aspects of the CLB. All other aspects of the CLB, e.g., . . . physical protection (security), . . . are not subject to physical aging processes that may cause noncompliance with those aspects of the CLB.

Final Rule: "Nuclear Power Plant License Renewal; Revisions," 60 Fed. Reg. 22,461, 22,475 (May 8,

(Continued)

their very nature, directly related to security and are therefore, under our rules, unrelated to 'the detrimental effects of aging.' Consequently, they are beyond the scope of, not 'material' to, and inadmissible in, a license renewal proceeding." *McGuire/Catawba*, CLI-02-26, 56 NRC at 364. The Commission repeated this principle in *Millstone* when it affirmed a Licensing Board decision ruling that terrorism issues are not within the scope of license renewal proceedings. CLI-04-36, 60 NRC at 638. In doing so, the Commission specifically stated "security issues at nuclear power reactors, while vital, are simply not among the aging-related questions at stake in a license renewal proceeding." *Id.*

These two cases make clear that security issues are outside the scope of license renewal proceedings. The only attempt that DPS makes to address this adverse precedent is to argue that the license renewal rules predate the September 11, 2001, terrorist attacks and the *Mothers for Peace* decision. *See* DPS Reply at 43-47. This argument is unpersuasive on both counts. First, the *Millstone* and *McGuire/Catawba* cases were decided *after* the September 11th attacks. The Commission emphasized that it "takes its security responsibilities seriously and has taken numerous regulatory steps to enhance security at nuclear power reactors." *Millstone*, CLI-04-36, 60 NRC at 638.[50]

Second, the *Mothers for Peace* decision is a NEPA decision that is not relevant to the current discussion of whether a security-related safety (i.e., AEA-related) contention may be admitted in a license renewal proceeding. In *Mothers for Peace*, the Ninth Circuit held that, given NRC's substantial consideration of terrorist attack scenarios under the AEA, NRC is not entitled to refuse categorically to consider the environmental effects of a terrorist attack on a nuclear facility under NEPA. *Mothers for Peace*, 449 F.3d at 1035. DPS Contention 3 is not based on NEPA. Instead, it is a safety contention based on the AEA. Accordingly, *Millstone* and *McGuire/Catawba*, not *Mothers for Peace*, are controlling. Given

1995). Second, the Statement of Considerations for the 1991 license renewal rule "concludes that a review of the adequacy of existing security plans is not necessary as part of the license renewal review process." Final Rule: "Nuclear Power Plant License Renewal," 56 Fed. Reg. 64,943, 64,967 (Dec. 13, 1991).

[50] It is because of the importance of security systems that the Commission does not wait until the license renewal stage to address the aging of security systems, but rather actively manages them under the current licensing basis. *See, e.g.*, 10 C.F.R. §§ 73.46(g)(1), 73.55(g)(1). As the Commission explained in the 1991 Statement of Considerations for the license renewal rule:

> The requirements of 10 CFR part 73, notably the testing and maintenance requirements of 10 CFR 73.55(g), include provisions for keeping up the performance of security equipment against impairment due to age-related degradation or other causes. Once a licensee establishes an acceptable physical protection system, changes that would decrease the effectiveness of the system cannot be made without filing an application for license amendment in accordance with 10 CFR 50.54(p)(1).

56 Fed. Reg. at 64,967.

this precedent, we find that security SSCs do not fall within the scope of section 54.4(a)(2). The issues raised are beyond the scope of this license renewal proceeding, and therefore DPS Contention 3 is not admissible.[51]

4. *DPS "Reservation" of Right to File Contentions on Energy Alternatives*

In addition to submitting the three contentions discussed above, DPS states that because the Staff has yet to develop an SEIS, DPS cannot file contentions related to energy alternatives at this time, but it reserves the right to do so should subsequent filings by Entergy or the Staff require such an action. DPS Petition at 9. Under NRC rules, a petitioner must file contentions based on the documents and information available at the time the petition is filed. 10 C.F.R. § 2.309(f)(2). With regard to NEPA issues, the regulation states "the petitioner shall file contentions based on the applicant's environmental report" but "may amend those contentions or file new contentions if there are data or conclusions in the NRC draft or final environmental impact statement, environmental assessment, or any supplements relating thereto, that differ significantly from the data or conclusions in the applicant's documents." 10 C.F.R. § 2.309(f)(2). Therefore, no "reservation of rights" is necessary. To the extent that the draft or final SEIS contains data or conclusions that differ significantly from the data or conclusions in Entergy's environmental report or in the GEIS, DPS is entitled to use 10 C.F.R. § 2.309(f)(2) as the grounds to file a new or amended contention. However, should DPS file an energy alternatives contention that is *not* based on new information, i.e., data or conclusions that differ significantly from data or conclusions in Entergy's ER or the GEIS, the contention can only be admitted upon a favorable balancing of the factors found in 10 C.F.R. § 2.309(c).[52]

[51] Entergy filed a motion to strike portions of the DPS reply, claiming it seeks to raise new arguments that were not included in the original petition but fails to address the criteria for nontimely filings. *See* Entergy Motion To Strike DPS Reply at 12, 14. Considering the purported illicit information relating to the reply that relates to DPS Contention 3 would not change our conclusion that the issues DPS seeks to raise in this contention are outside of the scope of this proceeding. Therefore, we deny Entergy's motion to strike the portions of the DPS reply that relate to DPS Contention 3 as the controversy is moot.

[52] Any new, amended, or nontimely contentions would also have to meet the requirements of 10 C.F.R. § 2.309(f)(1). *See Entergy Nuclear Vermont Yankee, LLC* (Vermont Yankee Nuclear Power Station), LBP-06-14, 63 NRC 568 (2006).

D. Ruling on NEC Contentions

1. *NEC Contention 1 (Environmental)*

Entergy Failed to Assess Impacts to Water Quality.[53]

In its only contention filed under NEPA, NEC asserts that Entergy's environmental report (ER) failed to "sufficiently assess[ ]" the environmental impacts of the license renewal, specifically the impacts of increased thermal discharges into the Connecticut River over the 20-year license extension period. NEC Petition at 10, 13. NEC points out that Entergy acknowledges that the continuing thermal discharge effects from the renewal are classified as a Category 2 issue. *Id.* at 11 (citing ER at 4-16). However, NEC argues that Entergy's effort to address the issue in its ER is flawed because it relies on a National Pollutant Discharge Elimination System (NPDES) permit[54] issued by the state. *Id.* Rather than providing an assessment of the environmental impacts of its thermal discharges, "Entergy simply concludes that the impact of this increased discharge is small because an NPDES permit may be issued." NEC Petition at 11. NEC objects to the failure of the ER to address the environmental impact of its thermal discharges and states that extended use of the once-through cooling system at Vermont Yankee would result in a one-degree increase in water temperature, which may have significant impacts on the biota in the river. *Id.* NEC argues that Entergy's reliance solely on its NPDES permit is not sufficient because the permit is under appeal and, even if issued, will only be valid for 5 years (2006-2011), and thus will not cover the cumulative impacts of thermal discharges over the 20-year period of the license renewal term (2012-2032). *Id.* NEC asserts that Entergy's ER fails to provide a sufficient basis for the "hard look" at environmental impacts that NEPA requires. *Id.* at 12. Furthermore, says NEC, by failing to provide a convincing rationale for its statement that the impacts of its thermal discharge are small, Entergy has failed to comply with NRC regulations requiring it to include "adverse information" in its environmental report. *Id.* (citing 10 C.F.R. § 51.45(e)).

NEC submits the declaration of Dr. Ross T. Jones, a researcher in ecology and evolutionary biology who specializes in aquatic species, in support of the contention. Dr. Jones asserts that the populations of some native species found in the Connecticut River have declined in recent years, and he cites several studies that show how temperature increases can affect the behavior and physiology of such species. NEC Petition, Exh. 6, Decl. of Dr. Ross T. Jones, Ph.D. (May 24,

[53] NEC Petition at 10.

[54] NPDES permits are issued by the U.S. Environmental Protection Agency (EPA) or by authorized states, pursuant to section 402 of the Federal Water Pollution Control Act of 1972 (FWPCA, Clean Water Act, or CWA), 33 U.S.C. § 1251 *et seq.* NPDES permits impose effluent limitations and other requirements on facilities that discharge pollutants into the waters of the United States.

2006), ¶ 1[illegible]nes Decl.]. He concludes that a 1-degree temperature increase could have a significant impact on heat-sensitive native species, and that understanding this impact is "even more important if the thermal discharge is going to be occurring for a twenty-year period." *Id.* ¶¶ 11-12.

Entergy responds with the claim that NEC Contention 1 is inadmissible as a challenge to NRC's license renewal rules and "barred" by the FWPCA. Entergy Answer to NEC at 11. First, Entergy asserts that NEC's petition is a "mischaracterization of the Application" in that it implies that the temperature increase is related to the license renewal, which is not the case. *Id.* Entergy claims that 10 C.F.R. § 51.53(c)(3)(ii)(B) expresses Entergy's only obligations here. *Id.* at 12. This regulation specifies that applicants with plants that have once-through cooling water systems

> shall provide a copy of current Clean Water Act 316(b) determinations and, if necessary, a 316(a) variance in accordance with 40 CFR part 125, or equivalent State permits and supporting documentation. If the applicant can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock and impingement and entrainment.

10 C.F.R. § 51.53(c)(3)(ii)(B). Entergy argues that the NPDES permit it will provide is Vermont's 316(a) determination, and that "[t]herefore, under NRC rules, no further analysis [is] required" and NEC's contention is barred. Entergy Answer to NEC at 12.

Entergy points out that section 511(c) of the FWPCA specifies that nothing in NEPA authorizes NRC to review or impose any "effluent limitation or other [FWPCA] requirement" as a condition of a license. *Id.* at 13. If "the EPA or an authorized state has approved a plant's cooling water system," says Entergy, the NRC must "weigh the overall project in light of the conclusions of the EPA or authorized state" and "must take that assessment at face value." *Id.* at 14. Additional analysis is not appropriate. *Id.* (citing *Tennessee Valley Authority* (Yellow Creek Nuclear Plant, Units 1 and 2), ALAB-515, 8 NRC 702, 712-13, 715 (1978)). According to Entergy, the NPDES permit and its supporting documentation provide an assessment that "is dispositive in this proceeding." *Id.* at 16.

In addition, Entergy argues, the contention should be rejected on the ground that "it is not supported by a basis indicating any genuine dispute concerning a material issue." Entergy Answer to NEC at 11. NEC's expert does not assert that thermal discharges will cause declines in aquatic species, says Entergy, but rather that such declines may occur and that additional studies are needed. *Id.* at 17. The example of adverse effects on the shad population were due to temperature changes of 9 to 18 degrees, far larger than permitted under the Vermont Yankee NPDES permit. *Id.* at 18. Entergy asserts that such "bare or conclusory assertions,

even by an expert" are not sufficient to support admission of a contention. *Id.* (citing *System Energy Resources, Inc.* (Early Site Permit for Grand Gulf ESP Site), LBP-04-19, 60 NRC 277, 289 (2004)). Because NEC has not provided sufficient support, says Entergy, Contention 1 fails to meet the contention admissibility standards of 10 C.F.R. § 2.309(f)(1) and should be rejected.

The NRC Staff does not object to admitting Contention 1 provided that it is limited to considering the effects of a 1-degree temperature increase on the American shad population during the license renewal period. Staff Answer to NEC at 8. However, the Staff goes on to complain that NEC's expert does not provide any information to explain why the impacts of a 1-degree increase in the river temperature would be any different from the impacts under a prior permit and why Entergy's characterization of the impacts as "small" is incorrect. *Id.* In the absence of such a showing, says the Staff, NEC has failed to show a genuine dispute with the Applicant as required by NRC regulations. *Id.* Accordingly, the Staff urges the rejection of "any basis challenging the *adequacy* of Entergy's assessment" and asserts that the only contention basis that remains is the "alleged *absence* of an assessment of the impacts of the discharge temperature increase, which can be cured by the submission of the amended [NPDES] permit." *Id.* at 9 (emphasis added). The Staff also notes that, to the extent that NEC seeks to have the NRC impose environmental monitoring conditions, the contention must be rejected as beyond NRC's authority. *Id.*

In its reply, NEC disputes the claim that the NPDES permit — "an expired permit that, if renewed, may not be renewed under the same terms and would expire before any license renewal issues" — disposes of Entergy's NEPA obligations during the license renewal term. NEC Reply at 2. NEC asserts that Entergy is also obligated to obtain a state water quality certification under section 401 of the FWPCA, 33 U.S.C. § 1341, and that Entergy has not done so. *Id.* at 3. Furthermore, says NEC, the NPDES permit that Entergy submitted with its answer expired the day after it was signed and is therefore not current. *Id.* at 4. Whatever the status of the permit, however, NEC claims that the extensive monitoring requirements contained therein "underscore[] Entergy's failure to provide a sufficient assessment of its discharge's impacts." *Id.* at 5. NEC also points out Entergy's statement that there is a 1-degree temperature increase related to an increase as *measured at a specific point* in the Connecticut River — Station 3 — 1.4 miles downstream from the discharge point, and notes that the temperature increases will be greater than 1 degree *above* that point. *Id.* at 11-12. Finally, NEC rejects the proposition that FWPCA § 511 precludes NEPA review from looking beyond an NPDES permit and states:

> Entergy misreads this provision. It only states that NEPA shall not be deemed to authorize federal agencies to review a state's water quality standards (effluent limitations) established under the [FWPCA] or the adequacy of a § 401 water quality

certification. *Id. See also S.D. Warren,* 547 U.S. at __, 126 S.Ct. at 1852, n.8. Requiring an adequate assessment is not a challenge to Vermont's Water Quality standards or the effluent limitations they establish.

Id. at 14.

Entergy's motion to strike portions of NEC's reply challenges those portions of the argument that related to section 401 of the FWPCA and others that relate to temperature increases of greater than 1 degree on the grounds that these matters exceed the scope of the original contention. Entergy Motion To Strike NEC Reply at 9-12, 14. NEC argues that all of its reply is permissible and asserts that references to section 401 of the FWPCA merely add support to its claim that no NPDES permit could ever demonstrate compliance with the Act for the entire 20-year license renewal period. NEC Opposition to Entergy Motion To Strike NEC Reply at 6. With regard to Entergy's arguments that NEC must limit its contention to a 1-degree temperature increase, NEC states that it is a "truism" that "[h]eating the Connecticut River by 1°F a mile and one-half downstream from the plant obviously requires a much higher discharge temperature that will heat portions of the River closer to the point of discharge by much more than one degree," and there was nothing objectionable in NEC's pointing this out in its reply. *Id.* at 8.

The Board concludes that NEC Contention 1 is admissible under 10 C.F.R. § 2.309(f)(1). As an initial matter, 10 C.F.R. § 2.309(f)(1)(i) is met because NEC has provided a "concise statement of the law or fact to be raised or controverted" — "whether Entergy's [ER] sufficiently assesses the impacts of increased thermal discharges over the requested twenty-year license extension."[55] NEC has satisfied 10 C.F.R. § 2.309(f)(2)(ii) by providing a "brief explanation of the basis" or logic underlying the contention — that the ER contains an insufficient analysis of the thermal impacts in the Connecticut River and merely refers to an NPDES permit, which is under appeal, of allegedly uncertain status, and does not cover the 20 years covered by the proposed license renewal. *Id.* at 11. The issue of whether the ER complies with the provisions of 10 C.F.R. Part 51 relevant to Category 2 environmental matters is certainly "within the scope" of a license renewal proceeding and "material," as required by 10 C.F.R. § 2.309(f)(1)(iii) and (iv),

[55] NEC Petition at 13. With regard to the NRC Staff's argument that the contention can be admitted if limited to a 1-degree increase, we believe that the contention must be read reasonably. For example, we do not believe that NEC is alleging that Entergy is planning to increase the temperature of the Connecticut River by 1 degree for the entire length of the river, both upstream and downstream of the discharge point, from the river's source to the sea. Instead, it appears that the 1-degree increase is measured at some specific point downstream of the place where the plant's outfall pipe discharges heated water into the Connecticut River. Above that measuring point (and below the outfall) there will be a mixing zone where the temperature increase in the river will be greater than 1 degree. Below that measuring point, the temperature increase in the river will likely be less than 1 degree.

respectively. The declaration of Dr. Jones is the type of "concise statement of the alleged facts or expert opinions" required by section 2.309(f)(1)(v). Suggestions that Dr. Jones' declaration is "bare or conclusory," Entergy Answer to NEC at 18, are without merit. He has provided extensive information to support his conclusions, and efforts to refute that information on substantive grounds are inappropriate at the contention admissibility stage of the proceeding. And the challenges to NEC's petition indicate that questions of both law and fact are sharply disputed, satisfying the requirement that a genuine dispute exist. 10 C.F.R. § 2.309(f)(1)(vi).

The main focus of the pleadings thus far seems to concern several substantive and merits-related issues. Although it is not this Board's intent to resolve all questions related to this contention at this early stage in the proceeding, some discussion of our reasoning in this matter is appropriate at this point.

First, we reject Entergy's assertion that this contention is barred by section 511(c) of the FWPCA. This is apparent both from the basic structure of NEPA and from the literal language of section 511(c). The basic scheme of NEPA is to require federal agencies to analyze the environmental impacts of each major federal action significantly affecting the environment. NEPA is procedural only and does not specify that the agency must take the least environmentally damaging course of action. NEPA assumes, but does not impose or require, that the action under environmental study is subject to other laws, regulations, and licenses, such as water, air, hazardous waste, zoning, and traffic regulations and permits. While the NEPA environmental impact statement process considers information regarding such other legal requirements, the fact that the applicant is subject to, and complying with, them does not obviate the NEPA mandate that the federal agency perform an EIS covering these topics. Thus, NRC's NEPA regulations state:

> Due consideration will be given to compliance with environmental quality standards and requirements that have been imposed by Federal, State, regional, and local agencies having responsibility for environmental protection . . . . The environmental impact of the proposed action will be considered in the analysis with respect to matters covered by such standards and requirements irrespective of whether a certificate or license from the appropriate authority has been obtained.

10 C.F.R. § 51.71(d). More importantly for purposes of NEC Contention 1, the NRC regulations flatly state that

> [c]ompliance with the environmental quality standards and requirements of the Federal Water Pollution Control Act . . . is not a substitute for and does not negate the requirement for NRC to weigh all environmental effects of the proposed action,

including the degradation, if any, of water quality, and to consider alternatives to the proposed action that are available for reducing adverse effects.

10 C.F.R. § 51.71(d) n.3.

Turning to the specific language of section 511 of the FWPCA, nowhere does it relieve NRC, or any federal agency, from the basic NEPA duty to do an EIS covering "all environmental effects . . . including water quality." Section 511 merely states that NRC cannot second-guess or impose its own effluent limitations, or other water quality requirements that EPA or the State may impose under the FWPCA. The statutory language specifies that

> Nothing in [NEPA] shall be deemed to —
>
> (A) authorize any Federal agency . . . to review any effluent limitation or other requirement established pursuant to this Act or the adequacy of any certification under section 401 of this Act; or
>
> (B) authorize any such agency to impose as a condition precedent to the issuance of any license or permit, any effluent limitation other than any such limitation established pursuant to this Act.[56]

In an early case, the Appeal Board construed section 511(c) as follows: "This Commission still must consider any adverse environmental impact that would accrue from the operation of the facility in compliance with EPA-imposed [FWPCA] standards; but it cannot go behind either those standards or the determination by EPA or the state that the facility would comply with them." *Public Service Co. of New Hampshire* (Seabrook Station, Units 1 and 2), ALAB-366, 5 NRC 39, 52 (1977). The Commission subsequently quoted this decision with approval, adding that "[t]he relationship of EPA and this Commission in the present setting may be summarized thus: EPA determines what cooling system a nuclear power facility may use and NRC factors the impacts resulting from the use of that system into the NEPA cost-benefit analysis." *Public Service Co. of New Hampshire* (Seabrook Station, Units 1 and 2), CLI-78-1, 7 NRC 1, 26 (1978).

Thus, we reject Entergy's assertion that section 511(c) of the FWPCA bars NEC Contention 1. Certainly, section 511(c) bars NRC from reviewing or imposing effluent limitations, water quality certification requirements, or other FWPCA requirements. But it does not bar NRC from including water quality matters in its assessment of the environmental impact of the license renewal. To

[56] 33 U.S.C. § 1371(c)(2). A recent Supreme Court case has taken note of this prohibition in its analysis. *S.D. Warren Co. v. Maine Board of Environmental Protection*, 126 S. Ct. 1843, 1853 n.8 (2006).

the contrary, NEPA requires the NRC to do so. The required EIS, including water quality matters, then becomes a basis for NRC's ultimate NEPA determination of "whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable at the license renewal stage." 10 C.F.R. § 51.95(c)(4); *see also* 10 C.F.R. § 51.71(d) n.3.

Turning to the specifics of NEC Contention 1 and the pleadings, we see that they focus on a second set of regulatory issues that are narrower and more difficult than the section 511(c) issue. For example, a key issue raised by the pleadings is whether Entergy has satisfied the requirement that renewal applicants with plants with once-through cooling water systems

> shall provide a copy of current Clean Water Act 316(b) determinations and, if necessary, a 316(a) variance in accordance with 40 CFR part 125, or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock and impingement and entrainment.

10 C.F.R. § 51.53(c)(3)(ii)(B). Entergy points to the March 30, 2006, amendment to its NPDES permit that was issued by the State of Vermont and claims that this document satisfies the first prong of section 51.53(c)(3)(ii)(B).[57] But the meaning and status of that amendment to the NPDES permit are unclear, given that the permit expired on March 31, 2006, is the subject of an appeal, and was recently stayed. *Entergy Nuclear/Vermont Yankee Thermal Discharge Permit Amendment* (State of Vermont Envtl. Court, Docket No. 89-4-06 Vtec, August 28, 2006) (Appeal of Connecticut River Watershed Council, *et al.*). If the NPDES permit, which addresses the increased thermal impact of the Vermont Yankee facility, is valid and effective, then the first prong of 10 C.F.R. § 51.53(c)(3)(ii)(B) is satisfied. If not, then the second prong requires Entergy to "assess the impact on fish and shellfish resources resulting from heat shock." 10 C.F.R. § 51.53(c)(3)(ii)(B). Presumably, as specified by the NRC Staff, these factual issues will be confronted in the litigation of NEC Contention 1.

Another issue concerning thermal impacts on aquatic systems is whether 10 C.F.R. § 51.53(c)(3)(ii)(B) is the *only* requirement the applicant must meet. The regulation focuses only on "heat shock." Does NEPA require an assessment of all environmental impacts of thermal discharges into a river or only the "heat shock" impacts? Are the general ER requirements found at 10 C.F.R. §§ 51.45(c) and 51.53(c) displaced, or instead merely supplemented, by the more narrow 10

[57] Letter from Ted A. Sullivan, Site Vice President, Vermont Yankee Nuclear Power Station, to Nuclear Regulatory Commission (License Renewal Application, Amendment No. 6) (July 27, 2006), ADAMS Accession No. ML062130080.

C.F.R. § 51.53(c)(3)(ii)(B)? This is a matter of regulatory interpretation we need not reach today.[58]

Likewise, NEC Contention 1 raises the issue of the dichotomy of the time periods covered by the respective permits. Entergy is asking for license renewal that will cover the period from 2012 to 2032. In order to comply with NEPA, NRC must assess the environmental impacts, including thermal water impacts, for the 20 years in question. Meanwhile, Entergy's NPDES permit (and/or FWPCA 316(b) determination), even once it is final and effective, will expire in 5 years. Under these circumstances, does Entergy satisfy 10 C.F.R. § 51.53(c)(3)(ii)(B) and Part 51 in general, and does NRC satisfy its NEPA duties, by simply attaching a copy of an NPDES permit that will expire before the NRC license renewal even takes effect? Again, this is a legal and factual issue squarely raised by NEC Contention 1.

Turning to another aspect of this contention, in its motion to strike, Entergy takes particular umbrage at those portions of NEC's reply that make reference to certification under section 401 of the FWPCA. Entergy Motion To Strike NEC Reply at 9-11. According to Entergy, "the original contention does not relate to whether a 401 certification is required," and "NEC's new claims regarding 401 certification [are not] related to the purported bases for the original contention." *Id.* at 9-10. Entergy also takes exception to NEC's reference to temperature increases of greater than 1 degree in certain parts of the river. *Id.* at 11. NEC responds that all of its reply "contains only permissible argument and information directly responsive to Entergy and the NRC Staff answers." NEC Opposition to Entergy Motion To Strike NEC Reply at 5.

The Board grants in part and denies in part Entergy's motion to strike portions of NEC's reply. We agree with Entergy that NEC's attempt to introduce an entirely new argument regarding the alleged need for a section 401 certification is not permissible in a reply. *See* Section III.A.6. We therefore strike those portions of NEC's reply that relate to certification under section 401 of the CWA: the last eight lines of page 3, the first two lines of page 4, the first and second full paragraphs on page 6, and the last five lines of the first full paragraph on page 14. We deny Entergy's motion with respect to all other portions of the reply related to NEC Contention 1, for reasons already stated above.[59] *See supra* note 55.

[58] As a general matter, an applicant's environmental report must include "a discussion of the status of compliance with applicable environmental quality standards and requirements including, but not limited to, . . . *thermal and other water pollution limitations* or requirements which have been imposed by Federal, State, regional, and local agencies." 10 C.F.R. § 51.45(d) (emphasis added). The question, then, is not whether Entergy must provide any information on the effects of thermal effluents in its ER, but rather whether the materials Entergy has submitted satisfy *all* obligations in this area.

[59] The Board will address NEC's motion to amend this contention at a later date. *See* NEC's Late Contention or, Alternatively, Request for Leave To Amend or File a New Contention (Aug. 7, 2006).

2. *NEC Contention 2 (Safety)*

> Entergy's License Renewal Application does not include an adequate plan to monitor and manage the effects of aging [due to metal fatigue] on key reactor components that are subject to an aging management review, pursuant to 10 C.F.R. § 54.21(a) and an evaluation of time limited aging analysis, pursuant to 10 C.F.R. § 54.21(c).[60]

NEC's first safety contention alleges that section 4.3 of Entergy's application acknowledges that "key [reactor] components will crack and/or fail due to metal fatigue during the proposed renewed license term" but that Entergy has failed to demonstrate that these aging effects will be adequately managed. NEC Petition at 14-15. The regulations specify that each renewal application must contain "an evaluation of time-limited aging analyses (TLAAs[61])" wherein:

> The applicant shall demonstrate that —
>
> (i) The analyses remain valid for the period of extended operation;
>
> (ii) The analyses have been projected to the end of the period of extended operation; or
>
> (iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

10 C.F.R. § 54.21(c)(1)(i)-(iii). NEC also cites 10 C.F.R. § 54.21(a)(3) (the application must "demonstrate that the effects of aging will be adequately managed"). NEC Petition at 16.

According to NEC, Table 4.3.3 of the application shows that Entergy does not meet the first two requirements of the regulation, i.e., subsections (i) and (ii). *Id.* at 15. NEC alleges that Entergy's own data show that the "cumulative use factors (CUFs) that identify which plant component is likely to develop cracks (CUF > 1.0) during the extended period of operation" is greater than 1.0 for a number of key reactor components and piping. *Id.*, Exh. 7, Decl. of Dr. Joram Hopenfeld (May 12, 2006) ¶¶ 8-10 [Hopenfeld Decl.]. NEC asserts that these data indicate that Entergy's time-limited aging analyses (TLAAs) for metal fatigue are not valid for the entire period of license renewal and cannot be projected to the

[60] NEC Petition at 14. This is a direct quote of the first sentence of NEC's section on Contention 2, and more accurately captures the thrust of the petition than does the title of the section.

[61] NRC license renewal regulations define time-limited aging analyses as "licensee calculations and analyses" that (1) "[i]nvolve systems, structures, and components within the scope of a license renewal"; (2) "[c]onsider the effects of aging"; (3) [i]nvolve time-limited assumptions defined by the current operating term"; (4) "[w]ere determined to be relevant by the licensee in making a safety determination"; (5) "[i]nvolve conclusions . . . related to the capability of the system, structure, or component to perform its intended function"; and (6) "[a]re contained or incorporated by reference in the [current licensing basis]" for the plant. 10 C.F.R. § 54.3.

end of that period, and therefore that Entergy has not complied with 10 C.F.R. § 54.21(c)(1)(i) and (ii). NEC Petition at 15.

Turning to 10 C.F.R. § 54.21(c)(1)(iii), NEC asserts that Entergy failed to "demonstrate that . . . the effects of aging . . . will be adequately managed." NEC points out that Entergy's demonstration that the effects of aging will be adequately managed consists entirely of Entergy's statement that it will implement one or more of the following:

> (1) further refinement of the fatigue analyses to lower the predicted CUFs to less than 1.0
>
> (2) management of fatigue at the affected locations by an inspection program that has been reviewed and approved by the NRC (e.g., periodic non-destructive examination of the affected locations at inspection intervals to be determined by a method acceptable to NRC);
>
> (3) repair or replacement of the affected locations.

NEC Petition at 16 (citing the license renewal application at 4.3-7).

NEC alleges that Entergy's proposal is "vague, incomplete, and lacking in transparency" and does not constitute a demonstration that the effects of aging will be adequately managed. NEC Petition at 16. NEC asserts that Entergy's compliance plan does not explain how the CUFs for plant components will be recalculated to yield acceptable values and does not contain either a clear inspection schedule or specific information on how Entergy will repair or replace affected components. NEC Petition at 16; Hopenfeld Decl. ¶¶ 11-13. In the absence of more specific information, says NEC, Entergy's aging management plan for metal fatigue amounts to nothing more than a "plan to develop a plan" and consequently does not meet the requirements of NRC license renewal regulations. NEC Petition at 16-17.

Entergy argues that Contention 2 "is inadmissible because it fails to provide a factual basis demonstrating the existence of any genuine, material dispute with the Application."[62] Entergy alleges that the Application includes a strategy

[62] Entergy Answer to NEC at 18. Entergy uses essentially the same broad objection — that the contention "fails to provide a *factual basis* demonstrating the existence of any *genuine, material dispute*" (emphasis added) — in response to many of the contentions. *See* Entergy Answer to NEC at 18, 25, 30, and 36. But throughout its discussion as to why NEC Contention 2 fails to meet the requirements of 10 C.F.R. § 2.309(f)(1)(i)-(vi), Entergy does not cite the regulation or its pertinent subsections. Perhaps Entergy is complaining that the contention lacks a brief explanation of its "basis," as required by 10 C.F.R. § 2.309(f)(1)(ii). Or perhaps Entergy is asserting that the issue raised in the contention is not "material" as required by subsection (iv). Alternatively, it may be that the contention lacks the factual support required by subsection (v), or that there is no showing of a *(Continued)*

for managing metal fatigue that combines 10 C.F.R. § 54.21(c)(1)(i) and 10 C.F.R. § 54.21(c)(1)(iii) — Entergy will either refine the CUF calculation for a given component until it comes out to the right number, or it will show how aging of that component will be managed during that period. *Id.* at 18-19. According to Entergy, only the problem of environmentally assisted fatigue — metal fatigue due to exposure to water in the plant — has been raised in this contention, and NEC has failed to challenge any of the specific elements of Entergy's proposed plan in this area. *Id.* at 20-21. Entergy also suggests that any such challenge would fail. The analyses presented in the Application sections relevant to environmentally assisted fatigue are conservative, says Entergy, and recalculating CUFs is therefore feasible at Vermont Yankee. *Id.* at 22. Entergy also claims that it has omitted certain elements of its management plan for plant components affected by environmentally assisted fatigue because it is waiting for new, NRC-approved guidance that is due out at the end of this year. *Id.* at 24.

The NRC Staff does not object to admitting NEC Contention 2 provided it is limited to questioning "whether Entergy has provided information on how CUF values are calculated" and "whether Entergy's aging management plan includes a monitoring plan with an inspection schedule and criteria for inspection frequency." Staff Answer to NEC at 11. The contention is "supported by a thin basis," according to the Staff, and does not provide information to support its challenges to information that does appear in the Application. *Id.* Therefore, says the Staff, the contention should be limited to alleged omissions from the Application and may be rendered moot by subsequent submissions by Entergy. *Id.*

In its reply, NEC repeats its claim that Entergy's defense of its program for managing environmentally assisted fatigue is "vague, incomplete and lacking in transparency." NEC Reply at 15. Entergy fails to provide a technical basis for its claim that the CUF values in the Application are conservative, says NEC, and fails to provide enough information for anyone to evaluate its proposed reanalysis of these values. *Id.* at 17. According to NEC, Entergy's plan to wait for new guidance before issuing its inspection schedule proves that the Application is deficient and premature at this time. *Id.* at 17-18. NEC also objects to the Staff's proposal to limit the contention to items of omission, saying that such a plan "puts NEC in quite a 'Catch 22' situation — *i.e.*, NEC's contention is insufficiently supported because NEC fails to address specifics of Entergy's aging management plan that Entergy has not provided, and apparently has not developed." *Id.* at 19.

In its motion to strike portions of NEC's reply, Entergy alleged that the expert witness declaration attached to the reply contained two new allegations that are

"genuine dispute" as required by subsection (vi). It would be helpful if Entergy tied its analysis to the pertinent regulation and specified which subsections of 10 C.F.R. § 2.309(f)(1) allegedly support its objection.

beyond the scope of the original contention and that therefore should be stricken. Entergy Motion To Strike of NEC Reply at 14. Specifically, Entergy claims that the original contention did not include a challenge to "(1) how the CUF values were calculated and adjusted for environmentally assisted fatigue; and (2) whether Entergy could rely on generic correction factors for certain components." *Id.* (citations omitted). NEC responds by claiming that the original contention challenged Entergy's entire plan for managing environmentally assisted fatigue, including the methods used to calculate the CUF values in the Application. NEC Opposition to Entergy Motion To Strike NEC Reply at 9-10. The second declaration by NEC's expert merely provides additional support for the original contention and is therefore admissible. *Id.* at 11.

The Board finds NEC Contention 2 to be admissible. NEC has identified an aging management issue that is clearly within the scope of a license renewal proceeding and has provided the threshold level of explanation and support required by 10 C.F.R. § 2.309(f)(1). NEC's explanation of the logic underlying its contention, in particular its description of how alleged shortcomings in the Application may result in violations of specific NRC license renewal regulations if not addressed, satisfies the basis requirement of 10 C.F.R. § 2.309(f)(1)(ii). NEC has also provided, in the form of a declaration by its expert, a "concise statement of the alleged facts or expert opinions which support the requestor's/petitioner's position." 10 C.F.R. § 2.309(f)(v).

NEC demonstrates a genuine, material dispute with the Application, as required by 10 C.F.R. § 2.309(f)(1)(iv) and (vi), by raising the question of whether Entergy's "plan to develop a plan" to manage environmentally assisted fatigue is sufficient to meet the license renewal requirements of 10 C.F.R. § 54.21(c)(1)(i)-(iii). Because Entergy itself has stated that it is relying on subsection (iii) of this regulation (i.e., the requirement to *demonstrate* that the effects of aging *will* be adequately managed) in the case of environmentally assisted fatigue, Entergy Answer to NEC at 19, a legitimate challenge to Entergy's aging management plan constitutes a genuine dispute.

Although we do not intend to address the merits of the contentions in this decision on admissibility, a quick glance at Entergy's brief presentation of this issue in its Application, Application at 4.3-6 to 4.3-7, suggests that NEC's challenge has sufficient legitimacy to warrant further exploration in this proceeding. Entergy does specify the plant locations at which environmentally assisted fatigue is most likely to cause a problem, but the description of Entergy's plans to manage any problems that occur takes up only half a page and appears to *summarize options for future plans* rather than *demonstrating* compliance. *Id.* Efforts by Entergy's attorneys to justify the options presented in the Application, for example, by claiming that reanalyzing the CUF factors is a feasible option, fail to address NEC's concern that the brief presentation in the Application provides no information at all about *how* Entergy intends to reanalyze the CUF factors if

it should become necessary to do so. Where such reanalysis does not produce a CUF less than 1, Entergy's statement that it will implement "management of fatigue at the affected locations by an inspection program that has been reviewed at and approved by the NRC (*e.g.*, periodic non-destructive examination of the affected locations at inspection intervals to be determined by method acceptable to NRC)," *id.* at 4.3-7, is a bit vague. The nature of the inspection program, the type of examination, the inspection locations, the intervals and the methods of inspection have all been left entirely open. Is this a "demonstration" that the effects of aging will be effectively managed, or just a promise or "plan to develop a plan"? We recognize that it may not be possible for Entergy to specify in advance every detail of its aging management program for metal fatigue — future events will inevitably determine some of the actions that Entergy will have to take. However, there is a range of possibilities between a fully elaborated management, analysis, and inspection program and the extremely abbreviated presentation that Entergy has provided here. Presenting sufficient information in the application to "demonstrate that . . . the effects of aging on the intended function(s) will be adequately managed for the period of extended operation," is required by 10 C.F.R. § 54.21(c)(1)(iii) and 10 C.F.R. § 54.21(a)(3), and there is a legitimate legal and factual question as to whether Entergy has met this requirement. We therefore conclude that NEC has raised a genuine, material dispute with the Application and has therefore met the remaining contention admissibility requirements of 10 C.F.R. § 2.309(f)(1).[63]

3. *NEC Contention 3 (Safety)*

Entergy's License Renewal Application Does Not Include an Adequate Plan to Monitor and Manage Aging of the Steam Dryer During the Period of Extended Operation.[64]

In Contention 3, NEC challenges Entergy's plan to monitor and manage aging of the steam dryer, saying that "Entergy's proposed monitoring techniques are not adequate to detect crack propagation and growth because they are not based on actual measurement of crack initiation and growth, but instead rely on theoretical calculations of computer models — the Computational Fluid Dynamic [CFD] Model and Acoustic Circuit [AC] Model." NEC Petition at 17. NEC avers that "[p]redictions based on these models are subject to large uncertainties, and must

[63] In admitting this contention, we find it unnecessary to rely on the portions of the NEC reply that Entergy argues improperly raise new arguments or claims not found in the original petition. *See* Entergy Motion To Strike NEC Reply at 14. Therefore, we deny Entergy's motion to strike the portions of the NEC reply that relate to NEC Contention 2 because the issue is now moot.

[64] NEC Petition at 17.

be confirmed by 'hands-on' assessment." *Id.* NEC acknowledges that Entergy has indicated it will manage cracking in the steam dryer in accordance with the NRC's Generic Aging Lessons Learned (GALL) Report, NUREG-1801, and with General Electric's Services Information Letter on BWR steam dryer integrity, GE-SIL-644, but says that, even so, Entergy's monitoring techniques are not adequate because they are based on "unproven computer models," i.e, the CFD Model and AC Model, neither of which "were benchmarked against properly scaled dryer structure." Hopenfeld Decl. ¶¶ 18-19.

The steam dryer at Vermont Yankee is prone to accelerated aging, says NEC, because the recent 20% power uprate has "increased flow-induced vibrations (FIV), which markedly increase cyclic loads on the steam dryer." NEC Petition at 18. These stresses may cause the dryer to break, and loose parts may create safety hazards if they interfere with important components of the reactor system. *Id.* NEC's expert, Dr. Hopenfeld, recommends that the existing cracks in the steam dryer be monitored continuously by a competent engineer. Hopenfeld Decl. ¶ 18.

Entergy argues that Contention 3 is inadmissible because it is "not supported by a basis demonstrating a material dispute with the Application." Entergy Answer to NEC at 25. Entergy says that NEC "fail[s] to take issue with documentation available on the docket," *id.* at 26, and cites to the Vermont Yankee's application to NRC for an extended power uprate (EPU) which includes a separate adjudication before a different Board,[65] to demonstrate that the steam dryer monitoring program at Vermont Yankee includes visual inspection and monitoring by instrument in addition to the predictions generated by the models NEC contests. Entergy Answer to NEC at 27-30. Entergy asserts that NEC has an "ironclad obligation" to examine this information and use it to support its contention. *Id.* at 26 (citing *Duke Power Co.* (Catawba Nuclear Station, Units 1 and 2), ALAB-687, 16 NRC 460, 468 (1982)). Entergy also alleges that Contention 3 is merely an attempt to revive steam dryer contentions that were rejected as late in the EPU proceeding. Entergy Answer to NEC at 26.

The NRC Staff admits that Contention 3 is within the scope of the proceeding "to the extent that it questions whether the two computer models provide an adequate basis for monitoring of crack propagation and growth . . . during the renewal period," but argues that the contention is not supported adequately because Dr. Hopenfeld's opinions are "conclusory." Staff Answer to NEC at 12. The Staff quotes the familiar dicta that "neither mere speculation nor bare or conclusory assertions, even by an expert, . . . will allow admission of a proffered contention." *Id.* at 13 (citing *Exelon Generation Co., LLC* (Early Site Permit for Clinton ESP Site), LBP-04-17, 60 NRC 229, 241 (2004)). The

[65] *Entergy Nuclear Vermont Yankee, LLC* (Vermont Yankee Nuclear Power Station), Docket No. 50-271-OLA, ASLBP No. 04-832-02-OLA.

160000

Staff therefore argues that Contention 3 lacks an adequate basis and fails to demonstrate a genuine dispute, and should therefore be rejected for failing to meet the contention admissibility standards of 10 C.F.R. § 2.309(f)(1).

In its reply, NEC emphasizes that

> Entergy's program to monitor its steam dryer during the remaining six years of its current license term, developed in the EPU proceeding, does not address NEC's concern that Entergy has not developed an adequate program to monitor aging of the steam drying [*sic*] during the additional twenty years of its requested second license term.

NEC Reply at 21. Aging management of the steam dryer was not an issue in the EPU proceeding, says NEC, and the EPU proceedings did not "establish[] the technical basis for life extension." *Id.* NEC asserts that the duration of Entergy's visual monitoring program is finite,[66] and that the application in *this* proceeding does not extend the current program for the full 20 years of the license renewal term. *Id.* at 22. NEC attaches a second declaration by Dr. Hopenfeld and certain testimony from a proceeding before the Vermont Public Service Board in further support of the contention. Entergy's motion to strike portions of NEC's reply specifically challenge the portions that make these assertions, as well as related attachments. Entergy Motion To Strike NEC Reply at 13, 17.

As a threshold matter, the Board notes that since Entergy's existing license continues until 2012, its application for a license renewal necessarily only involves aging management matters *after* that date. Steam dryer monitoring and inspection plans for the time period prior to 2012 are not directly relevant to, or dispositive of, our ruling on NEC Contention 3 except to the extent that Entergy's license renewal application, or other materials properly before *this* Board at this stage in the proceeding, indicates a commitment to continue existing programs. Entergy's apparent assertion that the history of the steam dryer issue in the separate EPU proceeding should resolve the issue in this proceeding is therefore without foundation. As demonstrated by Entergy's own pleading, steam dryer issues were addressed in the EPU proceeding primarily in regard to the power ascension program toward EPU levels and the first few operating cycles thereafter. Entergy Answer to NEC at 28-30. The Board in the EPU proceeding denied several contentions related to steam dryer cracking because they were not timely, but noted that one of the steam dryer contentions "may satisfy the six basic criteria of 10 C.F.R. § 2.309(f)(1)." *Vermont Yankee*, LBP-06-14, 63 NRC at 589 n.35.

[66] At oral argument, NEC's attorney emphasized that NEC is aware of Entergy's inspection and monitoring program for the current license period, and that the organization's main concern is visual inspection and monitoring during the license renewal term. Tr. at 331-32.

The rulings on contentions in other proceedings are not particularly relevant to the decision this Board must make on NEC Contention 3.

Taking these limits into account, the Board finds that NEC has demonstrated a "genuine dispute" under the standards of 10 C.F.R. § 2.309(f)(1)(vi) by raising a challenge to Entergy's plans for aging management of the steam dryer beyond 2012. Dr. Hopenfeld states his analysis and expert opinion as follows:

> [T]he management of cracking at the steam dryer will be in accordance with current guidance per NUREG 1801, GE-SIL-644 and possibly future guidance from BWRRVIP-139, if approved by NRC. No matter which guidance Entergy follows, the status of the existing dryer cracks must be continuously monitored and assessed by a competent engineer.
>
> Entergy's proposed monitoring techniques are not adequate to detect crack propagation and growth because they are not based on actual measurements of crack initiation and growth. Instead, Entergy relies on unproven computer models and moisture monitors which only indicate that the dryer was already damaged. The estimated fatigue loads on the dryer are based on theoretical calculations of two computer models: the [CFD] Model and the [AC] Model. Neither the CFD nor the ACM were benchmarked against properly scaled dryer structure and therefore their predictions are subject to large uncertainties.

Hopenfeld Decl. ¶¶ 18-19.

The Board rejects the argument that these statements are "bald or conclusory." We agree that NRC case law does not permit admission of contentions when petitioners "offer[] no tangible information, no experts, no substantial affidavits," but instead submit only "bare assertions and speculation." *Oyster Creek,* CLI-00-6, 51 NRC at 208. But this is not the case here, where Petitioners present sworn statements by an unchallenged expert who describes his professional reasoning and arrives at recommendations and conclusions based on that reasoning. Full evidentiary presentations are not required at the contention admissibility stage. NEC is not required to prove its contention at this time, but merely to identify the alleged shortcomings in Entergy's application with enough specificity to ensure that "the Applicants are sufficiently put on notice so that they will know at least generally what they will have to defend against or oppose, and that there has been sufficient foundation assigned to warrant further exploration of [the] contention."[67] We find that NEC has met this requirement.

We also reject the notion that NEC, in contending that Entergy's reliance on the CFD Model and AC Model is problematic, has ignored the other monitoring activities that Entergy has proposed for the next 6 years, and therefore has

[67] *Kansas City Gas & Electric Co.* (Wolf Creek Generating Station, Unit 1), LBP-84-1, 19 NRC 29, 34 (1984) (citing *Philadelphia Electric Co.* (Peach Bottom Atomic Power Station, Units 2 and 3), ALAB-216, 8 AEC 13, 20-21 (1974)).

raised no genuine dispute. To the contrary, Dr. Hopenfeld specifically notes that "management of cracking at the steam dryer will be in accordance with current guidance per NUREG-1801 [and] GE-SIL-644." As we see it, NEC is arguing that, even with such monitoring, reliance on the models during the renewal period that starts in 2012 is inappropriate.[68]

In admitting this contention, this Board grants in part and denies in part Entergy's motion to strike portions of NEC's reply. Specifically, the Board strikes the first paragraph on page 21 of the reply, the first full paragraph on page 23, all portions of the second Hopenfeld declaration concerning this contention (¶¶ 11-15), and all of the attached testimony from the proceeding before the Vermont Public Services Board. These portions of the reply and of its attachments include new arguments and factual information that were not included in the initial petition and do not directly address challenges in the answers, and that therefore exceed the permissible scope of a reply. *See* Section III.A.6.

The Board denies Entergy's motion to strike relating to NEC Contention 3 with respect to all other portions of the reply. The paragraphs in question respond to legal, logical, and factual arguments raised in the answers, and emphasize the obvious — that, given that this is a license renewal proceeding, NEC is challenging the aging management of the steam dryer during the license renewal period, not during the preceding 6 years. NEC Reply at 21-22. While NRC practice does not permit petitioners to use reply briefs to provide the threshold level of support required for contention admissibility, petitioners may use replies to flesh out contentions that have already met the pleading requirements of 10 C.F.R. § 2.309(f)(1). *National Enrichment Facility,* CLI-04-35, 60 NRC at 623.

The Board also emphasizes that it is not ruling on the factual material Entergy presents in its answer at this time. Entergy's answer appears to challenge NEC's petition on the merits by making extensive reference to documents in another proceeding which, when examined more fully, may or may not turn out to support Entergy's position in this matter. The contention admissibility stage of a proceeding is not the appropriate time for this examination. Furthermore, assurances offered by Entergy's counsel, whether in pleadings or at oral argument, are not in evidence before this Board and cannot be granted the same weight as sworn testimony or exhibits. We conclude that NEC has identified sufficient ambiguity in Entergy's aging management plan for the steam dryer to meet the requirements for contention admissibility.

[68] We also note that NEC has drawn attention to some ambiguities regarding Entergy's commitments and plans for steam dryer monitoring and inspection during the license renewal term. Specifically, while the Application makes reference to Entergy's current program for managing steam dryer cracking due to FIV, future commitments in this area appear tentative and unspecific. *See* Application at 3.1.2.2.11.

4. *NEC Contention 4 (Safety)*

Entergy's License Renewal Application Does Not Include an Adequate Plan to Monitor and Manage Aging of Plant Piping Due to Flow-Accelerated Corrosion During the Period of Extended Operation.[69]

NEC Contention 4 alleges that Entergy's plan for managing flow-accelerated corrosion (FAC) in plant piping fails to meet the requirements of 10 C.F.R. § 54.21(a)(3), i.e., "fails to demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operations." NEC Petition at 18. NEC takes particular exception to Entergy's proposal to use "a computer model called CHECWORKS to determine the scope and frequency of inspections of components that are susceptible to FAC." *Id.* NEC alleges that Entergy cannot rely on CHECWORKS because the recent power uprate has changed plant parameters, including coolant flow rates, and that the model cannot generate accurate recommendations because it has not been benchmarked with data reflecting these new parameters. *Id.* at 19. For that reason, says NEC, "Entergy cannot assure the public that the minimum wall thickness of carbon steel piping and valve components will not be reduced by FAC to below . . . code limits during the period of extended operation." *Id. See also* Hopenfeld Decl. ¶¶ 21-27.

Entergy argues that Contention 4 is "vague and not supported by an adequate basis demonstrating the existence of a genuine material dispute" and that NEC has not identified specific pipes and valves that are vulnerable to FAC. Entergy Answer to NEC at 30. Entergy claims that "NEC fails to demonstrate that its concerns about CHECWORKS have any basis or would materially affect the adequacy of the FAC program" at Vermont Yankee. *Id.* at 31. Entergy points out that CHECWORKS is only one of many "factors considered in planning future inspections," and that "[t]he inspection scope is determined not only by the use of the CHECWORKS tool, but also is based on past VYNPS inspections, engineering judgment and industry operating experience." *Id.* at 32. Entergy also argues that NEC fails to provide "any real basis indicating that CHECWORKS cannot be used after EPU, other than Dr. Hopenfeld's bald assertion that it would take '10-15 years' before CHECWORKS can be benchmarked by inspection data." *Id.* Dr. Hopenfeld "provides absolutely no support for this assertion," says Entergy, and "unsupported conclusory assertions, even by an expert, cannot support the admission of a contention." *Id.* at 32-33. Finally, Entergy claims that the factual information on predicting FAC that was presented in the EPU proceeding should be considered part of this proceeding, which would bar NEC's contention if NEC "makes no effort to discuss or identify any error in the

[69] NEC Petition at 18.

consideration of FAC in that proceeding." *Id.* at 36. NEC has failed to consider the record of the EPU proceeding, according to Entergy, and has therefore failed to demonstrate a genuine material dispute. *Id.*

The NRC Staff repeats Entergy's argument that Dr. Hopenfeld's claim about benchmarking CHECWORKS is unsupported and therefore provides no basis for Contention 4. Staff Answer to NEC at 14. The Staff asserts that the Generic Aging Lessons Learned (GALL) Report indicates that CHECWORKS was benchmarked using data from many plants, and that it is appropriate to use the model in this condition in connection with a comprehensive FAC management program such as that proposed by Entergy. *Id.* (citing GALL Report § XI.M17). Using CHECWORKS in this way "provides a bounding analysis," and an inspection schedule based on this analysis will "provide[] reasonable assurance that structural integrity will be maintained between inspections." *Id.*

In its reply, NEC emphasizes that resolution of the FAC issue in the EPU proceeding does not resolve it over the much longer time period the Board must consider in the license renewal proceeding. NEC asserts that "[t]he possibility of undetected wall thinning increases substantially with age," and "it may be necessary to modify the FAC program as the plant ages." NEC Reply at 26. NEC argues that Entergy has not explained how it will use CHECWORKS in an aging management program that covers the license renewal period, nor has Entergy provided support for its claim that the wear rate in pipes is proportional to the velocity increase at EPU conditions and therefore presents no prediction problems. *Id.* at 26-27. Finally, NEC argues that Dr. Hopenfeld's statement that it will take 10-15 years to benchmark CHECWORKS at EPU conditions is based on his extensive professional experience and is therefore not conclusory. *Id.* at 27. The declaration by Dr. Hopenfeld that accompanies the reply includes statements related to Contention 4. Entergy's motion to strike portions of the NEC reply seeks to have the second Hopenfeld declaration and all references to it stricken on the grounds that it represents an effort to "recast" the contention and is therefore impermissible under the rules governing reply briefs. Entergy Motion To Strike NEC Reply at 14; *see also* Section III.A.6.

As we did for Contention 3, the Board begins by pointing out that since Entergy's existing license continues until 2012, its Application for a license renewal necessarily involves only aging management matters after that date. FAC monitoring and inspection plans during the current license period are not directly relevant to, or dispositive of, our ruling on NEC Contention 4, except to the extent that Entergy's license renewal application, or other materials properly before *this* Board at this stage in the proceeding, indicates a commitment to continue existing programs. Resolution of this issue for the period up to 2012 does not necessarily resolve the issue for the years from 2012 to 2032, especially when the phenomenon in question may have cumulative effects.

Taking this limitation into account, the Board finds that NEC Contention 4

meets the admissibility standards of 10 C.F.R. § 2.309(f)(1). It raises a challenge to Entergy's plans for aging management of plant components subject to FAC, and it supports that challenge adequately. NEC's expert states his analysis and expert opinion in the following words:

> The theoretical basis of FAC is not completely understood; however, it is well established that turbulence intensity, steam quality, material compositions, oxygen content and coolant pH are the main variables that affect FAC. The CHECWORKS computer code is not a mechanistic code; it is an empirical code that must be updated continuously with plant-specific data. Inspection results are routinely used as inputs to the code. The code can be used to predict pipe wall thinning as long as plant parameters (velocity, coolant chemistry, etc.) do not change drastically and the data have been collected for a long period of time. It is important to realize that wall thinning rate from FAC is not necessarily consistent with time, and therefore a considerable number of cycles are needed to establish the FAC rate on a given component at a particular plant. Since Vermont Yankee has recently increased the coolant flow rate by 20%, which also significantly accelerates local wall thinning, it would take at least 10-15 years before CHECWORKS can be benchmarked with the Vermont Yankee inspection data.

Hopenfeld Decl. ¶ 24.

The Board does not agree that such statements are "bald" or "conclusory." As we stated above, NRC regulations do not permit admission of a contention when petitioners offer *no* documentary or expert support for their positions. *See* Section III.D.3. But NEC has done considerably more here — Dr. Hopenfeld has submitted a sworn statement describing his professional reasoning and conclusions, and his qualifications to speak as an expert on this subject matter have not been challenged. As we have already stated, NEC is not required to prove its contention at this point or to provide all the evidence for its contention that may be required later in the proceeding. *See* Section III.A.4. Rather, it is required only to provide sufficient information that "the Applicants are sufficiently put on notice so that they will know at least generally what they will have to defend against or oppose, and that there has been sufficient foundation assigned to warrant further exploration of [the] contention." *Wolf Creek*, LBP-84-1, 19 NRC at 34. We find that NEC has met this requirement.[70]

We also reject the notion that NEC's challenge to Entergy's use of CHECWORKS in its aging management program for FAC is barred because similar issues were discussed during the NRC review of Entergy's EPU application. As NEC has claimed,

[70] We do not elevate Dr. Hopenfeld's reference to "10-15 years" as dispositive here. His point seems to be that benchmarking will take longer than the 6-year period covered by the EPU.

> FAC is an aging phenomenon; the EPU proceedings assumed that the plant would operate six years, not 26 years at the high EPU velocities. The possibility of undetected wall thinning increases substantially with age. Therefore, it may be necessary to modify the FAC program as a plant ages. Entergy's license renewal application does not explain how it proposes to use CHECWORKS as an aging management tool during the period of extended operation, or how it will overcome the problem of establishing valid trends at higher EPU velocities . . . .

NEC Reply at 26. We have previously stated that materials submitted as part of the EPU proceeding are not dispositive in this proceeding except to the extent that Entergy's license renewal application, or other materials properly before *this* Board at this stage in the proceeding, indicates a commitment to continue existing programs. *See* Section III.D.3. At the moment we do not see any such clear and binding commitment in the record. Furthermore, even if such a commitment were made, the very nature of a license renewal proceeding prevents NEC from contesting the adequacy of Entergy's current FAC program to deal with the extent of corrosion that is likely over the coming 6 years. Rather, NEC is limited to contesting aging management plans for the next 20 years — in this case by questioning whether a program similar to the current one will be adequate to address the amount of corrosion that may occur during the 20 years of extended operation.

In ruling to admit this contention, this Board grants in part and denies in part Entergy's motion to strike portions of NEC's reply. Specifically, the Board strikes the second Hopenfeld declaration concerning this contention (¶¶ 16-22). This attachment to the reply includes new arguments and factual information that were not included in the initial petition and that do not directly address challenges in the answers, and that therefore exceed the permissible scope of a reply brief. *See* Section III.A.6.

The Board denies Entergy's motion to strike with respect those portions of the reply itself that deal with Contention 4. The portions in question merely respond to legal, logical, and factual arguments raised in the answers, in particular to Entergy's allegation that the treatment and resolution of the FAC issue during NRC review of the EPU application should be dispositive in the license renewal proceeding. As we see it, the argument in NEC's reply restates the obvious — NEC is challenging aging management plans during the license renewal period, not during the preceding 6 years.

As we did in our discussion of Contention 3, the Board also emphasizes that it is not ruling on the factual material Entergy presents in its answer at this time. Entergy's answer appears to challenge NEC's petition on the merits by making extensive reference to documents in the EPU proceeding which may or may not turn out to support Entergy's position in this matter. The contention admissibility stage of a proceeding is not the appropriate time to evaluate this information.

Additionally, given the differing natures of the EPU license amendment and a license renewal request, such materials may not be sufficient to resolve the issue in this proceeding even at the evidentiary stage. As we have already stated, assurances offered by Entergy's counsel, whether in pleadings or at oral argument, are not in evidence before this Board and cannot be granted the same weight as sworn testimony or exhibits. We conclude that NEC has identified sufficient ambiguity in Entergy's aging management plan related to FAC to meet the requirements for contention admissibility.

5. *NEC Contention 5 (Safety)*

The License Renewal Application Does Not State an Adequate Plan to Manage and Monitor Aging of the Condenser.[71]

NEC Contention 5 challenges Entergy's assertion that "main condenser integrity is continually verified during normal plant operation and no aging management program is required to assure the post accident intended function." Application at 3.4-26, Table 3.4.2-1. NEC contends that the plant condenser is "a key plant component necessary to mitigate the release of radioactive gases during an accident at the plant." NEC Petition at 19. Based on his review of the Application, Arnold Gunderson, NEC's expert, claims that "the applicant has not adequately addressed the actual condition of the condenser" and notes that this plant component is likely to withstand neither "the stresses of [EPU]" nor "the pressure of continual operation for the additional 20 years Entergy would like to extend Vermont Yankee's operation." *Id.*, Exh. 8, Decl. of Arnold Gundersen Supporting [NEC Petition] (May 26, 2006) ¶¶ 9-10. NEC's expert cites several documents provided during discovery in a proceeding before the Vermont Public Service Board in support of his opinion that the condenser is in poor condition and requires both additional inspections and preventive measures such as epoxy coating of certain condenser components if it is to remain in service. *Id.* ¶¶ 13-25. Following his review of these documents, Mr. Gundersen concludes that "it is not logical to assume that a deficient condenser with six-foot cracks with poor welds, which is lucky to withstand gravity, will be adequate protection to the public by preventing the flow of radioactive gases in the event it is required to mitigate an accident." *Id.* ¶ 33.

Entergy responds with the claim that Contention 5 fails because it "is entirely predicated on the erroneous unsupported assumption that the condenser must retain its integrity (*i.e.*, must remain intact) in order to perform its post-accident

[71] NEC Petition at 19.

function." Entergy Answer to NEC at 36. Entergy argues that, under the terms of its license renewal application,

> [c]ondenser integrity required to perform the *post-accident intended function (holdup and plateout of MSIV leakage)* is continuously confirmed by normal plant operation. *This intended function does not require the condenser to be leak-tight,* and the post-accident conditions in the condenser will be essentially atmospheric. Since the normal plant operation assures adequate condenser pressure boundary integrity, the post-accident intended function to provide holdup volume and plateout surface is assured.

Id. at 37 (citing Application at 3.4-26) (first emphasis added). Entergy points out that the condenser is not a safety-related component, and that even though the alternative source term analysis credits the condenser for some "hold-up and plate-out of gases[72] that might, in the event of a [LOCA], leak past the main steam isolation valve," this post-accident function of the condenser does not require the condenser to be leaktight. Entergy Answer to NEC at 37 n.19. In short, says Entergy, the fact that the condenser works properly during normal operations is sufficient to demonstrate that it remains capable of performing the more limited functions required of it during an accident. According to Entergy, NEC has failed both to provide sufficient information to challenge this part of the Application and to explain any plausible scenario in which the condenser would be unable to perform its post-accident function. *Id.* at 38-39. In Entergy's words, "[a]ll NEC shows is that the condenser may eventually have to be replaced." *Id.* at 40.

The NRC Staff argues that Contention 5 lacks a sufficient basis to the extent that it expresses concerns about the performance of the condenser during any license renewal period, and that it falls outside the scope of the proceeding to the extent that it makes allegations regarding the performance of the condenser during the current license term. Staff Answer to NEC at 16. According to the Staff, the documents referred to by NEC's expert were written in a different context and "do[] not indicate a dispute concerning an Application pending before the NRC." *Id.* Furthermore, says the Staff, "NEC ignores the fact that the application (at 3.4-2) . . . states that the Main Condenser and MSIV Leakage Pathway components will be under aging management programs" and therefore demonstrates that it has failed to fulfill "its obligation to examine publically available information." *Id.*

The Board concludes that NEC Contention 5 is not admissible because NEC has failed to show that the issue raised — the integrity of the condenser — is

[72] The phrase "hold-up and plate-out of gases" means that the condenser physically slows the release of gases (and by implication, the nongaseous daughter fission products) and that the surface areas of its plates capture or absorb some of the fission products.

"within the scope of" or "material to the findings NRC must make to support" a license renewal decision. 10 C.F.R. § 2.309(f)(1)(iii) and (iv). NEC has not provided any supporting information as to how the failure of the condenser would negatively affect its ability to perform its limited post-accident function — the hold-up and plate-out of some gases and solid daughter fission products. For example, even if the condenser cracked or broke into pieces at the same time a LOCA or other accident occurred, NEC has not given us facts, evidence, or any reason to think that the condenser surfaces would not be equally able to retard the flow of, or absorb, gases that may leak through the MSIVs.

NEC's attempt to rehabilitate its contention by focusing its reply on the "unusual accident" scenario — an accident that destroys the condenser just at the same time the condenser's post-accident function becomes important — fails both substantively and procedurally. In their initial submission to the Board, NEC and its expert mention this scenario but provide no discussion of how it might come about. NEC Petition at 20. However, they expand their arguments in this area in their reply, in which they make reference to an event at Entergy's Grand Gulf plant in which the condenser "imploded" and caused an emergency shutdown. NEC Reply at 29. NEC's pleading does not allege that any radioactive gases were released during the Grand Gulf event. Undeterred, NEC argues that the event demonstrates the possibility of a single incident that "simultaneously cause[s] both implosion of the condenser and a release of radioactive gas." *Id.* NEC's reply also includes a second declaration in which its expert, Arnold Gundersen, provides additional detail regarding scenarios that, in his opinion, might lead to such an outcome. *Id.*, Exh. 2, Decl. of Arnold Gundersen Supporting [NEC Reply] (Jun. 29, 2006) ¶¶ 6.3.1-6.3.2. Entergy's motion to strike portions of NEC's reply specifically addresses the sections in question here. Entergy Motion To Strike NEC Reply at 15-16.

As a substantive matter, the Board finds that NEC's reply, while suggesting events that could trigger NEC's postulated "unusual scenario," fails to explain how it makes any difference — i.e., how such an event would prevent a broken condenser from performing its limited post-accident function of hold-up and plate-out of gases and other fission products from an MSIV leak. In addition, as a procedural matter, the relevant portions of NEC's reply, including those paragraphs of the expert's second declaration that provide accident scenarios, exceed what is permissible in a reply brief and therefore should be seen as an attempt to rehabilitate and to amend the original contention. The Commission has stated clearly that such attempts to amend contentions are impermissible

in reply briefs.[73] NEC makes no effort to address the criteria for amended and new contentions in 10 C.F.R. § 2.309(f)(2). The Board therefore strikes Mr. Gundersen's second declaration and those portions of NEC's reply brief that refer to it.

For the reasons stated, NEC Contention 5 is not admissible.

6. *NEC Contention 6 (Safety)*

> The License Renewal Application does not include an adequate plan to monitor and manage aging of the primary containment boundary adequate to assure public health and safety for the twenty-year term of the proposed license extension (renewal), as required pursuant to 10 C.F.R. § 54.21(a)(3).[74]

NEC Contention 6 is a safety contention focusing on the adequacy of Entergy's aging management plan for the reactor primary containment. NEC states that "Entergy has not provided an aging management plan for areas of the primary containment which are difficult to inspect, maintain and repair because of limited access, and which may harbor conditions conducive to general, pitting and crevice corrosion." NEC Petition at 21. NEC alleges that Entergy has not demonstrated that the steel drywell shell is protected from moisture by its concrete encasement, saying instead that contact areas and narrow spaces between the concrete and the steel are the places "most likely to harbor undetected moisture and corrosion." *Id.* at 23. To support this contention, NEC cites two in-service inspection reports for the plant that made reference to corrosion and loss of coating in the drywell shell. *Id.* at 23-24. NEC also cites the NRC Staff's Proposed Interim Staff Guidance LR-ISG-2006-01: Plant Specific Aging Management Program for Inaccessible Areas of Boiling Water Reactor Mark I Steel Containment Drywell Shell.[75] NEC Petition at 25, Exh. 9.

Entergy responds that Contention 6 is inadmissible because it "fails to identify any deficiency in the discussion of this issue in the application" and therefore fails to demonstrate a genuine dispute with the applicant. Entergy Answer to NEC at 41. Specifically, Entergy asserts that NEC made no effort to show why Entergy's

---

[73] *National Enrichment Facility*, CLI-04-25, 60 NRC at 224-25 ("[W]e concur with the Board that the reply briefs constituted a late attempt to reinvigorate thinly supported contentions by presenting entirely new arguments in the reply briefs. . . . In Commission practice, and in litigation practice generally, new arguments may not be raised for the first time in a reply brief.").

[74] The topic heading of NEC Contention 6 ("Primary Containment Corrosion Including, But Not Limited to the Dry Well") does not contain a specific statement of the issue that NEC seeks to raise. The statement of the issue NEC seeks to raise appears in the first sentence of the body of the petition and thus we view this sentence as the specific contention. *See* Tr. at 430-31.

[75] 71 Fed. Reg. 27,101 (May 9, 2006).

May 15, 2006, amendment to its license renewal application,[76] which describes Entergy's monitoring plan for the steel drywell shell, its approach to determining whether corrosion is occurring in the inaccessible areas of the structure, and the methods it has used to deal with the corrosion mentioned in the in-service inspection reports, is inadequate. *Id.* at 41-44. The NRC Staff echoes Entergy's argument, saying that NEC has failed to demonstrate a genuine dispute with the applicant or to address why Amendment 2 is inadequate. Staff Answer to NEC at 18.

NEC first addressed Amendment 2 in its reply, arguing that it "does not alleviate NEC's concerns regarding the condition of the lower drywell shell, and the adequacy of Entergy's plans to monitor and inspect less accessible areas."[77] Specifically, says NEC, the amendment fails to address any "historically reported leaks" that might lead to moisture near the drywell, aging management of gaskets and seals where leakage might affect the primary containment, or maintenance activities and other stresses that might induce corrosion. *Id.* at 32. NEC also claims that Entergy fails to provide sufficient detail to allow reviews to evaluate its plans for ultrasonic testing of the drywell shell. *Id.*

The Board concludes that NEC Contention 6 fails to satisfy the contention admissibility requirements of 10 C.F.R. § 2.309(f)(1)(v) and (vi) in that NEC has failed to "[p]rovide a concise statement of the alleged facts or expert opinions which support the requestor's/petitioner's position on the issue" or to "show that a genuine dispute exists with the applicant/licensee." Specifically, we have little or no idea why NEC believes that Entergy's May 15, 2006, plan for aging management of the drywell shell is inadequate. The in-service inspection reports that NEC cites deal with events in 1999 and 2001 that have apparently been resolved and do not indicate that similar events will happen in the future. The only other support NEC offers for its contention is a meeting notice for a June 2006 meeting involving the NRC Office of Nuclear Reactor Regulation, at which the known corrosion problems at the Oyster Creek Generating Station were discussed, and the NRC Staff proposed guidance document. NEC Petition at 25-26. Neither is relevant to the question of whether corrosion of the drywell shell has been a significant problem at Vermont Yankee in the past or is likely to be so in the future, and neither provides support for NEC's argument that Entergy's plans to manage corrosion of the drywell shell are inadequate. Given the absence of documentary or expert support for NEC's position, this contention fails to

[76] Letter from Ted A. Sullivan, Site Vice President, Vermont Yankee Nuclear Power Station, to Nuclear Regulatory Commission (License Renewal Application, Amendment No. 2) (May 15, 2006), ADAMS Accession No. ML061380079 [Amendment 2].

[77] NEC Reply at 31. During the oral argument, it became clear that NEC was not aware of Amendment 2 when NEC filed its petition on May 26, 2006. Tr. at 433. This is understandable, because Amendment 2 did not become publicly available on ADAMS until May 26, 2006. Tr. at 446.

demonstrate that a genuine dispute exists. Under these conditions, the Board finds that NEC Contention 6 is inadmissible.

E. Ruling on Marlboro Request (Exclusion from Emergency Planning Zone)

The Town of Marlboro, Vermont, contends that it was erroneously excluded from the emergency planning zone (EPZ) surrounding the Vermont Yankee Nuclear Power Station. Marlboro Hearing Request at 1. According to Marlboro, the State of Vermont has a "whole-town inclusion policy," meaning every town with any property within a 10-mile radius must be included in evacuation and notification planning. *Id.* Marlboro further claims that, despite the fact that it is not included in the EPZ, the evacuation plan involves a travel route through Marlboro, which will require the assistance of volunteers from the Town and the use of Town resources. *Id.* Entergy and the Staff both argue that Marlboro's request must be denied because it does not contain a specific contention and because emergency planning issues are outside the scope of license renewal proceedings. Entergy Answer to Marlboro at 1; Staff Answer to Marlboro at 3.

We find that Marlboro has failed to submit an admissible contention. A petitioner must demonstrate that the issues raised in its contention are within the scope of the proceeding. 10 C.F.R. § 2.309(f)(1)(iii). Marlboro, however, has not demonstrated that emergency planning issues are within the scope of this proceeding. To the contrary, it is well established that concerns regarding emergency planning are beyond the scope of license renewal proceedings. *See, e.g., Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Units 2 and 3), CLI-05-24, 62 NRC 551, 560-61 (2005). Therefore, the Town of Marlboro hearing request is denied.[78]

IV. SELECTION OF HEARING PROCEDURES

A. Standards Governing Selection of Hearing Procedures

NRC regulations provide for a number of different procedural formats for adjudicatory hearings, two of which are relevant here. These are (1) the "Rules for Formal Adjudications," 10 C.F.R. Part 2, Subpart G, and (2) the rules for "Informal Hearing Procedures for NRC Adjudications," 10 C.F.R. Part 2, Subpart L. The formal adjudicatory procedures of Subpart G allow the parties to propound interrogatories, take depositions, and cross-examine witnesses without

[78] Although the Town of Marlboro is not admitted to the proceeding, it may still participate as an interested local governmental body. *See* Section VI.B.

leave of the Board. In contrast, under the "informal" adjudicatory procedures of Subpart L, discovery is prohibited except for certain mandatory disclosures, the Board conducts oral hearings during which it interrogates the witnesses, and cross-examination by the parties is permitted only if the Board deems it necessary for the development of an adequate record.

The Commission's rule governing the selection of hearing procedures states that upon granting a hearing request in a license renewal proceeding, a licensing board must determine the specific hearing procedures to be used in this proceeding as follows:

> (a) Except as determined through the application of paragraphs (b) through (h) of this section, proceedings . . . *may be* conducted under the procedures of subpart L of this part.
>
> . . . .
>
> (d) In proceedings . . . where the presiding officer by order finds that resolution of the contention or contested matter necessitates resolution of issues of material fact relating to the occurrence of a past activity, where the credibility of an eyewitness may reasonably be expected to be at issue, and/or issues of motive or intent of the party or eyewitness material to the resolution of the contested matter, the hearing for resolution of that contention or contested matter *will be* conducted under subpart G of this part.

10 C.F.R. § 2.310(a), (d) (emphasis added). Additionally, a petitioner requesting a Subpart G hearing pursuant to section 2.310(d) "must demonstrate, by reference to the contention and the bases provided and the specific procedures in subpart G of this part, that resolution of the contention necessitates resolution of material issues of fact which may be best determined through the use of the identified procedures." 10 C.F.R. § 2.309(g).

The selection of appropriate hearing procedures is a contention-by-contention matter, dependent on the nature of the specific issues involved in the contention. Thus, for example, a single adjudicatory proceeding may include some contentions litigated under Subpart L and others litigated under Subpart G or N.

B. Selection of Hearing Procedures

DPS asserts that it is entitled to an adjudicatory hearing under the formal procedures specified in Subpart G. DPS Petition at 2. NEC, the other admitted party in this proceeding, does not specify a preference for the hearing procedures. Entergy and the Staff oppose the DPS request for Subpart G hearing procedures and argue that the informal procedures set forth in Subpart L should govern this proceeding. Entergy Answer to DPS at 29-30; Staff Answer to DPS at 5-6.

Although DPS states that it is "entitled" to a Subpart G proceeding, DPS

Petition at 2, DPS did not attempt to demonstrate that its contentions meet the criteria of 10 C.F.R. § 2.310(d). DPS Petition at 4 n.4. In its request for a Subpart G hearing, DPS fails to reference its contentions and bases and does not show that resolution of its contentions require resolution of material issues of fact which may be best determined through the use of Subpart G procedures. *See* 10 C.F.R. § 2.309(g). Therefore, we conclude that DPS has not demonstrated that any of the admitted contentions meet the criteria of 10 C.F.R. § 2.310(d), mandating the use of Subpart G procedures.

We also reject the assertion by DPS that section 274(*l*) of the AEA, 42 U.S.C. § 2021(*l*), obviates the need for it to demonstrate that the Subpart G procedures are applicable to the admitted contentions. *See* DPS Petition at 4 & n.4. Essentially, DPS argues that because section 274(*l*) grants a State interrogation rights, a Subpart G proceeding is mandated. Its reasoning is based on the fact that, in Subpart G proceedings, the parties are allowed to cross-examine witnesses without leave of the Board, whereas in a Subpart L proceeding cross-examination is only permitted "if the presiding officer determines that cross-examination by the parties is necessary to ensure the development of an adequate record for decision," 10 C.F.R. § 2.1204(b)(3). *See* DPS Petition at 3-5.

DPS's brief fails to address *Citizens Awareness Network, Inc. v. United States* [*CAN v. United States*], 391 F.3d 338 (1st Cir. 2004). In that case the First Circuit upheld the validity of the Subpart L regulations on the basis of NRC's representation that the opportunity for cross-examination under 10 C.F.R. § 2.1204(b)(3) of Subpart L is equivalent to the opportunity for cross-examination under the Administrative Procedure Act (APA), 5 U.S.C. § 556(d), i.e., that cross-examination is available whenever it is "required for a full and fair adjudication of the facts."[79] Section 556(d) of the APA is a relatively generous standard.

DPS also failed to address the only decision concerning the relationship between Section 274(*l*) of the AEA and the right to a Subpart G proceeding. *See Entergy Nuclear Vermont Yankee, LLC* (Vermont Yankee Nuclear Power Station), LBP-04-31, 60 NRC 686, 710-11 (2004). In that proceeding, the Board held that *CAN v. United States* could be extended to apply to a State's cross-examination under the AEA. *Id.* Specifically, the Board found that since "the opportunity for cross-examination under Subpart L is equivalent to the opportunity for cross-examination under the APA, . . . [it] is likewise consistent with the State's 'reasonable opportunity . . . to interrogate witnesses' under 42 U.S.C. § 2021(*l*)." *Id.* at 710. We agree with this logic. Accordingly, we find that section 274(*l*) of the AEA does not give a State an absolute right of cross-examination, but states only that "the Commission . . . shall afford

[79] 391 F.3d at 351. The Commission represented to the First Circuit that "the standard for allowing cross-examination under [10 C.F.R. § 2.1204(b)(3)] [is] equivalent to the APA standard." *Id.*

reasonable opportunity for State representatives to . . . interrogate witnesses." 42 U.S.C. § 2021(*l*) (emphasis added). The Subpart L grant of cross-examination to situations where it "is necessary to ensure the development of an adequate record for decision," 10 C.F.R. § 2.1204(b)(3), is consistent with the AEA requirement that State representatives be given a "reasonable opportunity . . . to . . . interrogate witnesses." 42 U.S.C. § 2021(*l*).

Entergy and the Staff suggest that our determination that DPS failed to meet its burden under 10 C.F.R. § 2.309(g) to show that Subpart G procedures are mandated by 10 C.F.R. § 2.310(d) ends the matter, and *requires* that Subpart L procedures be used for each admitted contention in this proceeding. This is not correct. If a specific hearing procedure is not mandated, the plain language of 10 C.F.R. § 2.310(a) uses the term "may" in describing our options in selecting the appropriate hearing procedures. The use of the permissive "may" instead of the mandatory "shall" indicates that even if a petitioner fails to demonstrate that Subpart G procedures are required, the Board "may" still find that the use of Subpart G procedures is more appropriate than the use of Subpart L procedures for a given contention. "In such a circumstance, the Board, in its sound discretion, must determine the type of hearing procedures most appropriate for the specific contentions before it." *Vermont Yankee*, LBP-04-31, 60 NRC at 705. In adopting this approach we acknowledge the Commission's statement that, unless otherwise provided in 10 C.F.R. § 2.310, Subpart L proceedings should "ordinarily" be used. *See* Final Rule: "Changes to the Adjudicatory Process," 69 Fed. Reg. 2182, 2222 (Jan. 14, 2004). Furthermore, at this point we see no particular reason why the additional discovery mechanisms of Subpart G are necessary for the full and fair disclosure of the facts. Nor do we see any reason why the moderate limits on cross-examination under a Subpart L proceeding would hinder the development of an adequate record. Weighing these considerations and based on currently available information, we conclude that the procedures of Subpart L are appropriate for the adjudication of admitted contentions.

V. STATUTORY RIGHT TO HEARING

We now turn to the DPS argument that, because it is a State, section 274(*l*) of the AEA, 42 U.S.C. § 2021(*l*), gives it the right to offer evidence and interrogate witnesses even if a hearing would otherwise not be required and even if no contentions are admitted. *See* DPS Petition at 3-5. The Commission's regulations give a State two ways to participate in adjudicatory proceedings. First, an

660000

"interested State" is given "a reasonable opportunity to participate in a hearing" under 10 C.F.R. § 2.315(c).[80] This allows a State to

> introduce evidence, interrogate witnesses where cross-examination by the parties is permitted, advise the Commission without requiring the representative to take a position with respect to the issue, file proposed findings in those proceedings where findings are permitted, and petition for review by the Commission under § 2.341 with respect to the admitted contentions.

10 C.F.R. § 2.315(c). Second, a State that wishes to raise specific concerns may submit contentions complying with the 10 C.F.R. § 2.309(f)(1) requirements and become a party to the adjudication. As a party, a State may offer evidence and, where necessary to ensure the development of an adequate record, may be allowed to interrogate witnesses. 10 C.F.R. §§ 2.1204(b)(3), 2.1208. *See also* Section IV.B, *supra*. A State that has been admitted as a party is also given the additional opportunity to participate on another party's contentions. *See LES*, CLI-04-35, 60 NRC at 627.

We conclude that the two options that NRC affords to an interested State, when viewed in combination, comply with the section 274(*l*) mandate that a State, such as DPS, be given a "reasonable opportunity" to participate on the Vermont Yankee license renewal application. We reject the assertion that section 247(*l*) gives DPS a right to offer evidence and interrogate witnesses, even if no hearing is otherwise being held and no party has submitted an admissible contention. Federal case law recognizes that NRC's requirement that a petitioner identify specific contentions and the particular bases for the contentions is not inconsistent with section 189a of the AEA, which provides that a hearing shall be granted upon the request of any person whose interest may be affected by the proceeding. *See, e.g., Business and Professional People for the Public Interest v. AEC*, 502 F.2d 424, 426-29 (D.C. Cir. 1974). Given that the Commission's rules granting a hearing request only upon the submission of an admissible contention does not violate section 189a, we likewise find that limiting a State's participation to situations where at least one party submits an admissible contention does not violate the section 274(*l*) requirement that a State be given a "reasonable opportunity" to participate in a hearing. Therefore, we find that DPS's rights under section 247(*l*) are satisfied by the Commission regulations governing Subpart L proceedings.

[80] This regulation implements section 274(*l*) of the AEA. The Commission has held that the opportunity to participate as an interested state is available only if the State has not been admitted as a party under 10 C.F.R. § 2.309. *National Enrichment Facility*, CLI-04-35, 60 NRC at 626-27.

VI. CONTENTION ADOPTION AND INTERESTED STATE PARTICIPATION

A. Adoption

Shortly after all the hearing requests were submitted, DPS and NEC each filed a notice of intent to adopt the AG's contention and the contentions of one another. Although DPS and NEC took the position that a simple notice of adoption is sufficient, both also sought, in the alternative, to adopt the other's contentions by motion. *See* DPS Notice of Intent To Adopt Contentions at 1 n.1; NEC Notice of Adoption of Contentions at 1 n.1. Entergy opposed both filings because DPS and NEC failed to address the criteria for nontimely contentions. Entergy Answer to DPS Notice of Intent To Adopt Contentions at 1-2; Entergy Answer to NEC Notice of Adoption of Contentions at 1-3. The Staff does not oppose DPS and NEC adopting contentions, so long as each party demonstrates an independent ability to litigate any contention for which it becomes the primary sponsor should the initial contention sponsor withdraw from the proceeding. Staff Answer to DPS Notice of Intent To Adopt Contentions at 3; Staff Answer to NEC Notice of Adoption of Contentions at 3.

The Commission's regulations allow a petitioner to adopt the contention of a different petitioner if the adopting petitioner (1) agrees that the sponsoring petitioner will act as the representative with respect to that contention; or (2) if the sponsoring and adopting petitioners jointly agree and designate which one of them will have the authority to act for the petitioners on that contention. 10 C.F.R. § 2.309(f)(3). These are the only substantive regulatory requirements for adoption. When the procedures for adopting contentions were codified in 2004, the Commission explained that by adopting a contention, the adopting party preserves the right to litigate a contention that another party originally proposed if the original sponsoring party leaves the proceeding prior to the resolution of the contention. 69 Fed. Reg. at 2221.

Section 2.309(f)(3), which was added in 2004, is entirely new. Nevertheless, Entergy cites prior case law for the proposition that the nontimely factors should be applied when one intervenor seeks to adopt the contentions of a sponsoring intervenor that seeks to *withdraw* from a proceeding. Entergy Answer to DPS Notice of Intent To Adopt Contentions at 2. *See also Houston Lighting and Power Co.* (South Texas Project, Units 1 and 2), ALAB-799, 21 NRC 360, 381-82 (1985). Entergy seeks to extend the old *South Texas* decision to support the proposition that the section 2.309(c) nontimely factors are applicable *whenever* a party seeks to adopt contentions after the initial contention filing deadline. *See, e.g.*, Entergy Answer to DPS Notice of Intent To Adopt Contentions at 2.

We disagree and conclude that the circumstances in the *South Texas* proceeding are very different from the facts involved in the current contention adoption

requests. In that case, the adoption request came only after the sponsoring intervenor withdrew from the proceeding as part of a settlement agreement. *South Texas*, ALAB-799, 21 NRC at 381. That adoption attempt came several years after the Board admitted the contentions at issue. *See Houston Lighting and Power Co.* (South Texas Project, Units 1 and 2), LBP-80-11, 11 NRC 477 (1980); *Houston Lighting and Power Co.* (South Texas Project, Units 1 and 2), LBP-79-10, 9 NRC 439 (1979). As the Board termed it, the case involved an attempt to adopt "abandoned contentions." *Houston Lighting and Power Co.* (South Texas Project, Units 1 and 2), LBP-82-91, 16 NRC 1364, 1369 (1982).

In contrast, the DPS and NEC adoption notices came very early in this proceeding, only a few weeks after the contentions were due and before we ruled on the admissibility of the contentions. Absent prior consultation between the various petitioners *before* the contentions were filed, consultation which we will not presume, it would have been *impossible* for DPS or NEC to adopt each other's contentions prior to the date they were filed on May 26, 2006. Entergy's position, that all adoptions filed after the original deadline for filing contentions are *automatically* "nontimely" (and thus must go through the eight-factor hoops of 10 C.F.R. § 2.309(c)), would create an illogical and unfair exclusionary wall to adoption. 10 C.F.R. § 2.309(f)(3) imposes no such requirements. It is sufficient for our purposes to hold that if a notice of adoption of a contention is filed within a reasonable time (such as 20 days) after the contention has been filed *and* admitted, then it is deemed timely and is not subject to the nontimely factors specified in 10 C.F.R. § 2.309(c). Accordingly, we find that the DPS and NEC adoption notices were timely.[81]

Next, we turn to the Staff's position. Although the Staff does not oppose the adoption notice, the Staff states that if the initial contention sponsor withdraws from the proceeding, an adopting party must demonstrate an independent ability to litigate each contention it wishes to adopt. *See, e.g.*, Staff Answer to DPS Notice of Intent To Adopt Contentions at 3 (citing *Consolidated Edison Co. of New York* (Indian Point, Units 1 and 2), CLI-01-19, 54 NRC 109, 131-33 (2001)). In *Indian Point*, the Commission granted a petitioner's request to incorporate another petitioner's contentions by reference and stated "if the primary sponsor of an issue later withdraws from this proceeding, the remaining sponsor must then demonstrate to the Presiding Officer its independent ability to litigate this issue. A failure to do so renders the issue subject to dismissal prior to the hearing." *Id.* at 132. The Commission cited no regulation or precedent for this requirement. Nor did the Commission indicate whether it intended to impose this requirement in future adjudications.

[81] The 10-day motions deadline of 10 C.F.R. § 2.323(c) does not apply because the adoption of contentions does not require a motion, as simple notice suffices.

If the Commission did intend to create an additional adoption requirement in *Indian Point,* we would expect that this requirement would appear in the 2004 codification of the procedures for contention adoption, or would have been discussed in that rule's Statement of Considerations. Both 10 C.F.R. § 2.309(f)(3) and the Statement of Considerations, however, are entirely silent on whether the adopting party must demonstrate an independent ability to litigate a contention it seeks to adopt. Perhaps this silence is an expression of the fact that the Commission did not intend that this element be included in the new rule.[82]

We have serious reservations about requiring the adopting party to demonstrate an independent ability to litigate an issue. *Id.* at 132. First, what does it mean? Must the adopting petitioner provide us with its financial statements? Perhaps its membership lists? Amounting to much the same thing, must it hire separate and independent (duplicative?) experts and lawyers? Do we need to see the written retainer agreements, or are pro-bono volunteers sufficient? What level of investigation do we conduct, and what objective criteria do we use, to decide whether the adopting party satisfactorily "demonstrated its independent ability to litigate" the contention? Second, how can we impose this requirement on the adopting party, when there is no such requirement imposed on the original sponsoring petitioner? Surely the Staff is not suggesting that the fact that the original sponsoring party is able to meet the strict but minimal requirements for admission of a contention demonstrates that it has an independent ability to litigate the full merits of the contention. Section 2.309(f) lists many reasons for excluding a contention, but "demonstrating an independent ability to litigate an issue" is not one of them. Third, how does this requirement comport with section 189a of the AEA, which states that the "Commission shall grant a hearing upon the request of any person whose interest may be affected by the proceeding"? 42 U.S.C. § 2239(a)(1)(A). No plaintiff in any federal court faces such a hurdle.

Happily, we need not decide the issue now. NEC and DPS have adopted each other's contentions and neither one of them is withdrawing. Therefore, the current notices of adoption are timely and are granted to the extent that the DPS and NEC contentions have been admitted.[83]

[82] To the extent that the Staff has concerns that an adopting party would be unable to litigate an adopted contention after the withdrawal of the initial contention sponsor, we note that the regulations already provide a remedy for dealing with a party that cannot adequately litigate a contention. *See* 10 C.F.R. § 2.320.

[83] NEC also filed a motion for leave to file a reply to Entergy and the Staff answers on the adoption issue, a motion which Entergy and the Staff oppose. Having accepted NEC's notice, we deny its motion for leave to file a reply as moot.

B. Interested State Participation

As provided in 10 C.F.R. § 2.315(c), any interested State, local governmental body, and affected, federally recognized Indian Tribe that has not been admitted as a party under 10 C.F.R. § 2.309 will be given a reasonable opportunity to participate in any hearing conducted in this proceeding. The only timing requirement for giving notice of such participation states that a "representative shall identify those contentions on which it will participate in advance of any hearing held." 10 C.F.R. § 2.315(c). Accordingly, the AG for the Commonwealth of Massachusetts, the Town of Marlboro, Vermont, and any other interested state, local governmental body, or affected, federally recognized Indian Tribe that wishes to participate in this hearing shall notify us of same within 20 days of this Order.[84]

VII. CONCLUSION

For the reasons set forth above, the Board concludes that the Vermont Department of Public Service and the New England Coalition both have standing and have each proffered an admissible contention meeting the requirements of 10 C.F.R. § 2.309(f). Accordingly, their requests for hearing are granted. Although the Massachusetts Attorney General and the Town of Marlboro both have standing, neither has proffered an admissible contention and therefore their hearing requests are denied.

The Board rules that the procedures of Subpart L shall be used for these contentions. Within fifteen (15) days of the issuance of service of this Order, the Staff shall notify the Board whether it desires to participate in this proceeding as a party pursuant to 10 C.F.R. § 2.1202. Within thirty (30) days of the service of this Order, the parties shall make their initial disclosures pursuant to 10 C.F.R. § 2.336(a), the Staff shall make its initial disclosures pursuant to 10 C.F.R. § 2.336(b), and the Staff shall file the hearing file pursuant to 10 C.F.R. § 2.1203.

As provided under 10 C.F.R. § 2.311(c), a party, other than a hearing requestor with at least one admitted contention, may appeal this Order to the Commission. All such appeals must be filed within ten (10) days following service of this Order and conform to the provisions of 10 C.F.R. § 2.311(a). Those parties opposing the appeal may file a brief in opposition within ten (10) days of service of the appeal.

[84] As with the adoption of contentions, the 10-day motions deadline does not apply to interested state participation because such participation does not require a motion, as a simple notice suffices.

It is so O[illegible]ERED.

THE ATOMIC SAFETY AND
LICENSING BOARD[85]

Alex S. Karlin, Chairman
ADMINISTRATIVE JUDGE

Richard E. Wardwell[86] (by E. Roy Hawkens)
ADMINISTRATIVE JUDGE

Thomas S. Elleman (by E. Roy Hawkens)
ADMINISTRATIVE JUDGE

Rockville, Maryland
September 22, 2006

[85] Copies of this Order were sent this date by Internet e-mail transmission to counsel or a representative for (1) Applicant Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc.; (2) Petitioners Town of Marlboro, Vermont, the Massachusetts Attorney General, the Vermont Department of Public Service, and the New England Coalition; and (3) the NRC Staff.

[86] Judge Wardwell joins in all of this decision except for his dissent on NEC Contention 1, which follows.

DISSENTING OPINION OF JUDGE WARDWELL ON ADMISSIBILITY OF NEW ENGLAND COALITION'S CONTENTION 1 (ENVIRONMENTAL)

A. Introduction

I join my colleagues in the issues presented in this Order, except for my dissent with the discussion on NEC's only environmental contention. In this contention, NEC asserts that Entergy's Environmental Report (ER) failed to sufficiently assess the impacts of increased thermal discharges into the Connecticut River over the 20-year license extension period.[1]

In accordance with NRC regulations, it seems clear that Entergy has adequately addressed the impacts to water quality required by the rules in their ER and subsequent amendments to their License Renewal Application (LRA). Based on this, I concluded that NEC's contention is inadmissible because it fails to show that a genuine dispute exists with the Applicant. I agree with the NRC Staff, however, that this contention would be admissible on the limited grounds that Entergy's approved NPDES permit from the State of Vermont Agency of Natural Resources (VANR) was not included with the application because the permit had not yet been approved when Entergy submitted their LRA in January 2006. The amended NPDES permit was approved on March 30, 2006. On July 27, 2006, Entergy submitted a copy of the approved amended permit as Amendment 6 to the LRA, thus resolving this issue. While this permit has been appealed, its ongoing status does not have a bearing on my opinion for the reasons presented herein.

B. Discussion

In evaluating NEC Contention 1, I reviewed the regulations to determined what an Applicant is explicitly required to provide in its ER for their LRA. In addition, I reviewed the Staff's responsibilities in preparing their Supplemental Environmental Impact Statement (SEIS) to indicate whether it would be reasonable for an Applicant to provide any additional information that might assist the Staff in performing their NEPA review. These explicit and implicit requirements for an ER during license renewal are discussed in the next two sections. The impacts of the increased thermal discharge (including cumulative impacts) are discussed in Section B.3. The status of the NPDES permit and its effect on this opinion are summarized in Section B.4. Much of the NEC argument accepted by the majority

[1] NEC Petition at 13. For this dissent, I have also reviewed NEC's initial petition (May 26, 2006), and the Entergy and NRC Staff answers (June 22, 2006). While I have also reviewed NEC's reply (June 29, 2006) and note that nothing in it changes my opinion, I believe that most of their response is entirely new, inadmissible argument.

opinion implies that a NEPA analysis, as reflected in an EIS, will not be prepared for the proposed action. This issue is discussed in Section B.5, along with the consistencies between NRC regulations, NEPA, and the Federal Water Pollution Control Act (FWPCA), i.e., the Clean Water Act (CWA).

1. *Explicit ER Requirements*

As required by NRC regulations, 10 C.F.R. § 2.309(f)(2), initial contentions at this stage must be based on the Applicant's Environmental Report (ER). In part, NEC Contention 1 questions the completeness of the portion of Entergy's ER dealing with thermal discharges.

For license renewal applications, section 51.53(c)(2) of the regulations requires that the following general information be included in an applicant's ER: (1) a description of the proposed action, (2) a detailed description of modifications directly affecting the environmental or plant effluents, and (3) a discussion of the environmental impacts of alternatives to the license renewal. Specific requirements for the ER are presented in 10 C.F.R. § 51.53(c)(3) and may be summarized as follows: (1) an applicant's ER is not required to contain an analysis of the environmental impacts identified as Category 1 issues[2] in Appendix B to Subpart A of the Generic Environmental Impact Statement (GEIS); and (2) for a plant with once-through cooling system (which is one of the operating modes at Vermont Yankee), the applicant must include analyses for the three Category 2 issues[3] related to thermal discharges in their SEIS. The Category 2 thermal issues include entrainment of fish and shellfish in early life stages, impingement of fish and shellfish, and heat shock.[4]

It seems apparent that the increase in thermal discharge limits during the license renewal period (i.e., the water quality issues that NEC argues are not assessed in Entergy's application) does not relate to any of these Category 2 issues.[5]

[2] Category 1 issues are those: (1) that apply to all plants having specified plant or site characteristics, (2) that have a small impact, and (3) whose alternatives analyses demonstrate that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation. 10 C.F.R. Part 51, Subpart A, Appendix B.

[3] Category 2 issues are plant- or site-specific environmental impacts which must be evaluated in the SEIS. 10 C.F.R. Part 51, Subpart A, Appendix B; 10 C.F.R. § 51.71(d).

[4] Section 51.53(c)(3) of 10 C.F.R. also requires that the ER contain any new and significant information regarding the impacts of license renewal of which the applicant is aware; this is not an issue here since NEC has not argued that the applicant failed to present new and significant information.

[5] Heat shock occurs when aquatic biota that have been acclimated to cooler water are exposed to sudden temperature increases when artificial heating commences. While the temperature of the thermal plume is certainly higher near the discharge point, this is not considered to be heat shock as long as changes in the plume temperature are gradual.

This alone is sufficient reason to reject this contention. But continuing on, the regulations state that an applicant may address Category 2 thermal issues in one of two ways. They may include a copy of the current CWA § 316(b) determination (relating to the location, design, construction, and capacity of the cooling water system to minimize impingement and entrainment), and, if necessary, a section 316(a) demonstration (or equivalent State permits and supporting documentation) to minimize impact of effluent discharges. Alternatively, if the applicant cannot provide the relevant documents, it must assess the impact of the license renewal on fish and shellfish resources resulting from heat shock, impingement, and entrainment. 10 C.F.R. § 51.53(c)(3)(ii)(B).

For its section 316(b) determination, Entergy evaluated the environmental impacts on aquatic resources from entrainment, impingement, and heat shock in their ER (in sections 4.2 to 4.4). It also included a detailed section 316(a) demonstration in its application to amend its NPDES permit. Therefore, it is evident that Entergy has provided all of the information that is explicitly required in the regulations. The amended permit is under an ongoing appeal. The impact of this appeal on my decision is discussed in Section B.4.

2. *Implicit ER Requirements*

While Entergy has clearly met the explicit requirements of the regulations, the next question to address is whether the requirements of section 51.53(c)(3)(ii)(B) are inclusive of all the information needed in an ER. To resolve this issue, I turn to the discussion of the analyses that must be performed by the Staff in preparing the SEIS, using section 51.71(d) and section 51.95(c) of the NRC regulations for guidance. The former section states that the draft SEIS for a license renewal will rely on conclusions presented in the GEIS for Category 1 issues, but must contain an analysis of those issues identified as Category 2. As mentioned above, the only Category 2 issues related to this contention (i.e., thermal impacts on aquatic ecology) are entrainment, impingement, and heat shock. These impacts are addressed in the requirements of a CWA § 361(a) demonstration and the section 316(b) determination. As referenced by VANR's NPDES permit, Entergy has submitted these analyses in their ER and in their application to amend their NPDES permit.

Besides the Category 2 issues, section 51.71(d) does not require any other specific analyses for license renewals in the draft SEIS. Likewise, section 51.95(c) does not require any other new analyses from the Staff in the final SEIS that might affect the contents of the Applicant's ER. Therefore, the ER requirements listed in section 51.53(c)(3)(ii)(B) appear to be inclusive, since the regulations do not require the Staff to evaluate any other specific analyses in preparing their SEIS.

The information required by the regulations is now included in the LRA. Therefore, there is no material dispute and the contention should be rejected. To

require the applicant to do more is an impermissible challenge to a Commission regulation and outside the scope of the license renewal proceeding. *See* 10 C.F.R. § 2.335(a).

3. *Addressing Impacts of Increased Thermal Discharge Limits*

With the granting of a NPDES permit, the State has done a thorough review of the environmental impacts of the increased thermal limits on aquatic ecology. With additional limitations, VANR concluded that there will be no significant impact from the proposed thermal discharge on aquatic biota.

NEC has specifically raised the issue of cumulative impacts from the thermal increase on the aquatic biota in the adjacent river. While there are several Category 1 issues that are potentially associated with this issue,[6] cumulative impacts are not identified as a separate listed category in the GEIS. The Commission has already decided that a board cannot admit a contention regarding a Category 1 issue. Also, cumulative impacts of the thermal increase do not directly relate to the limited Category 2 issues of entrainment, impingement, and heat shock. Therefore, the NRC regulations do not allow a contention on this additional environmental issue, since it is beyond those delineated in the GEIS. Any contention that attempts to do so is a direct challenge to a Commission regulation and outside the scope of the license renewal proceeding. *See* 10 C.F.R. § 2.335(a). A petitioner has two options available to expand the scope of the relevant issues, including: (1) submitting a petition for rulemaking under 10 C.F.R. § 2.802, or (2) requesting a waiver of the regulations from the Commission under 10 C.F.R. § 2.335(b). To the best of my knowledge, NEC has not initiated either of these options.

While not directly required as part of the GEIS, cumulative impacts from effluent discharges have been addressed by Entergy in their application to amend the NPDES permit. VANR notes that the section 316(a) demonstration has considered cumulative impacts and it showed that the alternative effluent limitations will assure the protection and propagation of the aquatic habitat. As discussed in the Responsiveness Summary (RS), these conclusions were based on more than 30 years of monitoring and using predicative analysis by a calibrated computer simulation modeling of the Vernon pool and the tailwater reach below the dam (RS for Permit No. 3-1199, at p. 2-3). Therefore, Entergy has addressed the issue of this contention, even though it is not specifically required to do so by the NRC regulations.

---

[6] These include, but are not necessarily limited to, accumulation of contaminants in sediments or biota; cold shock; thermal plume barrier to migrating fish; distribution of aquatic organisms; premature emergence of aquatic insects; gas supersaturation; low dissolved oxygen; losses from predation, parasitism, and disease among organisms exposed to sublethal stresses; and stimulations of nuisance organisms. 10 C.F.R. Part 51, Subpart A, Appendix B.

VANR has the opportunity to re-address these effluent limits every 5 years during renewal of the NPDES permit, and to modify the parameters, if necessary, to protect the aquatic biota. In essence, the NPDES renewal period provides an ongoing assessment of cumulative impacts throughout the life of the plant. Based on this, cumulative impacts have been addressed for this issue.

4. *NPDES Permit Status*

The amendment to Entergy's NPDES permit (authorizing the temperature increase to the thermal discharges under question in this contention) was approved on March 30, 2006, and expired the next day. However, NEC admits that permit remains in effect until the review of the renewal application is complete. NEC Reply at 4; Tr. at 291-92.

The approved amendment was appealed and, in fact, was recently stayed by the State of Vermont Environmental Court on August 28, 2006. I considered the option of admitting this contention as one of omission until this case is decided. However, I ruled out this option as pointless. If the appeal is upheld and the NPDES permit is revoked, the effluent limitations revert back to the previous values and there will be no increase in thermal discharge, rendering this contention moot. If the appeal is denied and the NPDES permit is reinstated, it is my opinion that the contention is inadmissible for the reasons presented in Sections B.1 and B.2. If the NPDES permit is reinstated with modifications, the petitioner may request leave to amend their contention or file a new contention under 10 C.F.R. § 2.309(f)(2).

The petitioner also argues two other points: (1) that the permit will expire in 5 years, before the license renewal period even starts, and (2) that there is no valid section 316 determination since only part of the period was approved for the increased temperatures. In regards to the first issue, the 5-year renewal period for the NPDES permit seems to provide additional assurances that thermal increases will not affect aquatic biota by providing ongoing reassessment on the response of the steam to the higher discharge limits. As mentioned in Section B.3, the NPDES renewal period essentially provides a rolling assessment of cumulative impacts throughout the life of the plant.

In approving Entergy's amendment application, VANR agreed that the CWA § 316(a) demonstration was conclusive for the period from June 16 to October 14, but was inconclusive for the period from May 16 to June 15. As is their right under the CWA, VANR placed additional limitations on the thermal discharge by not approving them for the first portion of the request period (i.e., May 16 to June 15) and only approving the increased temperatures for the second part of the requested period (i.e., June 16 to October 14). These limits may be modified in the future if additional site monitoring indicates that the observed impact on aquatic biota warrants an alternation to these time periods. NEC's environmental

contention does not apply to the first period since the temperatures will remain at the previous values. The contention applies to the second period, but should be rejected for the reasons discussed in Sections B.1 and B.2.

5. *Consistency within NRC Regulations, CWA, and NEPA*

Contrary to what is alleged by NEC and the majority opinion, it is not a question of whether NRC is required to perform a NEPA analysis. The regulations make it clear that, under NEPA, the Commission must analyze the environmental impacts from the proposed action, i.e., license renewal in this case. The Commission has met its NEPA requirements by assessing the environmental impacts associated with license renewal applications in the GEIS. 10 C.F.R. Part 51, Subpart A, Appendix B.

The real dispute related to how the CWA effluent limitations relating to thermal discharge (i.e., sections 316, 401, and 402) are handled in the EIS. In accordance with 10 C.F.R. § 51.71(d), the Staff is required to rely on the conclusions of the GEIS for Category 1 issues and is required to augment the GEIS by evaluating Category 2 site-specific alternative analyses in the SEIS. As mentioned, the three Category 2 issues related to thermal discharge impacts on aquatic biota from once-through cooling systems have been addressed by Entergy's section 316 demonstrations and determinations. In accordance with 10 C.F.R. § 51.71(d), the water pollution limitations imposed pursuant to FWPCA for thermal discharges at Vermont Yankee (i.e., section 316 analyses) must be relied upon in the overall assessment of environmental impacts from the licensed renewal period.

These restrictive requirements in the NRC regulations are consistent with section 511(c)(2) of the CWA, which states that nothing in NEPA authorizes any federal agency to: (1) review any effluent limitation or other requirement established pursuant to the CWA, or (2) impose any effluent limitations other than those established pursuant to FWPCA. Therefore, water pollution limitations or requirements promulgated or imposed pursuant to the FWPCA must be followed as a compliance limitation in the analysis of the overall environmental impacts from the proposed activity. *See* 10 C.F.R. § 51.71(d).

Having said this, it is important to note that the Commission is not exempt from assessing the overall environmental impacts of the project in accordance with NEPA requirements. As noted in footnote 3 of section 51.71(d) of the NRC regulations, "compliance with the environmental water quality standards and requirements of FWPCA . . . is not a substitute for and does not negate the requirement for NRC to weight all environmental effects of the proposed action."

Here, as in other sections of the regulations (e.g., sections 51.45(c) and 51.53(c)), the proposed action is the license renewal, not the effluent discharge.[7]

What these regulations and accompanying footnote say is that a NEPA analysis must be performed on all environmental effects of the license renewal, but, with regards to thermal discharge (or other CWA requirements), the effluent limitations (e.g., section 316 for thermal discharges) or other requirements imposed by the State (as part of the CWA § 401 water quality certification and CWA § 402 NPDES permit) cannot be altered. In a case such as this where the State of Vermont has assessed the aquatic impacts in approving the plant's cooling system, the NRC must take their evaluation at face value and may not undercut their judgment by undertaking an independent analysis or establishing its own standards. *Carolina Power and Light Co.* (H.B. Robinson, Unit 2), ALAB-569, 10 NRC 557, 562 (1979); *Tennessee Valley Authority* (Yellow Creek Nuclear Plant, Units 1 and 2), ALAB-515, 8 NRC 702, 712-13, 715 (1978). However, the Agency must still perform a NEPA analysis for the license renewal, taking a hard look at other alternatives but not altering CWA effluent limitations.

In addition to not usurping the authority of other permitting agencies, NRC recognized that the "permit process authorized by the FWPCA is an adequate mechanism for control and mitigation of potential aquatic impacts." Proposed Rule: "Environmental Review for Renewal of Operating Licenses," 56 Fed. Reg. 47,016, 47,019 (Sept. 17, 1991). To require another analysis of alternatives on effluent limitations under NEPA would amount to an unnecessary and repetitive review of the water quality impacts already addressed by another permitting agency. However, when no assessment of aquatic impacts has been performed by any other permitting authority, NRC regulations require the Commission to establish the magnitude of potential impacts. *See* 10 C.F.R. § 51.71(d) n.3. This NRC requirement is also consistent with the CWA since section 511(c) would no longer apply.

C. Summary

Entergy has provided all the ER information required by the regulations. The applicant has addressed the section 316(b) determination in their ER, and cumulative impacts (as well as a section 316(a) demonstration) in their application

[7] To accept much of the argument in the NEC petition and the majority opinion, it seems that one would have to define the proposed action as the effluent discharge. With this definition, the requirements to "weigh all environmental effects" would specifically apply to the effluent discharge and not to the overall license renewal. This clearly is not the case, because to accept this position would make the NEPA mandate of weighing all environmental effects incompatible with section 511(c)(2) of FWPCA which prohibits an agency from using NEPA to impose other effluent limitations besides those authorized by FWPCA.

NPDES permit. While the NPDES amendment application was not yet approved when the LRA was submitted, the omission of the permit authorizing the thermal increase was rectified with Entergy's July 27, 2006, submittal. This contention is inadmissible on the grounds of lacking a real dispute, because the applicant has addressed the specific environmental concerns raised by NEC and done so in accordance with NRC regulations.

The approved NPDES permit amendment is presently being appealed and has recently been stayed by the State of Vermont Environmental Court. The future status of the permit does not affect the opinion presented herein. Specifically, NEC's contention deals solely with the impacts from the increased thermal limits desired by Entergy. If the approved NPDES permit is overturned, the license reverts back to the original effluent limitations in the previous permit, and the increased thermal discharges will not take place, rendering this contention moot.

There is no procedural way in a license renewal proceeding before this Board to further evaluate cumulative impacts from thermal discharge. To require an applicant to address this impact beyond the limited Category 2 issues of entrainment, impingement, and heat shock would inappropriately challenge a Category 1 issue. The cumulative impacts from the thermal discharge during the license renewal period that NEC tried to raise are not among the Category 2 issues. Moreover, the inability to review and alter the effluent limitations that have been built into the NRC regulations is consistent with CWA § 511(c). Consequently, NEC's contention in this license renewal proceeding, based solely on their undifferentiated claim that the Applicant has failed to analyze the cumulative effects of thermal discharge during the license renewal period would be a direct challenge to the NRC regulations and should be rejected.

000106

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

Michael C. Farrar, Chairman
E. Roy Hawkens
Nicholas G. Trikouros

In the Matter of **Docket No. IA-05-053**
(ASLBP No. 06-846-02-EA)

DALE L. MILLER **September 29, 2006**

In this challenge to an NRC Staff immediately effective enforcement order prohibiting a former Davis-Besse employee from working in NRC-licensed activities for 5 years, the Licensing Board finds a proposed settlement to be in the public interest, so that no adjudication is required.

ENFORCEMENT ACTIONS: SETTLEMENT OF PROCEEDINGS

In approving a proposed settlement between the NRC Staff and the subject of a very stringent enforcement order, the Board found no reason — where Staff had taken aggressive enforcement action in related respects — to look behind the Staff's newly emerged judgment that lesser measures as to this individual are now seen as adequate for compliance and enforcement purposes.

ORDER
(Approving Proposed Settlement and Dismissing Proceeding)

The parties to this enforcement proceeding, which arose out of the Davis-Besse reactor vessel head problems of several years ago, have entered into a

February 16, 2007

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Commission

In the Matter of	)	
	)	
Entergy Nuclear Vermont Yankee, LLC	)	Docket No. 50-271-LR
and Entergy Nuclear Operations, Inc.	)	
(Vermont Yankee Nuclear Power Station)	)	

In the Matter of	)	
	)	
Entergy Nuclear Generation Company	)	Docket No. 50-293-LR
and Entergy Nuclear Operations, Inc.	)	
(Pilgrim Nuclear Power Station)	)	

ENTERGY'S RESPONSE TO MASSACHUSETTS ATTORNEY GENERAL'S MOTION FOR RECONSIDERATION AND CLARIFICATION OF CLI-07-03

Pursuant to 10 C.F.R. §2.323(e), Entergy Nuclear Vermont Yankee, LLC, Entergy Nuclear Operations, Inc., and Entergy Nuclear Generation Company (hereinafter collectively referred to as "Entergy") hereby respond to – and oppose – the Massachusetts Attorney General's February 1, 2007 "Motion for Leave to File Motion for Reconsideration and Clarification of CLI-07-03" ("Motion for Leave") and "Motion for Reconsideration and Clarification of CLI-07-03" ("Reconsideration Motion"). In her Reconsideration Motion, the Attorney General requests that the Commission "(a) confirm [that CLI-03-07] is a non-final decision with respect to the Attorney General, (b) clarify that the Attorney General continues to have party status in the individual license renewal proceedings until those proceedings are concluded, and (c) further clarify that the Attorney General has the right to seek judicial review,

as necessary, to ensure the application of the final rulemaking to the individual license renewal proceedings for Pilgrim and Vermont Yankee." Reconsideration Motion at 3.

The Attorney General, however, completely fails to show the compelling circumstances necessary under the NRC's rules of practice for the Commission to reconsider its decision. Nor does she show that the Commission's decision is ambiguous or unclear in any respect. Hence the Attorney General's motions must be denied.

I. PROCEDURAL BACKGROUND

On May 26, 2006, the Attorney General filed in both the Vermont Yankee and Pilgrim license renewal proceedings a "Request for Hearing and Petition for Leave to Intervene" (the "Petitions").[1] The Petitions were essentially identical. They both alleged that new and significant information showed that the "continued storage of spent fuel in high-density storage racks in the [Applicants' pools] poses a significant and reasonably foreseeable environmental risk of a severe fire and offsite release of a large amount of radioactivity" (Petitions at 2), and they claimed as such that the Environmental Reports for both the Vermont Yankee and Pilgrim license renewal proceedings needed to address the environmental impacts of severe spent fuel pool accidents. Both Entergy and the NRC Staff acknowledged the Attorney General's standing, but determined that the Attorney General's contention concerning spent fuel pool fires was inadmissible because (1) the Contention was an impermissible challenge to the NRC's rules and

[1] Massachusetts Attorney General's Request for a Hearing and Petition to Intervene With Respect to Entergy Nuclear Operations Inc.'s Application for Renewal of the Pilgrim Nuclear Plant Operating License [ ] (May 26, 2006); Massachusetts Attorney General's Request for a Hearing and Petition to Intervene With Respect to Entergy Nuclear Operations Inc.'s Application for Renewal of the Vermont Yankee Nuclear Plant Operating License [ ] (May 26, 2006).

generic determinations, and (2) the Contention did not in fact raise any new and significant information concerning spent fuel pool fires.[2]

The Atomic Safety and Licensing Boards ("Licensing Board" or "Boards") for both the Vermont Yankee and Pilgrim proceedings denied the Attorney General's Petitions to intervene and request for a hearing because, under NRC regulations for license renewal proceedings, the continued storage of spent nuclear fuel is a "Category 1" issue, i.e., the issue has been determined generically by the GEIS[3] and is not subject to litigation and consideration in individual license renewal proceedings. Hence, both Boards determined that the Attorney General's contention was inadmissible and denied the Attorney General's Petition to intervene and request for hearing. LBP-06-20, 64 NRC 131, 161 (2006) ("For the reasons discussed above, AG Contention 1 is inadmissible and the AG's hearing request is denied") (emphasis added); LBP-06-23, 64 NRC 257, 349 (2006) (emphasis added) ("The Massachusetts Attorney General's Request for Hearing and Petition to Intervene is denied.") (emphasis added).

Dissatisfied with these determinations, the Attorney General appealed both Licensing Board decisions to the Commission.[4] The Attorney General's appeals were filed pursuant to 10 C.F.R. § 2.311, which allows interlocutory appeals of an "order denying a petition to intervene and/or request for hearing" by "the requestor/petitioner on the question as to whether the request and/or petition should have been granted." 10 C.F.R. § 2.311(b).

---

[2] In both the Vermont Yankee and Pilgrim license renewal dockets, the NRC Staff and Entergy filed the following responses: NRC Staff Answer Opposing Massachusetts Attorney General's Request for Hearing and Petition for Leave to Intervene and Petition for Backfit Order (June 22, 2006); Entergy's Answer to the Massachusetts Attorney General's Request for a Hearing, Petition for Leave to Intervene, and Petition for Backfit Order (June 22, 2006).

[3] NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Final Report, Vol. 1 (May 1996) ("GEIS").

[4] In the Pilgrim docket: Massachusetts Attorney General's Brief on Appeal of LBP-06-23 (Oct. 31, 2006). In the Vermont Yankee docket: Massachusetts Attorney General's Brief on Appeal of LBP-06-20 (Oct. 3, 2006).

The Commission duly considered the appeals, and on January 22, 2007, issued its decision affirming the Boards' actions in both the Pilgrim and Vermont Yankee license renewal proceedings.[5] The Commission found that, not only was the Category 1 issue raised by the Attorney General inappropriate for consideration in an individual licensing proceeding[6], but the appropriate mechanism for considering such an issue is through a rulemaking petition[7], which the Attorney General has already filed.[8] Hence, the Commission concluded that "the Licensing Boards were correct to reject the Mass AG's sole contention in the two cases" and "therefore *affirm[ed]* the Boards' decisions."[9]

Following the Commission's decision, the Attorney General now asserts that CLI-07-03 is "internally inconsistent, unclear, or potentially prejudicial to the Attorney General's claims." Reconsideration Motion at 2. The Attorney General thus seeks leave to file her Motion for Reconsideration and Clarification.

II. ARGUMENT

A. Applicable Legal Standard for Reconsideration

The Commission's revised rules of practice promulgated in January 2004 provide that:

> Motions for reconsideration may not be filed except upon leave of the presiding officer or the Commission, upon a showing of compelling circumstances, such as the existence of a clear and material error in a decision, which could not have reasonably been anticipated, that renders the decision invalid.

10 C.F.R. § 2.323(e). The compelling circumstances standard for granting leave to file a motion for reconsideration "is intended to permit reconsideration only where manifest injustice

---

[5] CLI-07-03, 65 NRC ___, slip op. at 1, 10.

[6] CLI-07-03, slip op. at 6.

[7] CLI-07-03, slip op. at 2.

[8] Massachusetts Attorney General's Petition for Rulemaking to Amend 10 C.F.R. Part 51 (Aug. 25, 2006) ("Rulemaking Petition").

[9] CLI-07-03, slip op. at 10 (emphasis in original).

would occur in the absence of reconsideration, and the claim could not have been raised earlier." 69 Fed. Reg. 2,182, 2,207 (Jan. 14, 2004).

B. The Attorney General Provides No Basis for The Commission to Reconsider CLI-07-03

The Attorney General's request for reconsideration must be denied because the Attorney General provides no compelling circumstances required to support reconsideration under 10 C.F.R. § 2.323(e). The Attorney General has made no showing "of a clear and material error" in the Commission's decision that would render the decision invalid. Nor do the Attorney General's Motions refer to any other allegedly compelling circumstances that would support reconsideration. Indeed, the Attorney General tacitly concedes the lack of compelling circumstances by asserting that reconsideration is also appropriate for requesting the Commission "'to clarify the meaning or intent of language in one of its decisions.' Duke Energy Corporation (Catawba Nuclear Station, Units 1 and 2), CLI-CLI-04-37 [sic], 61 NRC 646, 648 (2004), citing Curators of the University of Missouri (TRUMP-S Project), CLI-95-8, 41 NRC 386, 390-91 (1995)." Reconsideration Motion at 6. The current rules, however, provide no basis for reconsideration to request clarification as such.[10] While there could conceivably be instances of compelling circumstances where "manifest injustice would occur in the absence of" clarification, that is not the case here.

At the heart of the Attorney General's Motions is the claim that treating CLI-07-03 as a final appealable decision would remove the Attorney General as a party to the Vermont Yankee and Pilgrim license renewal proceedings so that she could not invoke 10 C.F.R. § 2.802 to seek a stay of the license renewal proceedings pending resolution of the Attorney General's rulemaking

[10] The decisions cited by the Attorney General were rendered prior to the major January 2004 amendment of the Commission's rules of practice. The Attorney General cites no cases subsequent to the amendment of the rules to support her position.

petition. The Attorney General points to various statements in CLI-03-07 to claim ambiguity about whether the Commission intended for the Attorney General to have "the right, as a party to [the Vermont Yankee and Pilgrim license renewal proceedings], to insist that the results of the proceeding on the petition for rulemaking must be applied in the individual license renewal proceedings." Reconsideration Motion at 9 (emphasis added).

However, there can be no ambiguity or confusion in this respect because the Attorney General has never been a party to the Vermont Yankee and Pilgrim license renewal proceedings. The Board and Commission rulings held that the Attorney General was not entitled to become a party because the Attorney General had not met the requirements for being a party to a licensing proceeding. A petitioner who seeks to intervene in an NRC proceeding is not automatically a "party" under the NRC's rules of practice. Rather, 10 C.F.R. § 2.309(a) expressly provides that a petitioner who "desires to participate as a party" in a licensing proceeding will be granted "party" status only upon satisfaction of two specific requirements: (1) satisfaction of standing requirements under § 2.309(d); and (2) the proposal of "at least one admissible contention that meets the requirements of paragraph (f) of this section." 10 C.F.R. § 2.309(a). While provision is made in the rules for the granting of party status to petitioners who fail to meet the standing requirements under § 2.309(d), no provision is made for petitioners to be named as a party to a proceeding upon failure to propose at least one admissible contention. See generally 10 C.F.R. § 2.309.

Here, as held by both Licensing Boards and affirmed by the Commission, the Attorney General failed to proffer an admissible contention. Accordingly, the Attorney General failed to meet the requirements "to participate as a party" in the Vermont Yankee and Pilgrim license renewal proceedings, and both Boards denied the Attorney General's request for a hearing.

Moreover, the Attorney General clearly understood that the Board decisions had denied her party status upon taking an appeal of the Board decisions under 10 C.F.R. § 2.311. An intervenor's right to appeal under 10 C.F.R. § 2.311 is only available when the intervenor has been denied admission as a party. The Attorney General understood this provision of the regulation as being applicable to herself when she appealed the Board decisions under 10 C.F.R. § 2.311. It is now specious for the Attorney General to assert ambiguity as to whether she is a party to the Vermont Yankee and Pilgrim license renewal proceedings because the Attorney General clearly understood that she was not a party in these proceedings when taking her appeals under 10 C.F.R. § 2.311.

Similarly, the Attorney General's attempt to disturb the finality of CLI-07-03 by arguing that the Attorney General has a right to insist that the "results of the proceeding on the petition for rulemaking must be applied in the individual license renewal proceedings," Reconsideration Motion at 9, is meritless. As recognized by the Commission in the Turkey Point license renewal decision, a rulemaking is a wholly separate avenue from licensing adjudication. Florida Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 NRC 3, 10 (2001). In addition to seeking admission to a proceeding as a party, any interested person is allowed under the NRC rules to "petition the Commission to issue, amend, or rescind any regulation." 10 C.F.R. § 2.802(a). The procedures and standards for submitting such a petition are contained in § 2.802. Rulemakings and licensing adjudications are distinct and different proceedings.

The Attorney General claims that she will lose her rights under 10 C.F.R. § 2.802(d) unless the Commission acts to clarify that she is a party to the proceeding. The Attorney General, however, never had any rights under this provision. It provides in whole that:

> The [rulemaking] petitioner may request the Commission to suspend all or any part of <u>any licensing proceeding to which the petitioner is a party</u> pending disposition of the petition for rulemaking.

10 C.F.R. § 2.802(d) (emphasis added). As explained, the Attorney General was never a party to the proceeding and therefore was never entitled to any rights under 10 C.F.R. § 2.802(d).

Similarly, the Attorney General's claim that the Commission may have intended that she be able to avail herself of a 10 C.F.R. § 2.802(d) request "to suspend all or any part of any licensing proceeding," Reconsideration Motion at 6, is likewise without merit. The Commission could never have intended any such circumstance. As explained by the Commission when it amended to § 2.802 to allow a petitioner to request "to suspend all or any part of any licensing proceeding," such a request can be made only where the petitioner has challenged a rule on the ground that unique or unusual circumstances of the facility at issue would undermine the rule:

> Section 2.758, pertaining to challenges of AEC regulations in adjudicatory proceedings, has been changed to clarify that such "challenges" can be made only on the ground that special circumstances in the particular proceeding are such that application of the regulation would not serve the purposes of the rule and justify a waiver or exception to the general rule. <u>In this connection</u>, § 2.802 has been amended to permit a petition for stay of a licensing proceeding pending action on the petition.

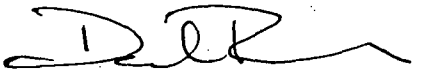
Final Rule, Restructuring of Facility License Application Review and Hearing Processes, 37 Fed. Reg. 15,127, 15,127 (July 28, 1972) (emphasis added). As noted by the Commission, the Attorney General "does not argue that unique or unusual characteristics of the Pilgrim and Vermont Yankee facilities undermine the GEIS's generic determinations." CLI-07-03, slip op. at 7. Consequently, a § 2.802(d) petition to suspend either license renewal proceeding is not available to the Attorney General.

In sum, nothing in the Commission's decision is ambiguous or unclear, and no clarification is required. There is no question that CLI-07-03 is a "final" decision under the NRC's procedural rules. There is no question, even for the Attorney General, that she is not a party in this license renewal proceeding. Finally, there is no question that, as a non-party, the Attorney General has no standing to request a stay in the license renewal proceeding for Vermont or Pilgrim.

III. CONCLUSION

For the foregoing reasons, the Attorney General's Motion for leave to request reconsideration of CLI-07-03 must be denied.[11]

Respectfully Submitted,



David R. Lewis
Paul A. Gaukler
PILLSBURY WINTHROP SHAW PITTMAN LLP
2300 N Street, N.W.
Washington, DC 20037-1128
Tel. (202) 663-8474

Counsel for Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc.

Dated: February 16, 2006

[11] The Attorney General's argument that clarification is needed in order to "conserve the parties' resources" is irrelevant to the issue of whether the CLI-07-03 is final and appealable. Reconsideration Motion at 9. Moreover, if the Appeals Court were convinced that further action should not be taken on any appeal that the Attorney General may take of CLI-07-03 until the Commission acts on the Attorney General's rulemaking petition, it could stay further proceedings on the appeal until such time as the Commission acted on the rulemaking petition.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
Entergy Nuclear Vermont Yankee, LLC	)	Docket No. 50-271-LR
and Entergy Nuclear Operations, Inc.	)	ASLBP No. 06-849-03-LR
	)	
(Vermont Yankee Nuclear Power Station)	)	
In the Matter of	)	
	)	
Entergy Nuclear Generation Company	)	Docket No. 50-293-LR
and Entergy Nuclear Operations, Inc.	)	ASLBP No. 06-848-02-LR
(Pilgrim Nuclear Power Station)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "Entergy's Response to Massachusetts Attorney General's Motion for Reconsideration and Clarification of CLI-07-03," dated February 16, 2007, were served on the persons listed below by deposit in the U.S. Mail, first class, postage prepaid, or with respect to Judge Elleman by overnight mail, and where indicated by an asterisk by electronic mail, this 16th day February, 2007.

*Dale Klein, Chairman
U.S. Nuclear Regulatory Commission
Mail Stop: O-16 G15
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738
e-mail: chairman@nrc.gov

*Jeffrey S. Merrifield, Commissioner
U.S. Nuclear Regulatory Commission
Mail Stop: O-16 C1
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738
e-mail: cmrmerrifield@nrc.gov

*Edward McGaffigan, Jr., Commissioner
U.S. Nuclear Regulatory Commission
Mail Stop: O-16 G15
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738
e-mail: cmrmcgaffigan@nrc.gov

*Gregory B. Jaczko, Commissioner
U.S. Nuclear Regulatory Commission
Mail Stop: O-16 C1
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738
e-mail: cmrjaczko@nrc.gov

*Peter B. Lyons, Commissioner
U.S. Nuclear Regulatory Commission
Mail Stop: O-16 C1
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738
e-mail: cmrlyons@nrc.gov

*Administrative Judge
Paul B. Abramson
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
e-mail: pba@nrc.gov

*Administrative Judge
Alex S. Karlin, Esq., Chairman
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
ask2@nrc.gov

*Administrative Judge
Dr. Thomas S. Elleman
Atomic Safety and Licensing Board
5207 Creedmoor Road, #101,
Raleigh, NC 27612.
tse@nrc.gov; elleman@eos.ncsu.edu;

Office of Commission Appellate Adjudication
Mail Stop O-16 C1
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

*Mitzi A. Young, Esq.
*Steven C. Hamrick, Esq.
Office of the General Counsel
Mail Stop O-15 D21
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
may@nrc.gov; sch1@nrc.gov

*Administrative Judge
Ann Marshall Young, Esq., Chair
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
e-mail: amy@nrc.gov

*Administrative Judge
Dr. Richard F. Cole
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
e-mail: rfc1@nrc.gov

*Administrative Judge
Dr. Richard E. Wardwell
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
rew@nrc.gov

*Secretary
Att'n: Rulemakings and Adjudications Staff
Mail Stop O-16 C1
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
secy@nrc.gov; hearingdocket@nrc.gov

Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

*Sarah Hofmann, Esq.
Director of Public Advocacy
Department of Public Service
112 State Street – Drawer 20
Montpelier, VT 05620-2601
Sarah.hofmann@state.vt.us

*Anthony Z. Roisman, Esq.
National Legal Scholars Law Firm
84 East Thetford Road
Lyme, NH 03768
aroisman@nationallegalscholars.com

*Ronald A. Shems, Esq.
*Karen Tyler, Esq.
Shems, Dunkiel, Kassel & Saunders, PLLC
9 College Street
Burlington, VT 05401
rshems@sdkslaw.com
ktyler@sdkslaw.com

*Jennifer J. Patterson, Esq.
Senior Assistant Attorney General
Environmental Protection Bureau
33 Capitol Street
Concord, NH 03301
e-mail: Jennifer.Patterson@doj.nh.gov

*Ms. Mary Lampert
148 Washington Street
Duxbury, MA 02332
e-mail: lampert@adelphia.net

*Molly H. Bartlett, Esq.
52 Crooked Lane
Duxbury, MA 02332
e-mail: mollyhbartlett@hotmail.com

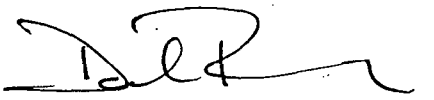
*Mr. Mark D. Sylvia
Town Manager
Town of Plymouth
11 Lincoln Street
Plymouth, MA 02360
e-mail: msylvia@townhall.plymouth.ma.us

*Sheila Slocum Hollis, Esq.
Duane Morris LLP
1667 K Street, N.W.
Suite 700
Washington, DC 20006
e-mail: sshollis@duanemorris.com

*Susan L. Uttal, Esq.
*Marian L. Zobler, Esq.
Office of the General Counsel
Mail Stop O-15 D21
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: slu@nrc.gov; mlz@nrc.gov

*Diane Curran, Esq.
Harmon Curran Spielberg & Eisenberg LLP
1726 M Street, N.W., Suite 600
Washington, DC 20036
e-mail: dcurran@harmoncurran.com

*Matthew Brock, Esq.
Assistant Attorney General
Environmental Protection Division
Office of the Attorney General
One Ashburton Place
Boston, MA 02108
e-mail: matthew.brock@ago.state.ma.us



David R. Lewis

February 16, 2007

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of	)	
	)	
ENTERGY NUCLEAR VERMONT YANKEE, LLC, and ENTERGY NUCLEAR OPERATIONS, INC.	)	Docket No. 50-271 -LR
	)	
(Vermont Yankee Nuclear Power Station)	)	ASLBP No. 06-849-03-LR

In the Matter of	)	
	)	
ENTERGY NUCLEAR GENERATION COMPANY, and ENTERGY NUCLEAR OPERATIONS, INC.	)	Docket No. 50-293-LR
	)	
(Pilgrim Nuclear Power Station)	)	ASLBP No. 06-848-02-LR

NRC STAFF ANSWER TO MASSACHUSETTS ATTORNEY GENERAL MOTION FOR LEAVE TO FILE and MOTION FOR RECONSIDERATION AND CLARIFICATION OF CLI-07-03

INTRODUCTION

Pursuant to 10 C.F.R. § 2.323(c), the staff of the Nuclear Regulatory Commission (Staff), hereby answers the Massachusetts Attorney General (MassAG) motion for leave to file a motion to reconsider and clarify CLI-07-03, and motion to reconsider and clarify CLI-07-03.[1] In CLI-07-03, the Commission affirmed the decisions of the Atomic Safety and Licensing Boards (Boards) in the above captioned matters. In each case, the respective Board had rejected the MassAG's single proposed contention that sought consideration of alleged new information regarding the environmental impacts of fires in high-density spent fuel pools.[2] The Mass AG is

[1] Massachusetts Attorney General's Motion for Leave to File Motion for Reconsideration and Clarification of CLI-07-03 (February 1, 2007) (Motion for Leave); Massachusetts Attorney General's Motion for Reconsideration and Clarification of CLI-07-03 (February 1, 2007) (Motion for Reconsideration).

[2] The contentions in both cases raised identical issues.

requesting that the Commission reconsider its decision and confirm that: CLI-07-03 is not a final decision as to the MassAG; the MassAG still has party status in the Pilgrim and Vermont Yankee license renewal proceedings; and the MassAG has the right to seek judicial review if the final rulemaking related to its rulemaking petition[3] is not applied to the license renewal proceedings. Motion for Reconsideration at 3. For the reasons discussed below, the MassAG's Motion for Reconsideration should be denied, to the extent that it requests the Commission reconsider its decision. Should the Commission decide that clarification is warranted, it should clarify that the decision is final as to the MassAG's participation in the license renewal proceedings.

BACKGROUND

These cases arise from two applications for license renewal filed pursuant to 10 C.F.R. Part 54. The first application was filed on January 25, 2006 by Entergy Nuclear Generation Company and Entergy Nuclear Operations, Inc. (collectively, Entergy Pilgrim) to renew the operating license for the Pilgrim Nuclear Power Station (Pilgrim) for an additional twenty-year period.[4] The second was also filed on January 25, 2006, by Entergy Vermont Yankee, LLC and Entergy Nuclear Operations, Inc. (collectively, Entergy VY) to renew the operating license for the Vermont Yankee Nuclear Power Station ("VYNPS") for an additional twenty-year period.[5] On May 26, 2006, the MassAG filed requests for hearing and petitions to intervene in the Pilgrim

---

[3] Massachusetts Attorney General's Petition for Rulemaking to Amend 10 C.F.R. Part 51 (August 25, 2006).

[4] Letter from Michael Balduzzi, Entergy Nuclear Operations, to U.S. NRC, Re: License Renewal Application, (January 25, 2006) (Agencywide Documents and Access Management System ("ADAMS") Accession No. ML060300028).

[5] Letter from William F. Maguire, Entergy, to the NRC Document Control Desk, "Vermont Yankee Nuclear Power Station, License No. DPR-28 (Docket No. 50-271), License Renewal Application," dated January 25, 2006 (Agencywide Documents Access and Management System ("ADAMS") Accession Nos. ML060300082, ML060300085, ML060300086).

matter, and in the VYNPS matter, proffering one virtually identical contention in each matter.[6] The Staff, Entergy Pilgrim and Entergy VY filed responses to the MassAG's Petitions.[7] On June 29, 2006 and June 30, 2006, the MassAG filed combined replies to the answers of Entergy and the Staff.[8]

Oral argument was held as to both matters on the admissibility of contentions: On July 6 and 7, 2006 in the Pilgrim matter; on August 1, 2006 in the VYNPS matter. On September 22, 2006, the Board presiding over the VYNPS matter issued LBP-06-20, in which it denied the MassAG's hearing request, finding its sole contention inadmissible. LBP-06-20, slip op. at 23. On October 16, 2006, the Board presiding over the Pilgrim matter issued LBP-06-23 denying the MassAG's hearing request,[9] finding the sole contention inadmissible. LBP-06-23,

---

[6] Massachusetts Attorney General's Request for a Hearing and Petition to Intervene with Respect to Entergy Nuclear Operations, Inc.'s Application for Renewal of the Pilgrim Nuclear Power Plant Operating License and Petition for Backfit Order Requiring New Design Features to Protect Against Spent Fuel Pool Accidents, May 26, 2006; Massachusetts Attorney General's Request for a Hearing and Petition for Leave to Intervene With Respect To Entergy Nuclear Operations Inc.'s Application for Renewal of the Vermont Yankee Nuclear Power Plant Operation and Petition for Backfit Order Requiring New Design Features to Protect Against Spent Fuel Accidents, dated May 26, 2006.

[7] NRC Staff Answer Opposing Massachusetts Attorney General's Request for Hearing and Petition for Leave to Intervene and Petition for Backfit Order (June 22, 2006) (Pilgrim); Entergy's Answer to the Massachusetts Attorney General's Request for a Hearing, Petition for Leave to Intervene, and Petition for Backfit Order (June 22, 2006)(Pilgrim); NRC Staff Answer Opposing Massachusetts Attorney General's Request for Hearing and Petition for Leave to Intervene and Petition for Backfit (June 22, 2006) (VY); Entergy's Answer to the Massachusetts Attorney General's Request for Hearing, Petition for Leave to Intervene, and Petition for Backfit Order (June 22, 2006) (VY).

[8] Massachusetts Attorney General's Reply to Entergy's and NRC Staff's Responses to Hearing Request and Petition to Intervene With Respect to Pilgrim License Renewal Proceeding (June 29, 2006); Massachusetts Attorney General's Reply to Entergy's and NRC Staff's Responses to Hearing Request and Petition to Intervene With Respect to Vermont Yankee License Renewal Proceeding (June 30, 2006).

[9] Memorandum and Order (Ruling on Standing and Contentions of Petitioners Massachusetts Attorney General and Pilgrim Watch), LBP-06-23, 63 NRC __ (October 16, 2006) (Contention Order). The Contention Order also granted the hearing request of Pilgrim Watch as to Contentions 1 and 3 which relate, respectively, to the aging management program for Pilgrim with regard to inspection for corrosion of buried pipes and tanks and detection of leakage of radioactive water that might result from undetected corrosion and aging; and to certain input data that Pilgrim Watch asserts should have been considered by the Applicant in its severe accident mitigation alternatives (SAMA) analysis. The Contention Order further denied admission of Pilgrim Watch's contentions 2, 4, and 5. On October31, 2006, Pilgrim Watch filed an (continued...)

slip op. at 31. On October 3, 2006, the MassAG filed a notice of appeal and supporting brief in the VYNPS matter and on October 31, filed a notice of appeal and supporting brief in the Pilgrim matter.[10]

On January 22, 2007, the Commission issued CLI-07-03, denying both appeals and affirming the Board decisions denying admission of the contention. CLI-07-03, slip op. at 1. On February 1, 2007, the MassAG filed its Motion for Leave and Motion for Reconsideration. The Staff hereby files its answer to both motions.

DISCUSSION

Legal Standards

A motion for reconsideration of a Commission decision must meet the requirements of 10 C.F.R. § 2.323(e), which requires that a petition may not be filed absent leave of the Commission and must demonstrate "compelling circumstances, such as the existence of a clear and material error in a decision, which could not have reasonably been anticipated, that renders the decision invalid." The standard is applied strictly and motions are not lightly granted. *Pacific Gas & Electric Co.* (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation), CLI-06-27, 64 NRC (2006), slip op. at 2 (November 9, 2006). *See also Louisiana Energy Services, L.P.* (National Enrichment Facility), CLI-04-35, 60 NRC 619, 622 (2004).

---

[9](...continued)
appeal, under 10 C.F.R. § 2.311, requesting Commission review of the Board's decision denying admission of Contention 4. *See* Pilgrim Watch Brief on Appeal of LBP-06-23, October 31, 2006. Contention 4 is similar to the Mass AG's contention, in that they both raise issues concerning spent fuel pool accidents. Contention Order at 20-21.

[10] Massachusetts Attorney General's Notice of Appeal of LBP-06-20 and Brief on Appeal of LBP-06-20 (October 3, 2006); Massachusetts Attorney General's Notice of Appeal of LBP-06-23 and Brief on Appeal of LBP-06-23 (October 31, 2006).

The MassAG's Motions

In the Motion for Leave the MassAG asserts that it has met the standard for reconsideration because the motion meets the criteria of 10 C.F.R. § 2.323(e). The Staff disagrees. The regulation requires that motions for reconsideration not be filed absent leave of the Commission upon a showing of "compelling circumstances, such as the existence of a clear and material error in a decision, which could not have reasonably been anticipated, that renders the decision invalid." 10 C.F.R. § 2.323(e). Nowhere in either of her motions does the MassAG demonstrate a clear and material error that renders the decision invalid. The motions are more in the nature of a request for clarification, not reconsideration. While the Staff opposes the request for reconsideration as unwarranted, if the Commission determines that clarification is warranted, the Staff submits that the Commission should make it clear that the decision in this matter is final as to the MassAG's participation in the Pilgrim and VYNPS license renewal proceedings.[11]

The MassAG first asserts that CLI-07-03 is unclear regarding finality for purpose of review under the Hobbs Act, 28 U.S.C. § 2342. Motion for Leave at 2; Motion for Reconsideration at 2, 6-9. In support of this assertion, she points to two alleged indicia that the Commission's decision is not final. First while acknowledging that the Commission did, in fact, affirm the Boards' decisions rejecting her contention, and taking final action as to the MassAG, *id.* at 6, she asserts that two factors create the uncertainty alleged: the Commission's statement that the merits of MassAG's contention have not been addressed (Motion for Reconsideration at 7); and, the Commission's citation of 10 C.F.R. § 2.802 when discussing the MassAG's request to suspend the license renewal proceedings until the rulemaking has been

[11] The Commission has, in the past, on motion, clarified the terms of its orders. *See, e.g., Curators of the University of Missouri* (Trump-S Project), CLI-95-8,41 NRC 386, 389-91(1995).

completed. Motion for Reconsideration at 7-8. The MassAG interprets the citation as an offer of the use of provisions of section 2.802 at a later date. *Id.* at 8.

The Staff does not agree with the MassAG that CLI-07-03 is unclear or ambiguous in any way. It is abundantly clear that the Commission affirmed the Boards' decisions not to admit the contention and, without an admitted contention, the Mass AG is not a party to the renewal proceedings. A decision denying a request for a hearing or dismissing a party's contentions *is* a final decision. *See Environmental Law and Policy Center v. NRC*, 470 F.3d 676, 681 (Cir. 2006).

As to the merits of the MassAG's contention not being addressed in the license renewal proceedings, the merits were not addressed because the subject matter of the contention was clearly outside the scope of the proceedings. The Commission agreed with the Boards' decision that the *Turkey Point* case is controlling. CLI-07-03, slip op. at 6-8. *See also Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 NRC 3 (2001). The Commission, thus, affirmed the Boards' decisions holding that the contention was inadmissible because on-site spent fuel management is a Category 1 issue pursuant to 10 C.F.R. Part 51, Appendix B, and thus could not be addressed in the absence of a waiver of 10 C.F.R. § 51.53(c)(3)(i). CLI-07-03, slip op. at 6-7. "[A]ny contention on a "category one" issue amounts to a challenge to our regulation that bars challenges to generic environmental findings." *Id.* at 7. The fact that the merits of the contention were not addressed puts this case in the same posture as any case where a contention has been deemed inadmissible. If a contention is deemed to be inadmissible at this stage, there is no merits decision. Thus, the MassAG's claim that the lack of a decision on the merits somehow creates confusion as to finality is baseless.

The second prong of the MassAG's argument is that the Commission's discussion in footnote 37 of CLI-07-03 is somehow an offer of a future remedy. Motion to Reconsider at 7-8. In that footnote, the Commission discussed the MassAG's rulemaking petition and the request therein to suspend the renewal proceedings until resolution of the rulemaking. CLI-07-03, slip op. at 9, n. 37. The Staff submits that the Commission, in citing to section 2.802, was merely reciting relevant provisions of the regulation, which provides that such a request may be made in a rulemaking petition by a party to a licensing proceeding, in order to provide a context for the MassAG's request. The Commission was, in the Staff's view, merely pointing out the regulation under which the MassAG claimed the right to make the request to suspend the renewal proceedings, not offering an opportunity to participate in proceedings in which the MassAG participation has been denied.

Because the Mass AG's request that the Commission reconsider its decision and clarify that it is not final does not "demonstrate a compelling circumstance, such as the existence of a clear and material error in a decision, which could not have been reasonably anticipated, which renders the decision invalid" and because it has no basis in law or fact, it should be denied.

CONCLUSION

For the foregoing reasons, the MassAG's Motion for Leave and Motion for Reconsideration should be denied. The Staff does not object to the motion, in so far as it requests clarification. If the Commission grants the Motion for Leave as to the request for clarification, the Staff respectfully requests that the Commission clarify that CLI-07-03 is a final decision.

Respectfully submitted,

/RA/

Susan L. Uttal
Counsel for the NRC Staff

/RA/

Steven C. Hamrick
Counsel for NRC Staff

Dated at Rockville, Maryland
this 16th day of February, 2007

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of	)	
	)	
ENTERGY NUCLEAR OPERATIONS, INC.	)	Docket No. 50-293-LR
	)	
(Pilgrim Nuclear Power Station)	)	ASLBP No. 06-848-02-LR
	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the "NRC STAFF ANSWER TO MASSACHUSETTS ATTORNEY GENERAL MOTION FOR LEAVE TO FILE and MOTION FOR RECONSIDERATION AND CLARIFICATION OF CLI-07-03" in the above-captioned proceeding have been served on the following by electronic mail and deposit in the U.S. Mail Service or by deposit in the U.S. Nuclear Regulatory Commission's internal mail system as indicated by a single asterisk(*), or by deposit in the U.S. mail system, as indicated by a double asterisk (**) this 16th day of February, 2007.

Administrative Judge*
Richard F. Cole
Atomic Safety and Licensing Board Panel
Mail Stop: T-3F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: rfc1@nrc.gov

Administrative Judge*
Ann Marshall Young, Chair
Atomic Safety and Licensing Board Panel
Mail Stop: T-3F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: amy@nrc.gov

Sheila Slocum Hollis**
Duane Morris LLP
1667 K Street, NW, Suite 700
Washington, DC 20006
E-mail: sshollis@duanemorris.com

Administrative Judge*
Paul B. Abramson
Atomic Safety and Licensing Board Panel
Mail Stop: T-3F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: pba@nrc.gov

Office of Commission Appellate *
Adjudication
Mail Stop: O-16C1
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: OCAAMail@nrc.gov

Office of the Secretary*
Attn: Rulemaking and Adjudications Staff
Mail Stop: O-16C1
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: hearingdocket@nrc.gov

Atomic Safety and Licensing Board*
Mail Stop: T-3 F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Molly H. Bartlett, Esq.**
52 Crooked Lane
Duxbury, MA 02332
E-mail: mollynbartlett@hotmail.com

Chief Kevin M. Nord**
Fire Chief & Director Duxbury Emergency
Management Agency
668 Tremont Street
Duxbury, MA 02332
E-mail: nord@town.duxbury.ma.us
Fax: 781-934-6530

Diane Curran, Esq.**
Harmon, Curran, Spielberg
& Eisenberg, L.L.P.
1726 M Street, NW., Suite 600
Washington, DC 20036
E-mail: dcurran@harmoncurran.com

Terence A. Burke, Esq.**
Entergy Nuclear
1340 Echelon Parkway
Mail Stop: M-ECH-62
Jackson, MS 39213

David R. Lewis, Esq.**
Paul A. Gaukler, Esq.
Pillsbury, Winthrop, Shaw, Pittman, LLP
2300 N Street, NW
Washington, DC 20037-1137
E-mail: david.lewis@pillsburylaw.com
paul.gaukler@pillsburylaw.com

Town Manager**
Town of Plymouth
11 Lincoln St.
Plymouth, MA 02360
E-mail: msylvia@townhall.plymouth.ma.us

Matthew Brock, Esq.**
Assistant Attorney General
Office of the Massachusetts Attorney
General
Environmental Protection Division
One Ashburton Place, Room 1813
Boston, MA 02108-1598
E-mail: matthew.brock@ago.state.ma.us

/RA/

_____
Susan L. Uttal
Counsel for the NRC Staff

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of	)	
	)	
ENTERGY NUCLEAR VERMONT YANKEE, LLC, and ENTERGY NUCLEAR OPERATIONS, INC.	)	Docket No. 50-271-LR
	)	ASLBP No. 06-849-03-LR
	)	
(Vermont Yankee Nuclear Power Station)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the "NRC STAFF ANSWER TO MASSACHUSETTS ATTORNEY GENERAL MOTION FOR LEAVE TO FILE and MOTION FOR RECONSIDERATION AND CLARIFICATION OF CLI-07-03" in the above-captioned proceeding have been served on the following by electronic mail and deposit in the U.S. Mail Service or by deposit in the U.S. Nuclear Regulatory Commission's internal mail system as indicated by a single asterisk(*), or by deposit in the U.S. mail system, as indicated by a double asterisk (**) this 16th day of February, 2007.

Administrative Judge
Alex S. Karlin, Chair
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: ask2@nrc.gov

Administrative Judge
Richard E. Wardwell
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: rew@nrc.gov

Administrative Judge
Thomas S. Elleman*
Atomic Safety and Licensing Board Panel
5207 Creedmoor Road, #101
Raleigh, NC 27612
E-mail: elleman@eos.ncsu.edu

Office of the Secretary
Attn: Rulemaking and Adjudications Staff
Mail Stop: O-16C1
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: hearingdocket@nrc.gov

Office of Commission Appellate
Adjudication
Mail Stop: O-16C1
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: OCAAmail@nrc.gov

Sarah Hofmann, Esq.*
Special Counsel
Department of Public Service
112 State Street - Drawer 20
Montpelier, VT 05620-2601
E-mail: sarah.hofmann@state.vt.us

Diane Curran, Esq.*
Harmon, Curran, Spielberg
& Eisenberg, L.L.P.
1726 M Street, NW., Suite 600
Washington, DC 20036
E-mail: dcurran@harmoncurran.com

Ronald A. Shems, Esq.*
Karen Tyler, Esq.*
Shems Dunkiel Kassel & Saunders, PLLC
91 College Street
Burlington, VT 05401
E-mail: rshems@sdkslaw.com
Ktyler@sdkslaw.com

Marcia Carpentier, Esq.
Atomic Safety and Licensing Board Panel
Mail Stop: T-3F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: mxc7@nrc.gov

Jennifer J. Patterson*
Senior Assistant Attorney General
Environmental Protection Bureau
Office of the Attorney General
33 Capitol Street
Concord, New Hampshire 03301
E-mail: jennifer.patterson@doj.nh.gov

Anthony Z Roisman, Esq.*
National Legal Scholars Law Firm
84 East Thetford Rd.
Lyme, NH 03768
E-mail: aroisman@nationallegalscholars.com

Matthew Brock, Esq.*
Assistant Attorney General
Office of the Massachusetts Attorney
General
Environmental Protection Division
One Ashburton Place, Room 1813
Boston, MA 02108-1598
E-mail: matthew.brock@ago.state.ma us

David R. Lewis, Esq.*
Matias F. Travieso-Diaz*
Pillsbury Winthrop Shaw Pittman LLP
2300 N Street, NW
Washington, DC 20037-1128
E-mail: david.lewis@pillsburylaw.com
matias.travieso-diaz@pillsburylaw.com

/RA/
Steven C. Hamrick
Counsel for the NRC Staff

OCT 1 6 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Commission

In the Matter of	)	
	)	
Entergy Nuclear Vermont Yankee, LLC	)	Docket No. 50-271-LR
and Entergy Nuclear Operations, Inc.	)	ASLBP No. 06-849-03-LR
	)	
(Vermont Yankee Nuclear Power Station)	)	

ENTERGY'S BRIEF IN OPPOSITION TO THE MASSACHUSETTS ATTORNEY GENERAL'S APPEAL OF LBP-06-20

David R. Lewis
Matias F. Travieso-Diaz

PILLSBURY WINTHROP SHAW PITTMAN LLP
2300 N Street, N.W.
Washington, DC 20037-1128
Tel. (202) 663-8474

Counsel for Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc.

Dated: October 13, 2006

TABLE OF CONTENTS

TABLE OF AUTHORITIES

Cases **Page**

Statutes & Regulations

October 13, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Commission

In the Matter of	)	
	)	
Entergy Nuclear Vermont Yankee, LLC	)	Docket No. 50-271-LR
and Entergy Nuclear Operations, Inc.	)	ASLBP No. 06-849-03-LR
	)	
(Vermont Yankee Nuclear Power Station)	)	

ENTERGY'S BRIEF IN OPPOSITION TO THE
MASSACHUSETTS ATTORNEY GENERAL'S APPEAL OF LBP-06-20

Pursuant to 10 C.F.R. § 2.311(a), Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc. (hereinafter collectively referred to as "Entergy") submit this brief in opposition to the appeal filed by the Massachusetts Attorney General in the Vermont Yankee license renewal proceeding. The Massachusetts Attorney General's Notice of Appeal[1] and Brief on Appeal[2] request that the Commission review and reverse that portion of the Atomic Safety and Licensing Board's ("Licensing Board" or "Board") Memorandum and Order (Ruling on Standing, Contentions, Hearing Procedures, State Statutory Claim, and Contention Adoption), LBP-06-20, 63 N.R.C. ___ (Sept. 22, 2006) ("LBP-06-20") denying the Attorney General's contention and related hearing request alleging the need for Entergy's Environmental Report ("ER") to address the impacts of severe spent fuel accidents. The Board, however, properly denied the contention and request for hearing based on the Commission's decision in Turkey Point[3] that on-

[1] Massachusetts Attorney General's Notice of Appeal of LBP-6-20 (Oct. 3, 2006).

[2] Massachusetts Attorney General's Brief on Appeal of LBP-6-20 (Oct. 3, 2006) ("Brief").

[3] Florida Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 N.R.C. 3 (2001) ("Turkey Point").

000136

site spent fuel storage is a Category 1 environmental issue for which the environmental impacts have been determined generically by regulation to be "small." Hence, as the Commission held in Turkey Point, "all" onsite spent fuel storage environmental issues, "including accident risk," are not subject to hearing in individual licensing renewal proceedings absent a waiver or suspension and amendment of the rules. 54 N.R.C. at 23 (emphasis added).

The Commission should affirm the Board's decision because the decision is firmly founded on Turkey Point and is fully in accordance with NRC regulations and the National Environmental Policy Act ("NEPA"). As the Attorney General acknowledges, the Commission has discretion to address environmental issues by generic rulemaking. The Attorney General's claim that a petitioner can challenge an ER for not addressing assertedly new and significant information runs afoul of the Commission's determination to handle spent fuel issues in license renewal proceedings by generic rule. Because the Commission's NEPA consideration of spent fuel impacts is embodied in regulation, the asserted new and significant information can only be handled under the Commission's established mechanisms for waiver or suspension and amendment of the rule as described in Turkey Point. The Attorney General's filing of a Rulemaking Petition tacitly concedes this point.

STATEMENT OF THE CASE

Entergy submitted an application, dated January 25, 2006, requesting renewal under 10 C.F.R. Part 54 of Operating License DPR-28 for the Vermont Yankee Nuclear Power Station for an additional 20-year period beyond its current license expiration date (the "Application"). On March 27, 2006, the Nuclear Regulatory Commission ("NRC" or "Commission") published a Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing ("Notice") regarding the Application. 71 Fed. Reg. 15,220 (Mar. 27, 2006)). The Notice permit-

ted any person whose interest may be affected to file a request for hearing and petition for leave to intervene within 60 days of the notice. Id. at 15,220-21.

On May 26,2006, the Attorney General submitted a petition to intervene seeking admission of a single contention concerning the alleged need for the ER to address the environmental impacts of severe spent fuel pool accidents because of asserted new and significant information concerning the likelihood and severity of such accidents.[4] The Attorney General also filed a "Petition for Backfit Order" that sought to require that the Vermont Yankee spent fuel pool be returned to its original low-density storage configuration and to use dry storage for any excess spent fuel. Id.

On June 22, 2006, Entergy and the NRC Staff filed their Answers to the Attorney General's Petition. Both Entergy and the Staff acknowledged the Attorney General's standing but determined that the Attorney General's sole contention concerning spent fuel pool fires was inadmissible because (1) the Contention was an impermissible challenge to the NRC's rules and generic determinations, and (2) the Contention did not in fact raise any new and significant information concerning spent fuel pool fires.[5] On June 29, 2006 the Attorney General filed a Reply to the Entergy and NRC Staff Answers.[6]

---

[4] Massachusetts Attorney General's Request for a Hearing and Petition for Leave to Intervene with Respect to Entergy Nuclear Operations, Inc.'s Application for Renewal of the Vermont Yankee Nuclear Power Plant Operating License and Petition for Backfit Order Requiring New Design Features to Protect Against Spent Fuel Pool Accidents (May 26, 2006) ("Petition").

[5] NRC Staff Answer Opposing Massachusetts Attorney General's Request for Hearing and Petition for Leave to Intervene and Petition for Backfit Order (June 22, 2006) ("Staff Answer"); Entergy's Answer to the Massachusetts Attorney General's Request for a Hearing, Petition for Leave to Intervene, and Petition for Backfit Order (June 22, 2006) ("Entergy Answer").

[6] Massachusetts Attorney General's Reply to Entergy's and NRC Staff's Responses to Hearing Request and Petition to Intervene With Respect to Vermont Yankee License Renewal Proceeding (June 29, 2006) ("Reply").

A Prehearing conference was held on August 1 and 2, 2006, during which the Licensing Board heard oral argument concerning the admissibility of the petitioners' contentions, including the Attorney General's Contention.[7] At that conference, the Attorney General advised the Board and the parties that it would be filing a Rulemaking Petition raising the same issues as those raised in his Contention. Prehearing Tr. at 79-81.

On August 25, 2006, the Attorney General submitted a Petition for Rulemaking which requested that the Commission to amend 10 C.F.R. Part 51 based on the same asserted new and significant information raised in the Attorney General's Contention[8] and which incorporated the Contention and its supporting materials. Like the Contention, the Rulemaking Petition claims that the asserted new and significant information shows that the determination made in the license renewal GEIS[9] that "the likelihood of a fuel-cladding fire is highly remote" is incorrect and it requests the Commission (at 3) to "withhold any decision to renew the operating licenses for the Pilgrim and Vermont Yankee nuclear power plants until the requested rulemaking has been completed and until the NRC has completed" the related NEPA process that may be required by any amended rule. On August 30, 2006, Counsel for Entergy requested the Commission to act on and resolve the Rulemaking Petition by November 2007 in order to avoid any potential for delay in the renewal of the Vermont Yankee and Pilgrim licenses.[10]

---

[7] In the Matter of Entergy Nuclear Generation Company and Entergy Nuclear Operations, Inc. (Vermont Yankee Nuclear Power Station), Docket No. 50-271-LR, ASLBP No. 06-849-03-LR, Oral Arguments on Contentions (Aug. 1 & 2, 2006) ("Prehearing Tr.").

[8] Massachusetts Attorney General's Petition for Rulemaking to Amend 10 C.F.R. Part 51 (Aug. 25, 2006) ("Rulemaking Petition").

[9] NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants (1996) ("GEIS" or "NUREG-1437").

[10] Letter to Chairman Klein and Commissioners McGaffigan, Merrifield, Jaczko, and Lyons from David R Lewis, Counsel for Entergy (Aug. 30, 2006).

On September 22, 2006, the Licensing Board issued LBP-06-20. The Board ruled that "even if the AG has presented new and significant information related to the risks and environmental impacts of high density racking in spent fuel pools, as a matter of law the contention is inadmissible because the Commission has already decided, in Turkey Point, that licensing boards cannot admit an environmental contention regarding a Category 1 issue." LBP-06-20, slip op. at 21. Accordingly, the Board found the Attorney General's Contention to be inadmissible and denied the Attorney General's hearing request. Id. at 29. In doing so, the Board did not reach the issue of whether the Attorney General had in fact supplied new and significant information in his Contention, but the Board did observe that the "risks and effects of high density racking of spent fuel in pools have been studied and debated since 1979 . . . and have been the subject of substantial litigation" in NRC licensing proceedings. Id. at 27 (citation omitted).

On October 3, 2006, the Massachusetts Attorney General filed his Notice of Appeal and Brief on Appeal appealing the Licensing Board's denial of his Request for Hearing and Petition for Leave to Intervene. On October 10, 2006, the Commission issued an Order denying the Attorney General's "Petition for Backfit Order" which had sought to require that the Vermont Yankee spent fuel pool be returned to its original low-density storage configuration and to use dry storage for any excess spent fuel.[11]

ARGUMENT

I. THE ATTORNEY GENERAL'S APPEAL IS UNTIMELY

The Commission's regulation governing appeals from rulings on petitions to intervene provides that an order denying a petition to intervene "may be appealed . . . within ten (10) days

[11] Order, CLI-06-26, 63 N.R.C. ____, slip op. (Oct. 10, 2006).

after the service of the order." 10 C.F.R. § 2.311(a). Here the Board's Memorandum and Order denying the Attorney General's request for hearing and petition to intervene was issued September 22, 2006. As reflected in the Memorandum and Order, copies were served that same day by electronic e-mail transmission to counsel for the parties. LBP-06-20, slip op. at 94 n. 85. Hence, to be timely, the Attorney General's appeal needed to be filed by October 2, 2006.[12]

The Attorney General's appeal was not filed until October 3, 2006. The Attorney General neither filed a request for an extension of time nor provided any reason why the appeal was not filed October 2, 2006. The failure to meet a filing deadline provides a sufficient basis to deny the requested relief and the Attorney General's appeal should be denied on that basis. See. Private Fuel Storage, L.L.C. (Independent Fuel Storage Installation), LBP-00-28, 52 N.R.C. 226, 234-239 (2000), aff'd CLI-01-1, 53 N.R.C. 1 (2001) (denying admission of late-filed contentions based on draft EIS where the contentions were filed six days after the deadline established by the licensing board for the filing of such contentions).

II. THE BOARD CORRECTLY DENIED ADMISSION OF THE ATTORNEY GENERAL'S CONTENTION BECAUSE THE CONTENTION IMPERMISSIBLY CHALLENGES COMMISSION REGULATIONS

The Attorney General argues that the Licensing Board erred in relying upon Turkey Point in ruling that his Contention was inadmissible because (1) Turkey Point is assertedly inapposite here, (2) Turkey Point as applied by the Board is inconsistent with the NRC's regulations, and

[12] The Commission's regulations do allow one additional business day for electronic transmissions where a document is "received by a party after 5 p.m., in the recipient's time zone on the date of transmission." 10 C.F.R. § 2.306. Here, the electronic transmission of the Board's decision was sent at 2:04 p.m. on September 22, 2006. See Electronic Transmission from M. Carpentier, Law Clerk for Atomic Safety and Licensing Board Panel, to Vermont Yankee License Renewal Service List (Sept. 22. 2006). Neither the Attorney General's Notice of Appeal nor the Brief on Appeal gives any indication that the transmission was not timely received by counsel for the Attorney General who is located in Washington D.C. Counsel for Applicant, also located in Washington D.C., had received the transmission and forwarded a brief summary of the Memorandum and Order to his client before 4:00 p.m.

(3) Turkey Point as applied by the Board is inconsistent with NEPA. None of these arguments are meritorious. The Turkey Point decision is directly on point, the Board correctly applied Turkey Point in accordance with the decision and NRC regulations, and Turkey Point is fully consistent with the NRC's regulations and NEPA. Hence, the Commission should deny the Attorney General's appeal and affirm the decision of the Licensing Board.

A. Turkey Point is Fully Applicable to This Case

The Attorney General's claim that Turkey Point is inapposite to this case (Brief at 12) is clearly without merit because Turkey Point is squarely on point and controlling here. In Turkey Point, the Commission held that a contention seeking to litigate the environmental impacts of a catastrophic accident involving the storage of spent fuel at the Turkey Point plant was inadmissible because the impacts from onsite spent fuel storage – including the risk of severe accidents – were Category 1 issues that had been resolved generically in 10 C.F.R. Part 51, Appendix B, Table B-1 of the Commission's regulations. 54 N.R.C. at 21-23. As held by the Commission:

> Part 51's license renewal provisions cover environmental issues relating to onsite spent fuel storage generically. All such issues, including accident risk, fall outside the scope of license renewal proceedings.

Id. at 23 (emphasis added; footnote omitted); see also id. at 22 ("Part 51 treats all spent fuel accidents, whatever their cause, as generic, Category 1 events not suitable for case-by-case adjudication") (emphasis added). Hence, under Turkey Point, the Attorney General's claims concerning the accident risk of spent fuel storage are not litigable in this license renewal proceeding.

Further, Turkey Point expressly addresses how a person claiming the existence of new and significant information that would impact and alter a Category 1 finding codified in 10 C.F.R. Part 51, Appendix B, Table B-1 could seek redress for his or her claim. 54 N.R.C. at 11-

13. As explained there by the Commission:

> The Commission recognizes that even generic findings sometimes need revisiting in particular contexts. Our rules thus provide a number of opportunities for individuals to alert the Commission to new and significant information that might render a generic finding invalid, either with respect to all nuclear power plants or for one plant in particular. In the hearing process, for example, petitioners with new information showing that a generic rule would not serve its purpose at a particular plant may seek a waiver of the rule. See 10 C.F.R. § [2.335] . . . Petitioners with evidence that a generic finding is incorrect for all plants may petition the Commission to initiate a fresh rulemaking.

54 N.R.C. at 12 (emphasis added). Thus, claims of new and significant information affecting Category 1 findings, such as those raised by the Attorney General, do not transform such findings into litigable issues within the scope of a license renewal proceeding. Rather, such claims must be pursued under the waiver or rulemaking provisions of the Commission's regulations.

In light of these broad holdings, the Attorney General's suggestion (Brief at 12) that Turkey Point is not controlling here because the "decision gives no indication that the petitioner's contention in that case had claimed a violation of 10 C.F.R. § 51.53(c)(3)(iv)" is meritless. This provision of the regulations only provides that "[t]he environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware." 10 C.F.R. § 51.53(c)(3)(iv) (emphasis added). This is a subjective standard and not an objective standard. It does not require an applicant to provide and address in the ER information that some other party might conceivably believe is new and significant, and hence does not provide a mechanism for a petitioner to introduce and litigate the alleged existence of new and significant information. As set forth in Turkey Point, the NRC has other established mechanisms (waiver and rulemaking) to serve this function. Furthermore, the Commission expressly addressed in Turkey Point an applicant's obligation under 10 C.F.R. § 51.53(c)(3)(iv) to

provide new and significant information in the ER, 54 N.R.C. at 11, but never identified potential challenges to alleged violations of 10 C.F.R. § 51.53(c)(3)(iv) as a mechanism for a petitioner to raise claims of new and significant information.

Moreover, the Attorney General's claim that a petitioner could transform Category 1 findings into litigable issues simply by alleging that an ER failed to address alleged new and significant information would open a Pandora's box that would obviate the Commission's objective of utilizing generic findings to avoid unnecessary litigation of the same issue in numerous individual licensing proceedings. As discussed further below, it would enable petitioners to directly challenge Commission regulations in individual licensing proceedings contrary to 10 C.F.R. § 2.335 and well established Commission precedent, including Turkey Point.

B. Turkey Point is Fully Consistent with NRC Regulations

The Attorney General's claim (Brief at 12-14) that Turkey Point as applied by the Board's contravenes NRC regulations is likewise meritless. The Board's reliance on Turkey Point in holding that "a petitioner may not challenge an ER's failure to consider new and significant information for a Category 1 environmental impact without first seeking waiver of the generic rule" (LBP-06-20, slip op. at 26) is fully consistent with and required by NRC regulations.

The Commission's regulations expressly provide that, absent waiver of a regulation, "no rule or regulation of the Commission . . . is subject to attack . . . in any adjudicatory proceeding." 10 C.F.R. § 2.335(a) (emphasis added). Numerous Commission precedents confirm and apply this fundamental tenet of NRC jurisprudence.[13] The generic Category 1 findings from the GEIS

[13] See, e.g., Dominion Nuclear Connecticut, Inc. (Millstone Nuclear Power Station, Unit 2), CLI-03-14, 58 N.R.C. 207, 217-18 (2003); Private Fuel Storage, L.L.C. (Independent Spent Fuel Storage Installation), CLI-01-12, 53 N.R.C. 459, 470 (2001).

are set forth in the Commission's rules at 10 C.F.R. Part 51, Appendix B, Table B-1 and hence are not subject to attack by any means in NRC license proceedings (absent waiver or suspension of the rule). Specifically, the management of on-site spent fuel is identified in Table B-1 of Appendix B as a Category 1 issue with "SMALL" impacts based on the generic finding set forth in Table B-1 that "the expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available." 10 C.F.R. Part 51, App. B, Table B-1.

Furthermore, as held by the Commission in Turkey Point, quoted above, the generic finding of "SMALL" impacts set forth in 10 C.F.R. Part 51 encompasses "[a]ll [onsite spent fuel storage] issues, including accident risk." As elaborated on by the Commission in Turkey Point,

> The GEIS's finding encompasses spent fuel accident risks and their mitigation. *See* GEIS at xlviii, 6-72 to 6-76, 6-86, 6-92. The NRC has spent years studying in great detail the risks and consequences of potential spent fuel pool accidents, and the GEIS analysis is rooted in these earlier studies. NRC studies and the agency's operational experience support the conclusion that onsite reactor spent fuel storage, which has continued for decades, presents no undue risk to public health and safety. Because the GEIS analysis of onsite fuel storage encompasses the risk of accidents, [a contention seeking to raise spent fuel accidents in a license renewal proceeding] falls beyond the scope of individual license renewal proceedings.

Turkey Point, CLI-01-17, 54 N.R.C. at 21.[14] In this respect, the analysis in the GEIS includes a finding that "even under the worst probable cause of a loss of spent-fuel pool coolant (a severe

---

[14] The Commission went on to emphasize that the GEIS covered mitigation of accidents as well as their environmental impacts:

> [T]he GEIS deals with spent fuel storage risks (including accidents) generically, and concludes that "regulatory requirements already in place provide adequate mitigation."

Id. at 21-22 (citations omitted).

seismic-generated accident causing a catastrophic failure of the pool), the likelihood of a fuel-cladding fire is highly remote." GEIS at 6-72 – 6-75 (citation omitted).[15]

Consequently, the Attorney General's assertion that the ER is inadequate because it fails to address the environmental impacts of severe spent fuel accidents (Petition at 21) is a direct challenge to the generic finding that is codified in Table B-1 of Part 51. The assertion is also a direct challenge to 10 C.F.R. §§ 51.53(c), 51.71(d) and 51.95(c), which integrate the Category 1 generic findings into the regulations for developing the ER and the Draft and Final EIS and which also do not require analysis of Category 1 issues.[16]

The Attorney General's claim that Turkey Point as applied by the Board is inconsistent with NRC regulations (Brief at 12-14) totally ignores and never mentions these regulations which both codify the GEIS generic findings and obviate further analysis. By virtue of their em-

---

[15] It is well established that under NEPA's rule of reason, agencies are not required to probe remote or speculative consequences or discuss every conceivable alternative to a proposed action. See, e.g., NRDC v. Morton, 458 F.2d 827, 837 (D.C. Cir. 1972). In particular, NEPA does not require consideration of accidents that are remote and speculative. San Luis Obispo Mothers for Peace v. NRC, 751 F.2d 1287, 1300-01 (D.C. Cir. 1984), aff'd on rehearing en banc, 789 F.2d 26 (D.C. Cir.), cert. denied, 479 U.S. 923 (1986); Carolina Envtl. Study Group v. U.S., 510 F.2d 796, 798-800 (D.C. Cir. 1975).

[16] In this respect, 10 C.F.R. § 51.53(c)(3)(i) expressly provides that:

> The environmental report for the operating license renewal stage is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in appendix B to subpart A of this part.

Similarly, 10 C.F.R. § 51.71(d) provides that:

> The draft supplemental environmental impact statement for license renewal prepared pursuant to § 51.95(c) will rely on conclusions as amplified by the supporting information in the GEIS for issues designated as Category 1 in appendix B to subpart A of this part.

And 10 C.F.R. § 51.95(c)(4) provides that:

> In order to make its recommendation and final conclusion on the proposed [license renewal] action, the NRC staff, adjudicatory officers, and Commission shall integrate the conclusions, as amplified by the supporting information in the generic environmental impact statement for issues designated Category 1 . . . .

bodiment in NRC regulations, the GEIS findings are not subject to attack in license renewal proceedings absent waiver or suspension of the rule. 10 C.F.R. § 2.335.

The provisions of the regulations relied upon by the Attorney General are not to the contrary. As discussed above, 10 C.F.R. § 51.53(c)(iv), relied upon by the Attorney General, does not require an applicant to provide and address in the ER every piece of information that some other party might conceivably believe is new and significant. Nor does this regulation require an applicant to reanalyze or revalidate Category 1 issues should there be new and significant information, as claimed by the Attorney General, because 10 C.F.R. § 51.53(c)(3)(i) (quoted in note 16 supra) expressly relieves an applicant of any such obligation.[17]

Furthermore, the regulatory history of the license renewal regulations set forth in the Board's decision clearly demonstrates that the Attorney General's asserted interpretation and application of 10 C.F.R. § 51.53(c)(3)(iv) is wrong. As explained by the Board, the requirement that the ER include new and significant information of which an applicant is aware was not part of the proposed rule but was added to the final rule to expand "the framework for consideration of significant new information" in response to comments received from the Council for Environmental Quality and the Environmental Protection Agency. LBP-06-20, slip op. at 24. The Statement of Considerations for the final rule refers to SECY-93-032,[18] a Staff memorandum re-

[17] The lack of any such obligation is confirmed by the NRC's rejection of a comment to the final rules suggesting such revalidation as follows:

> Based on the NRC's confidence in the applicability of its generic review, it does not see any reason to require that an applicant perform a site-specific validation of GEIS conclusions. The NRC believes that such a requirement eliminates the efficiency and stability sought by the Part 51 rulemaking.

NUREG-1529, "Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response" (Feb. 1996) at C9-14.

[18] SECY-93-032, Memorandum from James M. Taylor, EDO, to the Commissioners (Feb. 9, 1993).

porting to the Commission on the addition of 10 C.F.R. § 51.53(c)(3)(iv) which explained that the addition of this provision would have little impact on license renewal adjudications because:

> Litigation of environmental issues in a hearing will be limited to unbounded category 2 and category 3 issues unless the rule is suspended or waived.

SECY-93-032 at 4.[19] The Commission approved the modifications in the proposed rule and specifically endorsed SECY-93-032.[20] The Commission's approval of SECY-93-032 demonstrates that, when the Commission adopted the final rule, it contemplated that Category 1 issues could only be litigated after the granting of a waiver petition pursuant to 10 C.F.R. § 2.335.

The Commission's intent is further demonstrated by the dialogue set forth in the Board's decision between Commissioner Curtiss and the Deputy General Counsel for Licensing and Regulation upon the Commission's deliberation on the final rule and discussion of SECY-93-032. This dialogue clearly confirms that neither 10 C.F.R. § 51.53(c)(3)(iv) nor any other part of the license renewal regulations would enable a petitioner to litigate a Category 1 issue on the claim that there was new and significant information concerning the issue without first obtaining a waiver or other approval from the Commission itself. LBP-06-20, slip op. at 25 & n. 31.

The Attorney General neither disputes this regulatory history nor cites any contrary regulatory history. Rather, he argues that the Board erroneously relied on this regulatory history because such history "may be relied on only to 'resolve ambiguities' in the regulations" and here there are none according to the Attorney General. Brief at 13. However, both Commission and

---

[19] The final rule subsequently combined Category 2 and 3 issues (61 Fed. Reg. 28,467, 28,474 (June 5, 1996)) but made no changes that would alter the treatment of Category 1 issues.

[20] Memorandum from Samuel J. Chilk, Secretary, to James M. Taylor, EDO (Apr. 22, 1993), ADAMS Accession No. ML003760802.

judicial precedent make clear that "there is wisely no rule of law forbidding resort to explanatory legislative history no matter how clear the words may appear on superficial examinations."[21] Indeed, both cases cited by the Attorney General referred to and relied upon explanatory regulatory history of the regulation in question.[22]

Furthermore, the Attorney General's claim that the language of the regulations is unambiguous and allows only his interpretation and application is specious. The Attorney General wholly ignores:

- (1) the plain language of 10 C.F.R. § 51.53(c)(3)(iv) that only requires an applicant to identify new and significant information "of which the applicant is aware," which as discussed above is a subjective not an objective standard that does not mandate addressing information claimed by others to be new and significant;
- (2) the conflict specifically identified by the Board in its decision (LBP-06-20, slip op. at 21) between 10 C.F.R. § 51.53(c)(3)(iv) as interpreted by the Attorney General and C.F.R. § 51.53(c)(3)(i), which expressly provides that the "environmental report for the operating license renewal stage is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues;" and
- (3) the fundamental conflict between the Attorney General's interpretation, which would open a Pandora's box and allow direct challenges in license renewal proceedings to the generic GEIS findings codified in the Commission's regulations, and 10 C.F.R. § 2.335 which expressly provides that absent waiver of a regulation, "no rule or regulation of the Commission . . . is subject to attack . . . in any adjudicatory proceeding."[23]

Moreover, the Attorney General concedes that "an interpretation of a regulation should be consistent with the overall regulatory scheme." Brief at 14. Here, the Attorney General's "in-

---

[21] Toledo Edison Co. (Davis-Besse Nuclear Power Station, Unit 1) ALAB-323, 3 N.R.C. 331, 336 (1976) quoting Supreme Court precedent. See also, e.g., FDA v. Brown & Williamson Tobacco Corp., 529 U.S. 120, 132-33 (2000).

[22] Wrangler Laboratories ALAB-951, 33 N.R.C. 505, 515 (1991); Long Island Lighting Co. (Shoreham Nuclear Power Station, Unit 1), ALAB-900, 28 N.R.C. 275, 295 (1988).

[23] The Attorney General also refers to 10 C.F.R. § 2.309(f)(2). That provision, however, only provides that petitioners are to file contentions based on the application, including the environmental report, and neither specifies the information to be included in the environmental report nor what constitutes an admissible contention.

terpretation" is inconsistent with the fundamental "overall regulatory scheme" or purpose of the license renewal rules which the Statement of Considerations repeatedly describes as follows:

> The purpose of the this rulemaking is to resolve as many [NEPA] issues as possible before beginning plant-by-plant license renewal proceedings.

56 Fed. Reg. 47,016, 47,023 (Sept. 17, 1991) (emphasis added).

> Those impacts that cannot be evaluated generically will have to be evaluated for each plant before its license is renewed. However, the environmental impacts that can be evaluated generically will not have to be evaluated for each plant.

Id. at 47,016 (emphasis added).

> By assessing and codifying certain potential impacts on a generic basis, no need exists to address these impacts for each future license renewal.

Id. at 47,017(emphasis added). Contrary to this fundamental objective of the license renewal regulations, the Attorney General's position would eliminate any finality on generic issues by allowing their litigation based solely on an allegation that the applicant should have recognized some asserted new and significant information. In contrast, requiring a waiver or suspension and amendment of generic rules to address new and significant information preserves the finality of the generic rules while still permitting appropriately packaged challenges to the rules where truly warranted (e.g., where a prima facie showing is made in a waiver petition).

In short, the Board properly reviewed the regulatory history and both that history and the overall regulatory scheme of the license renewal rules demonstrate that the Attorney General's asserted interpretation of the regulations is patently wrong.

Finally, contrary to the Attorney General's claim (Brief at 14), there is no inconsistency between the inability of petitioners to litigate new and significant information concerning Category 1 issues and the Commission's statement that adjudicatory license renewal proceedings

share the same scope as the NRC's Staff's review.[24] As reflected in SECY-93-032, should the Staff determine that new and significant information exists with respect to a Category 1 issue, the Staff must also seek Commission approval to either waive or suspend and amend the rules. This process is specifically called for with respect to the Staff's review of comments provided by the public,[25] but the same considerations apply with respect to new and significant information provided by an applicant in the ER or identified independently by the Staff. Like licensing boards, the Staff cannot act contrary to Commission regulations and can only proceed to incorporate new and significant information that would modify the generic findings of the GEIS codified in NRC regulation by seeking Commission approval as set forth in SECY-93-032.

Thus, the regulatory history of the license renewal regulations reflects that the Staff is to review information that the applicant, the Staff itself, and members of the public believe may be new and significant, and if the Staff determines that to be the case the Staff will seek Commis-

---

[24] The Attorney General asserts that the Board "observed that *Turkey Point* is internally inconsistent" for the same reason, Brief at 10-11 (emphasis added), whereas the Board indicated only that Turkey Point "seems inconsistent" on this point (LBP-06-20, slip op. at 26-27 n. 32). As discussed above, however, there is no inconsistency.

[25] SECY-93-032 provides in this respect as follows:

> a. The staff may determine that the information furnished [by a commenter] is not new and significant and therefore the analysis codified in the rule stands. A commenter dissatisfied with such a response may file a petition for rulemaking under 10 C.F.R. § 2.802 or seek a waiver under 10 C.F.R. § 2.758 [now 10 C.F.R. § 2. 335] in order to pursue the matter in a hearing.
>
> b. If the staff determines that the information furnished is new and significant, and relevant to both the plant and to other plants, the staff will seek Commission approval to either suspend the application of the rule with respect to that analysis or to delay granting the renewal application (and possibly other renewal applications) until the rule can be amended.
>
> c. If the staff determines that the information furnished is new and significant, but relevant only to the specific plant, the staff will seek Commission approval to waive the appropriate section of the rule in that renewal proceeding.

SECY-93-032, at 3-4 (emphasis added). In contrast, SECY-93-032 provides for unbounded Category 2 and Category 3 issues (now Category 2) that the Staff can directly address new and significant information in the EIS without first seeking Commission approval. Id. at 3.

sion approval to waive application of the rule for the license renewal proceeding in question or to suspend and amend the rule. This process spelled out in SECY-93-032 and approved by the Commission maintains the integrity of the regulations codifying Category 1 issues while providing the Commission with the ability to update Category 1 findings for new and significant information. Thus, the scope of the Staff's review concerning Category 1 issues is the same as that for adjudicatory hearings. In neither case can new and significant information be considered and incorporated into the EIS absent prior Commission approval because in both instances the generic determination codified in the Commission's rules must first be waived or amended.

C. Turkey Point is Fully Consistent with NEPA

The Attorney General's claim (Brief at 14) that Turkey Point as applied in LBP-06-20 "is inconsistent with NEPA and the NRC's regulatory scheme for implementing [NEPA]" is likewise meritless. As the Attorney General acknowledges in his Appeal (Brief at 2) and his Rulemaking Petition (at 16), the Commission has ample authority to proceed generically in implementing NEPA and need not allow litigation of NEPA issues in individual licensing proceedings. The authority of the NRC to resolve environmental NEPA issues by regulation as opposed to adjudication is established by well-recognized Supreme Court precedent in Vt. Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519 (1978) and Baltimore Gas & Electric Co. v. NRDC, 462 U.S. 87, 100-01 (1983). The Attorney General does not dispute this authority and indeed cites to it. See, e.g., Brief at 2. Obviously, if the Commission may resolve issues generically by rule, it is not required to revisit such issues or allow their litigation in each individual licensing proceeding.

Nothing in Turkey Point detracts from the Commission's NEPA obligations. Indeed, as quoted above, the Commission expressly recognized in Turkey Point that "generic findings sometimes need revisiting in particular contexts" and laid out the process by which the generic conclusions in the GEIS could be revisited by the Commission to take into account new and significant information. The processes identified by the Commission in Turkey Point included the requirement for an applicant to identify in the ER new and significant information of which it is aware under 10 C.F.R. § 51.53(c)(3)(iv) and the ability of the public to bring new and significant information to the attention to the attention of the NRC. Additionally, the Staff is obligated under NRC regulation to identify new and significant information. See 10 C.F.R. §§ 51.70(b), 51.72(a)(2) and 51.92(a)(2); see also Regulatory Guide 4.1S at 4.2-S-4.[26] As summarized by the Staff in Reg. Guide 4.1S at 4.2-S-4:

> An applicant should state in the ER whether it is or is not aware of any new and significant information and explain any actions that were taken to identify new information and evaluate its significance. This information will assist the staff in fulfilling its responsibilities under C.F.R. 51.70(b), which in part states, "The NRC staff will independently evaluate and be responsible for the reliability of all information used in the draft environmental impact statement." New and significant information may also be identified by other parties and the NRC in the scoping and public comment process.

Thus, nothing in Turkey Point is inconsistent with the NRC's NEPA obligations. Rather, Turkey Point merely reflects the Commission's determination made in the license renewal regulations to proceed by generic rulemaking for resolving Category 1 NEPA issues as opposed to litigating such issues in numerous individual license renewal proceedings. In accordance with this chosen approach, consideration of new and significant information that would modify the

[26] Supplement 1 to Regulatory Guide 4.2, Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses (Sept. 2000) ("Reg. Guide 4.2S1").

generic findings must proceed by waiver of the rule or by suspension and amendment of the rule. The Attorney General tacitly acknowledges this fact by having filed a Rulemaking Petition.

Finally, the Attorney General's claim (Brief at 15) that by "protecting licensees from contentions regarding their compliance with 10 C.F.R. § 51.53(c)(3)(iv), *Turkey Point* effectively shifts accountability for identifying new and significant information from the licensee to the NRC Staff and the public" is meritless.[27] Turkey Point expressly reaffirms an applicant's obligation to provide new and significant of which the applicant is aware as part of the license renewal application, CLI-01-17, 54 N.R.C. at 11, which would be subject to extensive review and audit by the NRC Staff as part of the Staff review process. Furthermore, it is well established that "[i]nformation provided to the Commission by an applicant for a license . . . must be "complete and accurate in all material respects." 10 C.F.R. § 50.9. Failure of an applicant to do so can result in significant fines and sanctions.[28] Additionally, it is not to be assumed that an applicant or licensee would act contrary to NRC requirements,[29] as presumed by the Attorney General here.

III. THE ATTORNEY GENERAL'S CONTENTION IS ALSO INADMISSIBLE BECAUSE IT PROVIDES NO NEW AND SIGNIFICANT INFORMATION

The Attorney General's Contention is also inadmissible because it does not present any "new and significant" information that would alter the generic findings of the GEIS for on-site

---

[27] The Attorney General's suggestion as part of this argument that 10 C.F.R. § 51.53(c)(3)(iv) requires a full fledged EIS analysis of any new and significant information concerning Category 1 issues is mistaken, for as discussed above, 10 C.F.R. § 51.53(c)(3)(i) expressly provides that a license renewal ER "is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues."

[28] See, e.g., Virginia Electric & Power Co. (North Anna Power Station, Units 1 and 2), CLI-76-22, 4 N.R.C. 480 (1976), aff'd, 571 F.2d 1289 (4th Cir. 1978); 52 Fed. Reg. 49,362 (Dec. 31, 1987) (Completeness and Accuracy of Information; Final Rule and Statement of Policy).

[29] See, e.g., Carolina Power & Light Co. (Shearon Harris Nuclear Power Plant), LBP-99-25, 50 N.R.C. 25, 34 (1999) citing General Public Utilities Nuclear Corp. (Oyster Creek Nuclear Generating Station), LBP-96-23, 44 N.R.C. 143, 164 (1996).

spent fuel storage codified in 10 C.F.R. Part 51, Appendix B, Table B-1. While the Board did not rule on this issue,[30] the Board did observe that "the risks and effects of high density racking of spent fuel in pools have been studied and debated since 1979 . . . and have been the subject of substantial litigation" before the NRC. LBP-06-20, slip op. at 27. As the Board put it, "[t]his ground is well trod." Id.[31]

The ground is indeed well trod. The GEIS notes that the "[c]urrent and potential environmental impacts from spent fuel storage have been studied extensively and are well understood." GEIS at 6-81. Further, the GEIS's determination that the occurrence of a zirconium spent fuel pool fire is "highly remote" (GEIS at 6-72 – 6-75) relies on the Commission's 1990 Review and Revision of the Waste Confidence Decision (55 Fed. Reg. 38,474 (Sept. 18, 1990)), which in turn is based on a long series of technical studies dating back to 1979 and before. As set forth in NUREG-1353,[32] the major study referenced in the Waste Confidence Decision (55 Fed. Reg. at 38,481), these technical studies analyzed a wide range of potential accident initiators that could result in drain-down or boil-down of the spent fuel pool. NUREG-1353 at 4-13 – 4-36. Based on these analyses, the Commission concluded in the Waste Confidence decision that:

> [E]ven if the timing of a spent fuel pool failure were conducive to fire, a fire could occur only with a relatively sudden and substantial loss of coolant – a loss great enough to uncover all or most of the fuel, damaging enough to admit enough air to keep a large fire going, and sudden enough to deny operators the time to restore the pool to a safe condition. Such a severe loss of cooling water is likely to result only from an earthquake well beyond the conservatively estimated earth-

---

[30] It is well established that "successful parties before the Licensing Board . . . may urge that its decision be sustained on any ground which finds support in the record." Niagara Mohawk Power Corp. (Nine Mile Point Nuclear Station, Unit 2), ALAB-264, 1 N.R.C. 347, 357 (1975).

[31] The Attorney General's claim (Brief at 15) that "in dicta the Board suggests that the Attorney General more than met the standard for gaining admission of a contention" is thus misplaced.

[32] NUREG-1353, Regulatory Analysis for the Resolution of Generic Issue 82, "Beyond Design Basis Accidents in Spent Fuel Pools" (April 1989) ("NUREG-1353").

> quake for which reactors are designed. Earthquakes of that magnitude are extremely rare.
>
> The plant specific studies . . . found that, because of the large safety margins inherent in the design and construction of their spent fuel pools, even the more vulnerable older reactors could safely withstand earthquakes several times more severe than their design basis earthquake. Factoring in the annual probability of such beyond-design-basis earthquakes, . . . the average annual probability of a major spent fuel pool fuel pool failure at an operating reactor . . . was calculated at two chances in a million per year of reactor operation.

Id. (emphasis added) (citations omitted).

Thus, the probability of the dominant accident sequence contributing to the risk of a spent fuel pool fire – seismically induced major spent fuel pool failure – was calculated at two chances per million per reactor year of operation,[33] which the Commission considered "extremely rare." 55 Fed. Reg. at 38,481. The Commission went on to note that the risks due to other accident scenarios – such as structural failure of the pool due to high energy tornado or other missiles, aircraft crashes, and heavy load drops, inadvertent drainage of the pool, and boil-down of the pool due to loss of spent fuel cooling or make-up water – "are at least an order of magnitude smaller." Id. These other probabilities are summarized in Table 1 below.

TABLE 1
NUREG-1353 Accident Initiators and Associated Probabilities

Accident Initiator	Probability of Spent Fuel Pool Drain-down or Boil-down	NUREG-1353 Page References
Tornado and Other High Energy Missiles	1×10^{-8}	4-13 – 4-18, 4-36
Aircraft Crash	6×10^{-9}	4-14, 4-36
Heavy Load Drop	3.1×10^{-8}	4-14 – 4-15, 4-36

[33] 55 Fed. Reg. at 38,481, citing NUREG-1353 at ES-3-4. In a subsequent study, the NRC concluded that the risk of a seismically induced structural failure of the spent fuel pool was in the range of 2×10^{-6} to 2×10^{-7}. NUREG-1738 at 3-36 to 3-38. See note 34 infra.

Inadvertent Drainage, (including Pneumatic Seal Failure)	4.2×10^{-8}	4-15 – 4-22, 4-36
Boil-down due to Loss of Cooling or Makeup	6.0×10^{-8}	4-22 – 4-28, 4-36

The Attorney General's Contention provides no new and significant that would alter the determination reached by the Commission in its Waste Confidence decision and relied upon in the GEIS that "even if the timing of a spent fuel pool failure were conducive to fire," the likelihood of such a fire would be "extremely rare." 55 Fed. Reg. at 38,481 (emphasis added). The Contention refers to NUREG-1738,[34] a report by the National Academy of Sciences concerning spent nuclear fuel storage,[35] and the reports of Drs. Gordon Thompson[36] and Jan Beyea[37] supporting the Contention. Petition at 22, 24, 30. None of these sources contains new and significant information that would "lead[] to an impact finding different from that codified in 10 C.F.R. Part 51," requiring amendment of the rules,[38] nor provides the basis for an admissible contention.

---

[34] NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk and Decommissioning Nuclear Power Plants" (Jan. 2001) ("NUREG-1738").

[35] National Academy of Sciences Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, "Safety and Security of Commercial Spent Nuclear Fuel Storage" (The National Academies Press: 2006) ("NAS Rept.")

[36] Gordon R. Thompson, "Risks and Risk-Reducing Options Associated with Pool Storage of Spent Nuclear Fuel at the Pilgrim and Vermont Yankee Nuclear Power Plants" (May 25, 2006) ("Thompson Rept.").

[37] Jan Beyea, "Report to the Massachusetts Attorney General on the Potential Consequences of a Spent-Fuel-Pool Fire at the Pilgrim or Vermont Yankee Nuclear Power Plant" (May 25, 2006) ("Beyea Rept.").

[38] Reg. Guide 4.2S1 at 4.2-S-4 (emphasis added). The Staff has provided a definition in Reg. Guide 4.2S1 of the meaning of "new and significant information" as that term is used in 10 C.F.R. § 51.53(c)(3)(iv), which has two prongs and provides as follows:

> (1) information that identifies a significant environmental issue that was not considered in NUREG-1437 and, consequently, not codified in Appendix B to Subpart A of 10 C.F.R. Part 51, or (2) information that was not considered in the analyses summarized in NUREG-1437 and that leads to an impact finding different from that codified in 10 C.F.R. Part 51.

This definition accords with NRC precedent which holds that "[n]ot every change requires a supplemental EIS; only those changes that cause effects which are significantly different from those already studied. The new circumstance must reveal a seriously different picture of the environmental impact of the proposed project." Hy-

Footnote continued on next page

NUREG-1738 considered the potential of spent fuel pool fires in the context of plants undergoing decommissioning (which lack many of the functioning safety systems of an operating nuclear power plant). While NUREG-1738 does provide some additional information on the potential for spent fuel pool fires, the repeated claims made by the Attorney General that NUREG-1738 undercuts the rationale of the license renewal GEIS (e.g., Brief at 4; Petition. at 30-31) is simply not supported by that document. None of the information presented in NUREG-1738 controverts the conclusion in the GEIS that the occurrence of a zirconium spent fuel pool fire is "highly remote." See GEIS at 6-72 – 6-75. Indeed, NUREG-1738 ultimately concludes that there is a "very low likelihood" of a zirconium pool fire (NUREG-1738 at ix, xi, 5-1 and 5-3; emphasis added) – a conclusion that parallels and reconfirms the conclusion of the GEIS that the likelihood of a fuel cladding fire is "highly remote" (GEIS at 6-72 – 6-75).

The lack of any new and significant information in NUREG-1738 that undermines the conclusions of the GEIS is reinforced by the probabilities that NUREG-1738 determined for various accident initiators. NUREG-1738 considered accident initiating events similar to those considered in NUREG-1353 and reached similar conclusions regarding the improbability of those events causing pool drain-down or boil-down. The probability of occurrence (per year) of pool drain-down or boil-down resulting from the various accident scenarios evaluated in NUREG-1738 are set forth in Table 2 below.

---

dro Resources, Inc., CLI-01-4, 53 N.R.C. 31, 52 (2001) (internal quotes and citations omitted). Clearly the first prong of the above definition of new and significant information does not apply here for the GEIS expressly considered severe spent fuel pool accidents and concluded that "even under the worst probable cause of a loss of spent-fuel pool coolant (a severe seismic-generated accident causing a catastrophic failure of the pool), the likelihood of a fuel-cladding fire is highly remote." GEIS at 6-72 – 6-75 (citation omitted).

TABLE 2 NUREG-1738 Accident Initiators and Associated Probabilities		
Accident Initiator	Probability of Spent Fuel Pool Drain-down or Boil-down	NUREG-1738 Page References
Tornado Missile	$<1.0 \times 10^{-9}$	3-38
Aircraft Crash	2.9×10^{-9}	3-38
Cask Drop	2×10^{-7}	3-38
Boil-down (Loss of Cooling, Makeup, etc.)	1.8×10^{-7}	3-35
Drain-down Due to Seismic Events[39]	2×10^{-6} (LLNL) 2×10^{-7} (EPRI)	3-36 – 3-38

Important to note in relation to the repeated claims made by the Attorney General is that the probabilities in the Table are the probability of drain-down or boil-down and therefore these probabilities assume that the fuel will burn if drain-down or boil-down does occur due to any of these initiating events (though as the fuel ages it may well not burn).[40] Furthermore, NUREG-1738 expressly considered partial drainage and obstructed air flow scenarios (e.g., NUREG-1738 at A1A-4) which the Attorney General repeatedly claims had not been taken into account in previous Commission studies.[41] Even accepting that this information is new to NUREG-1738,

[39] NUREG-1738 utilized the separate seismic hazard estimates that had been developed independently by Lawrence Livermore National Laboratory("LLNL") and the Electric Power Research Institute ("EPRI") for U.S. nuclear power plants and developed separate spent fuel pool fire estimates based on each. See NUREG-1738 at ix, 3-7 – 3-9, 3-36 – 3-38.

[40] The Attorney General repeatedly claims based on NUREG 1738 that "regardless of the age of the fuel in a pool, the fuel will burn shortly after the tops of the fuel assemblies are uncovered." E.g., Petition at 31 (emphasis added); see also Brief at 4. This claim, however, misstates the NUREG's conclusion. Rather, the NUREG's conclusion was that, because of the different variables involved, the possibility of "a zirconium fire cannot be precluded" based solely on the decay time of the fuel. NUREG 1738 at 2-1 – 2-2 (emphasis added).

[41] This claim (e.g., Petition at 30; Reply at 14) is refuted by NUREG/CR-0649, "Spent Fuel Heatup Following Loss of Water During Storage" (Mar. 1979) prepared by Sandia National Laboratories which expressly considered the "Effect of Incomplete Drainage" of the spent fuel pool and concluded that "[i]t is clear". . . that an incomplete drainage [of the pool] can potentially cause a more severe heatup problem than a complete drainage" of the pool. NUREG/CR-0649, § 5.1 ("Effect of Incomplete Drainage") at 73-78 (emphasis added). NUREG/CR-0649 was one of the authoritative sources extensively relied upon and subsumed within the technical analyses underlying the Commission's Waste Confidence Decision and the GEIS. See, e.g., NUREG-1353 at 4-7 – 4-11, 8-1. Thus, this information was considered in the analyses summarized within NUREG-1437 and does not constitute new information.

based on the probabilities in Table 1 and Table 2, the information is clearly not significant. It is self evident from these two Tables that the probability of accident initiators in NUREG-1738 – which expressly account for partially obstructed pool fires – is virtually identical to those in NUREG-1353, as is NUREG-1738's conclusion, discussed above, that there is a "very low likelihood" of a spent fuel pool fire, which is identical to that in both the GEIS and the Waste Confidence Decision. Hence, the information in NUREG-1738 that partial drainage of a pool is a more severe condition than total, instantaneous drainage would not "lead[] to an impact finding different from that codified in 10 C.F.R. Part 51," and thus is not significant even if new.

In short, the conclusion of NUREG-1738 that there is a "very low likelihood" of a zirconium pool fire (NUREG-1738 at ix, xi, 5-1 and 5-3; emphasis added), which parallels and reconfirms the conclusion of the GEIS that the likelihood of a fuel cladding fire is "highly remote" (GEIS at 6-72 – 6-75), demonstrates that the information in NUREG-1738, even if considered new, is not significant.[42] Indeed, the Commission in Turkey Point referred to NUREG-1738 noting that NUREG-1738 found the "the risk of accident somewhat greater than originally believed but still very low." CLI-01-17, 54 N.R.C. at 22 n. 11. Referring to Waste Confidence studies and NUREG-1738, the Commission noted that these studies "concluded that the risk of accidents is acceptably small." 54 N.R.C. at 22.

---

[42] In his Reply (at 13-14), the Attorney General incorrectly seeks to dismiss this conclusion of NUREG-1738 because the study concerned decommissioned plants. The reference to NUREG-1738 at 5-2, relied upon by the Attorney General, of a large number of different accident sequences at operating plants concerns severe reactor accidents and not spent fuel pool accidents which would be subject to the same types of accident sequences (e.g., loss of spent fuel cooling and makeup) at both operating and shutdown plants. Furthermore, NUREG-1738 conducted analyses for plants that had only recently been shut down (starting at 30 or 60 days after final shutdown depending on the analyses) and moreover assumed that, because the plant was permanently shutting down, the full core would be unloaded into the spent fuel pool. NUREG-1738 at 2-1, 3-28, A1A-3 – A1A-4, A4-2; see also NAS Rept. at 45. Because of its assumption that the full core had just recently been off-loaded to the spent fuel pool, the analysis in NUREG-1738 is in fact highly conservative compared to an operating plant where typically only one-third of the core is off-loaded to the spent fuel pool at each refueling outage.

It is well established that, in determining the admissibility of a contention, licensing boards are to "carefully examine[]" documents provided in support of a contention to determine whether they "supply an adequate basis for the contention." See, e.g., Dominion Nuclear North Anna, LLC (Early Site Permit for North Anna ESP Site), LBP-04-18, 60 N.R.C. 253, 265 (2004). Where the board's independent examination of a document shows no basis for the contention, the contention must be dismissed. See, e.g. Yankee Atomic Electric Co. (Yankee Nuclear Power Station), LBP-96-2, 43 N.R.C. 61, 88-90 (1996).[43] In Yankee Atomic, the petitioner had claimed that the applicable NEPA analysis for decommissioning the Yankee Rowe plant had failed to consider a transportation accident scenario evaluated by a Sandia National Laboratory technical report. Id. at 89. However, upon its independent examination, the licensing board found that the report had concluded that such an accident event had "a very low probability" of occurring, and, on that basis, dismissed the contention since NEPA does not require evaluation of "remote and speculative" events. Id. at 89-90.[44]

Similarly here, assuming that the Commission does not affirm the Board's decision dismissing the Contention for the reasons discussed in Section II supra, it should nevertheless dismiss the Attorney General's Contention based on its review of NUREG-1738 – touted by the Attorney General as a major source of new information for the asserted certainty of spent fuel pool fires following drain-down or boil-down – because actual review of NUREG-1738 shows a "very low likelihood" for a spent fuel pool fire even assuming that pool drain-down or boil-down

[43] Reversed in part on other grounds, Yankee Atomic Electric Co. (Yankee Nuclear Power Station), CLI-96-7, 43 N.R.C. 235 (1996).

[44] The Licensing Board in its decision suggests that a licensing board should eschew such an independent examination. LBP-06-20, slip op. at 27. Such a course of action is, however, contrary to the precedent discussed above.

invariably results in a spent fuel pool fire. Hence, NUREG-1738 extensively relied upon by the Attorney General shows such an event to be remote and speculative and not requiring an evaluation under NEPA, and provides absolutely no basis for his Contention.

Similarly, the NAS Report does not provide significant new information mandating the Commission to reconsider its license renewal GEIS. The NAS Report focused on terrorist attacks potentially causing a severe spent fuel accident. However, as discussed below, the Commission has ruled that NEPA imposes no legal duty on the NRC to consider intentional malevolent acts, and thus the subject of the NAS Report is beyond the scope of this license renewal proceeding. Moreover, the NRC has carefully evaluated the NAS Report, and has acted on the Report's Findings and Recommendations as it deemed appropriate. Most relevant to the issue here, the NRC has concluded, after reviewing the information in the NAS Report, that it continues to generally consider "the likelihood of a zirconium fire capable of causing large releases of radiation into the environment to be extremely low."[45] Thus, the NRC has fully considered the NAS Report and found no basis, even in the context of a terrorist attack, to change its conclusion regarding the risks of spent fuel pool fires stated in the GEIS.

The Thompson and Beyea reports repeat many arguments that were made in a 2003 paper by Alvarez, et al. (referenced in Thompson Report at 12 and Beyea Report at 3). This article has, however, already been reviewed by the NRC and found to suffer from excessive conservatisms, so that its recommendations do not have a sound technical basis.[46] No new substantive informa-

---

[45] "U.S. Nuclear Regulatory Commission Report to Congress on the National Academy of Sciences Study on the Safety and Security of Commercial Spent Nuclear Fuel Storage" ((Mar. 2005), at 21. ("NRC Rept. on NAS Study").

[46] COMSECY-03-0019, Review of the Paper "Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States," Robert Alvarez et al., January 31, 2003, Adams Accession No. ML052340740.

tion responding to the deficiencies identified by the NRC in the Alvarez paper is provided in the Contention or its supporting papers. For example, the report supplied by Dr. Beyea on radiological consequences continues to use unrealistic and excessive conservatisms regarding the overestimation of radiation release and overestimation of societal costs associated with a severe spent fuel accident. See Entergy Answer at 24-25. Similarly, Dr. Thompson's Report provides no new substantive information regarding the probability of a worst case spent fuel damage scenario involving a terrorist attack. Rather, it claims, without any factual support or explication, that "prudent judgment indicates that a probability of at least one per century is a reasonable assumption for policy purposes." Thompson Rept. at 26. This is the same sophistry that NRC rejected as meaningless in COMSECY-03-0019. See COMSECY-03-0019, Attachment at 2-4.

While Dr. Thompson alleged in his Report (at 18) that certain accident events could lead to spent fuel pool fire at Vermont Yankee, he provided no information to demonstrate that the accident induced probabilities of pool drain-down or boil-down underlying the GEIS set forth in NUREG-1353 are incorrect. See Entergy Answer at 18-20. Dr. Thompson did postulate that a severe reactor accident would trigger a spent fuel pool accident, but he completely ignored the fact that, even in such an event, pool drain-down due to structural failure of the pool or pool boil-down due to loss of cooling or make-up water capability must still occur before a spent fuel pool fire could be triggered. See Entergy Answer at 20-24. For example, he used an entirely unsupported assumption of a 50% conditional probability of a spent fuel pool fire given a severe reactor accident wholly devoid of any factual basis.[47]

[47] Id. See also Entergy's Brief on New and Significant Information in Response to Licensing Board Order of July 14, 2006 (July 21, 2006) at 15 n. 24 filed in the Pilgrim license renewal case.

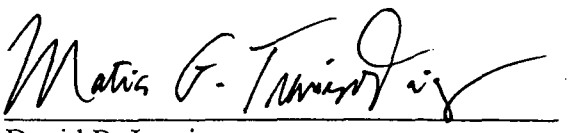
of sabotage could not be assessed meaningfully and therefore was unlitigable. Therefore, even though the Ninth Circuit's decision has now become effective, there is a split in the circuits, and Vermont Yankee is not located in the Ninth Circuit. Furthermore, the Pacific Gas & Electric Company has filed a petition for certiorari requesting Supreme Court review of the Ninth Circuit decision. Therefore, although the decision is now effective, it is still under review.

Because the Ninth Circuit decision is not controlling, and because the Commission held in McGuire that sabotage is already addressed in the GEIS, Entergy respectfully submits that the Commission should continue to follow it established precedent precluding consideration of terrorism in license renewal proceedings. In any event, because spent fuel storage is governed by the Waste Confidence Rule and is a Category 1 issue, the issue can be admitted as a contention only if the Commission waives these rules.

CONCLUSION

For the reasons stated above, the Commission should affirm the Licensing Board's decision dismissing the Massachusetts Attorney General's Petition to Intervene and Contention.

Respectfully Submitted,



David R. Lewis
Matias F. Travieso-Diaz
PILLSBURY WINTHROP SHAW PITTMAN LLP
2300 N Street, N.W.
Washington, DC 20037-1128
Tel. (202) 663-8474
Counsel for Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc.

Dated: October 13, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
Before the Commission

In the Matter of	)	
	)	
Entergy Nuclear Vermont Yankee, LLC	)	Docket No. 50-271-LR
and Entergy Nuclear Operations, Inc.	)	ASLBP No. 06-849-03-LR
	)	
(Vermont Yankee Nuclear Power Station)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "Entergy's Brief in Opposition to the Massachusetts Attorney General's Appeal of LBP-06-20" dated October 13, 2006, were served on the persons listed below by deposit in the U.S. Mail, first class, postage prepaid, and where indicated by an asterisk by electronic mail, this 13th day of October, 2006.

*Dale Klein, Chairman
U.S. Nuclear Regulatory Commission
Mail Stop: O-16 G15
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738
e-mail: chairman@nrc.gov

*Jeffrey S. Merrifield, Commissioner
U.S. Nuclear Regulatory Commission
Mail Stop: O-16 C1
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738
e-mail: cmrmerrifield@nrc.gov

*Edward McGaffigan, Jr., Commissioner
U.S. Nuclear Regulatory Commission
Mail Stop: O-16 G15
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738
e-mail: cmrmcgaffigan@nrc.gov

*Gregory B. Jaczko, Commissioner
U.S. Nuclear Regulatory Commission
Mail Stop: O-16 C1
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738
e-mail: cmrjaczko@nrc.gov

*Peter B. Lyons, Commissioner
U.S. Nuclear Regulatory Commission
Mail Stop: O-16 C1
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738
e-mail: cmrlyons@nrc.gov

*Administrative Judge
Alex S. Karlin, Esq., Chairman
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
ask2@nrc.gov

*Administrative Judge
Dr. Thomas S. Elleman
Atomic Safety and Licensing Board
5207 Creedmoor Road, #101,
Raleigh, NC 27612.
tse@nrc.gov; elleman@eos.ncsu.edu

*Administrative Judge
Dr. Richard E. Wardwell
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
rew@nrc.gov

Office of Commission Appellate Adjudication
Mail Stop O-16 C1
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

*Secretary
Att'n: Rulemakings and Adjudications Staff
Mail Stop O-16 C1
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
secy@nrc.gov, hearingdocket@nrc.gov

*Mitzi A. Young, Esq.
*Steven C. Hamrick, Esq.
Office of the General Counsel
Mail Stop O-15 D21
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
may@nrc.gov; sch1@nrc.gov

Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

*Anthony Z. Roisman, Esq.
National Legal Scholars Law Firm
84 East Thetford Road
Lyme, NH 03768
aroisman@nationallegalscholars.com

*Sarah Hofmann, Esq.
Director of Public Advocacy
Department of Public Service
112 State Street – Drawer 20
Montpelier, VT 05620-2601
Sarah.hofmann@state.vt.us

*Diane Curran, Esq.
Harmon, Curran, Spielberg &Eisenberg, LLP
1726 M Street, N.W., Suite 600
Washington, D.C. 20036
dcurran@harmoncurran.com

*Ronald A. Shems, Esq.
*Karen Tyler, Esq.
Shems, Dunkiel, Kassel & Saunders, PLLC
9 College Street
Burlington, VT 05401
rshems@sdkslaw.com
ktyler@sdkslaw.com

Mr. Dan MacArthur
Director, Emergency Management
P.O. Box 30
Marlboro, VY 50344
dmacarthur@igc.org

*Matthew Brock, Esq.
Assistant Attorney General
Environmental Protection Division
Office of the Attorney General
One Ashburton Place
Boston, MA 02108
Matthew.brock@ago.state.ma.us

*Callie B. Newton, Chair
Gail MacArthur
Lucy Gratwick
Town of Marlboro
Selectboard
P.O. Box 518
Marlboro, VT 05344
marcialynn@ev1.net; cbnewton@sover.net

Matias F. Travieso-Diaz

Matias F. Travieso-Diaz

OCT 1 6 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of	)	
	)	
ENTERGY NUCLEAR VERMONT YANKEE, LLC, and ENTERGY NUCLEAR OPERATIONS, INC.	)	Docket No. 50-271-LR
	)	ASLBP No. 06-849-03-LR
	)	
(Vermont Yankee Nuclear Power Station)	)	

NRC STAFF'S BRIEF IN OPPOSITION TO MASSACHUSETTS ATTORNEY GENERAL'S APPEAL OF LBP-06-20

Steven C. Hamrick
Counsel for NRC Staff

October 13, 2006

TABLE OF CONTENTS

TABLE OF AUTHORITIES

REGULATIONS

FEDERAL REGISTER

October 13, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of	)	
	)	
ENTERGY NUCLEAR VERMONT YANKEE, LLC, and ENTERGY NUCLEAR OPERATIONS, INC.	)	Docket No. 50-271-LR
	)	ASLBP No. 06-849-03-LR
	)	
(Vermont Yankee Nuclear Power Station)	)	

NRC STAFF BRIEF IN OPPOSITION TO MASSACHUSETTS ATTORNEY GENERAL'S APPEAL OF LBP-06-20

INTRODUCTION

Pursuant to 10 C.F.R. § 2.311(a), the Staff of the U.S. Nuclear Regulatory Commission ("Staff") hereby responds to the "Massachusetts Attorney General's Brief on Appeal of LBP-06-20," dated October 3, 2006 ("AG Brief"). In LBP-06-20, the Atomic Safety and Licensing Board ("Board") denied admission of the Attorney General's sole contention. Memorandum and Order (Ruling on Standing, Contentions, Hearing Procedures, State Statutory Claim, and Contention Adoption). 63 NRC __ (Sept. 22, 2006), slip op. at 23. For the reasons discussed below, the Commission should affirm the Board's decision.

BACKGROUND

By letter dated January 26, 2006, Entergy Vermont Yankee, LLC and Entergy Nuclear Operations, Inc. (collectively, "Entergy" or "Applicant") submitted an application, under 10 C.F.R. Part 54, to renew Operating License No. DPR-28 for the Vermont Yankee Nuclear Power Station ("VYNPS"). In practical terms, the proposed renewal would renew the operating license to authorize the Applicant to operate VYNPS for an additional 20 years beyond the current expiration date of March 21, 2012. In response to the notice of acceptance for

docketing and opportunity for hearing published in the *Federal Register*,[1] the Attorney General, the New England Coalition ("NEC"), the Town of Marlboro, Vermont, and the Vermont Department of Public Service timely filed intervention petitions.[2] On June 8, 2006, an Atomic Safety and Licensing Board was established to preside over the proceeding.[3] On June 22, 2006, Entergy and the Staff filed answers opposing the Attorney General's hearing request.[4] On June 30, 2006, the Attorney General filed a reply.[5]

Following oral argument on the Attorney General's contention on August 1, 2006, the Board, on September 22, 2006, issued LBP-06-20, in which it denied the Attorney General's hearing request, finding its sole contention inadmissible. LBP-06-20, slip op. at 23. The Board granted the hearing request of DPS, admitting one of DPS's three contentions. The Board also granted NEC's hearing request, admitting four of NEC's six contentions, and denied the hearing request of the Town of Marlboro. On October 3, the Attorney General filed his notice of appeal and supporting brief. In his brief, the Attorney General argues that the Board improperly

---

[1] *See* "Entergy Nuclear Operations, Inc.; [VYNPS]: Notice of Acceptance of Docketing of the Application and Notice of Opportunity for Hearing Regarding Renewal of Facility Operating License No. DPR-28 for an Additional 20-Year Period," 71 Fed. Reg. 15220 (Mar. 27, 2006).

[2] *See* "[NEC] Petition for Leave to Intervene Request for Hearing and Contentions," dated May 26, 2006; "Massachusetts Attorney General's Request for a Hearing and Petition for Leave to Intervene With Respect To Entergy Nuclear Operations Inc.'s Application for Renewal of the Vermont Yankee Nuclear Power Plant Operation and Petition for Backfit Order Requiring New Design Features to Protect Against Spent Fuel Accidents," dated May 26, 2006; "Vermont Department of Public Service Notice of Intention to Participate and Petition to Intervene," dated May 26, 2006; Letter from Town of Marlboro Selectboard and Emergency Management Director, dated April 27, 2006.

[3] See "Establishment of Atomic Safety and Licensing Board," dated June 6, 2006. 71 Fed. Reg. 34397 (June 14, 2006).

[4] *See* NRC Staff Answer Opposing Massachusetts Attorney General's Request for Hearing and Petition for Leave to Intervene and Petition for Backfit, (June 22, 2006) (Staff Answer); Entergy's Answer to the Massachusetts Attorney General's Request for Hearing, Petition for Leave to Intervene, and Petition for Backfit Order (June 22, 2006) (Entergy Answer).

[5] *See* Massachusetts Attorney General's Reply to Entergy's and NRC Staff's Responses to Hearing Request and Petition to Intervene With Respect to Vermont Yankee License Renewal Proceeding, (June 30, 2006) (Attorney General Reply).

applied the *Turkey Point* case to his contention and that the Commission's decision in *Turkey Point* is inconsistent with both the Commission's regulations and the National Environmental Policy Act ("NEPA"). AG Brief at 12-15 (citing *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 NRC 3 (2001)).

LEGAL STANDARDS

I. Legal Standards for the Admission of Contentions

To gain admission to a proceeding as a party, a petitioner, in addition to establishing standing, must proffer at least one contention that satisfies the admissibility requirements of 10 C.F.R. § 2.309(f). *See* 10 C.F.R. § 2.309(a). *See also AmerGen Energy Company, LLC* (Oyster Creek Nuclear Generating Station), CLI-06-24, 63 NRC __, slip op. at 7 (2006). For a contention to be admissible, the petitioner must satisfy the following six requirements:

> (i) Provide a specific statement of the issue of law or fact to be raised or controverted;
>
> (ii) Provide a brief explanation of basis for the contention;
>
> (iii) Demonstrate that the issue raised in the contention is within the scope of the proceeding;
>
> (iv) Demonstrate that the issue raised in the contention is material to the findings the NRC must make to support the action that is involved in the proceeding;
>
> (v) Provide a concise statement of the alleged facts or expert opinions which support the . . . petitioner's position on the issue and on which the petitioner intends to rely at the hearing, together with references to the specific sources and documents on which the . . . petitioner intends to rely to support its position on the issue; and
>
> (vi) Provide sufficient information to show that a genuine dispute exists with the . . . licensee on a material issue of law or fact. This information must include references to specific portions of the application (including the applicant's environmental report and safety report) that the petitioner disputes and the supporting reasons for each dispute, or, if the petitioner believes that the application fails to contain information on a relevant matter as required by law, the identification of each failure and the supporting reasons for the petitioner's belief.

10 C.F.R. § 2.309(f)(1)(i)-(vi). These contention requirements are "strict by design." *Oyster Creek*, CLI-06-24, slip op. at 7. A contention that fails to comply with these requirements will not be admitted for litigation. *Id.*

II. License Renewal Environmental Review

In 1996, the Commission amended 10 C.F.R. Part 51 to establish environmental review requirements for license renewal applicants.[6] The environmental review for license renewal is divided into generic and plant-specific components. *See* 10 C.F.R. Part 51, Subpart A, Appendix B; *see also Turkey Point*, 54 NRC at 11. Underlying the environmental review framework is an extensive, systematic study of the potential environmental consequences of operating a nuclear power plant for an additional 20 years. *Id.* (citing NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Final Report, Vol. 1 ("GEIS")(May 1996)).

On many issues, the NRC found that it could draw generic conclusions applicable to all existing nuclear power plants, or to a specific subgroup of plants, issues referred to as "Category 1." *Id.* (citing 10 C.F.R. Part 51, Subpart A, App. B). License renewal applicants need not submit in their site-specific Environmental Reports an analysis of these generic Category 1 issues. *See* 10 C.F.R. § 51.53(c)(3)(i). For those issues, applicants instead may reference and adopt the generic environmental impact findings codified in Table B-1, Appendix B to Part 51. *Turkey Point*, 54 NRC at 11.

All other environmental issues for which the Commission was not able to make environmental findings on a generic basis, are referred to as "Category 2" issues. *See* 10 C.F.R. Part 51, Subpart A, App. B. License renewal applicants must provide a plant-specific review of these issues. *Turkey Point*, 54 NRC at 11. Additionally, the applicant must provide

---

[6] Final Rule, "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses," 61 Fed. Reg. 28,467 (June 5, 1996).

additional analysis for Category 1 issues in its Environmental Report if new and significant information may bear on the applicability of the Category 1 finding at its particular plant. *Id.* (citing 10 C.F.R. § 51.53(c)(3)(iv)).

DISCUSSION

I. The Attorney General's Contention

The Attorney General's contention argued that Entergy's Environmental Report "does not satisfy the requirements of 10 C.F.R. § 51.53(c)(3)(iv) and NEPA . . . because it fails to address new and significant information regarding the reasonably foreseeable potential for a severe accident involving nuclear fuel stored in high-density storage racks in the Vermont Yankee fuel pool." Petition at 21. The Attorney General argued that, although an NRC sponsored study conducted in 1979 raised the potential for a severe accident in a high-density fuel storage pool if water is partially lost from the pool,[7] the NRC failed to take that risk into account in every NRC Environmental Impact Statement ("EIS") prepared since then, including the 1996 GEIS, upon which the Vermont Yankee license renewal application relies. *Id.*

The Attorney General claims that such new and significant information exists based on five "facts or expert opinions:" (1) the expert declaration and report of Dr. Gordon Thompson; (2) the expert declaration and report of Dr. Jan Beyea; (3) excerpts from NUREG-1738; (4) the 2006 "Safety and Security of Commercial Spent Nuclear Fuel Storage" report of the National Academy of Sciences; and (5) the terrorist attacks of September 11, 2001. *Id.* at 22. The Attorney General also argued that Entergy's ER failed to contain severe accident mitigation alternatives (SAMAs) for a spent fuel pool fire. *Id.* at 47.

Entergy and the Staff opposed admission of the Attorney General's contention. Both argued that the environmental impact of onsite spent fuel storage is identified as a Category 1

---

[7] NUREG/CR-0649, *Spent Fuel Heatup Following Loss of Water During Storage* (March 1979) ("Sandia Report").

issue in Appendix B to 10 C.F.R. Part 51. Entergy Answer at 11-12; Staff Answer at 11-12. Therefore, according to section 51.53(c)(3)(i), Entergy's ER need not contain a discussion of the environmental impacts of Category 1 issues. *Id.* The Staff and Entergy argued that, in order to litigate a Category 1 issue, a petitioner must first petition for a waiver of the generic Category 1 determination, or petition for a change in the rule. *Id.* Additionally, both the Staff and Entergy argued that the information provided by the Attorney General was not new and significant. *See* Staff Answer at 16-22; Entergy Answer at 13-25.

In LBP-06-20, the Licensing Board held "that the failure of an ER to include known new and significant information concerning a Category 1 issue as required in 10 C.F.R. § 51.53(c)(3) cannot give rise to an admissible contention." LBP-06-20, slip op. at 23. In its ruling, the Licensing Board relied upon the Commission decision in *Turkey Point*, concluding that Category 1 issues are not litigable. *Id.* On appeal, the Attorney General argues that *Turkey Point* is inapplicable to his contention and that the Commission's decision in *Turkey Point* is inconsistent with both the Commission's regulations and the National Environmental Policy Act ("NEPA"). AG Brief at 12-15.

II. The Licensing Board's Decision Should Be Affirmed

A. The Licensing Board Correctly Applied Turkey Point to This Proceeding

The Attorney General argues that *Turkey Point* is not applicable to his contention. AG Brief at 12. The Attorney General distinguishes his contention from that involved in *Turkey Point* by noting that the *Turkey Point* petitioner challenged the ER's failure to consider a Category 1 issue, whereas the Attorney General's contention challenges Entergy's failure to discuss new and significant information concerning a Category 1 issue in its ER. AG Brief at 12. Admittedly, the Attorney General's contention is not an exact copy of the *Turkey Point* contention. However, the Commission in *Turkey Point* nonetheless removed any doubt regarding the proper course of action in this case and the Board appropriately considered and

applied the Commission's interpretation of the interplay between 10 C.F.R. § 51.53(c)(3)(i) and (iv). The Commission in *Turkey Point* specifically addressed the methods by which a petitioner may "alert the Commission to *new and significant information* that might render a generic finding invalid." 54 NRC at 12 (emphasis added). This very situation arises in the instant case. Therefore, the Board's reliance upon *Turkey Point* in making its decision was wholly appropriate.

In *Turkey Point*, the Commission recognized "that even generic findings sometimes need revisiting in particular contexts," and stated that its "rules thus provide a number of opportunities for individuals to alert the Commission to new and significant information that might render a generic finding invalid, either with respect to all nuclear power plants or for one plant in particular." 54 NRC at 12. "In the hearing process," the Commission continued, "petitioners with new information showing that a generic rule would not serve its purpose at a particular plant may seek a waiver of the rule" pursuant to 10 C.F.R. § 2.758 (now § 2.335). *Id.* Petitioners with evidence that a generic finding is incorrect for all plants have the opportunity to "petition the Commission to initiate a fresh rulemaking" pursuant to 10 C.F.R. § 2.802. *Id.* The Attorney General pursued none of these avenues.[8] In making this list in *Turkey Point*, the Commission did not expressly state that litigation without waiver of the rule was not an available option. *Id.* However, as the Board in this case concluded, adding the option of filing a contention without first obtaining a waiver of the rule "would obviate the other three [options], because a logical petitioner would always opt for it and skip the extra burdens associated with" the enumerated options. LBP-06-20, slip op. at 23.

Turkey Point makes clear that litigation of Category 1 issues is not available to the Attorney General because 10 C.F.R. § 51.53(c)(3)(i), which precludes litigation of Category 1

---

[8] The Attorney General has subsequently filed a rulemaking petition. *See* [Attorney General] Petition for Rulemaking to Amend 10 C.F.R. Part 51 (Aug. 25, 2006).

issues, remains in effect unless waived. 54 NRC at 12-15. A Licensing Board may not admit a contention unless it is within the scope of the proceeding. 10 C.F.R. § 2.309(f)(1)(iii). As long as the rules that preclude the consideration of Category 1 issues remain in effect, the Attorney General's contention is outside the scope of this proceeding. *See* LBP-06-20, slip op. at 26-27, n.32. The Board reiterated this point by citing a later passage in *Turkey Point* where the Commission stated that "Part 51 treats all spent fuel accidents, whatever their cause, as generic, Category 1 events not suitable for case-by-case adjudication." LBP-06-20 at 23 (citing 54 NRC at 22). In holding that Category 1 issues are not litigable absent a waiver of Commission rules, the Board correctly applied the precedent from *Turkey Point* to the Attorney General's contention.

B. <u>The Licensing Board's Regulatory Interpretation is Correct</u>

The Attorney General next argues that the Board erred by relying on regulatory history in interpreting the regulations. AG Brief at 12-13. The use of extrinsic aids, he argues, is only appropriate to resolve ambiguities in the regulation. *Id.* (citing *Wrangler Laboratories, et al.,* ALAB-951, 33 NRC 505, 513-14 (1991)). According to the Attorney General, 10 C.F.R. § 51.53(c)(3)(iv), which requires the discussion of new and significant information regarding the environmental impacts of license renewal, is not ambiguous, so reliance upon regulatory history for interpretive guidance is unnecessary and inappropriate. *Id.*

The Attorney General also acknowledges the proposition that "an interpretation of a regulation should be consistent with the overall regulatory scheme." *Id.* at 14 (citing *Duke Energy Corp.* (Catawba Nuclear Station, Units 1 and 2), LBP-05-10, 61 NRC 241, 299 (2005). When reading the regulations independently, there is little, if any, ambiguity. However, when the two regulations are read in concert, and in the context of the overall regulatory scheme, ambiguity arises:

> The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

10 C.F.R. § 51.53(c)(3)(iv).

> The environmental report for the operating license renewal stage is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in appendix B to subpart A of this part.

10 C.F.R. § 51.53(c)(3)(i).

There is, arguably, a conflict in Part 51 for the scenario presented here, where a petitioner seeks to challenge a license renewal application for its failure to provide new and significant information with respect to an issue designated as Category 1. The Attorney General ignores this ambiguity - 10 C.F.R. § 51.53(c)(3)(i) is not mentioned once in his Appeal Brief. The Board recognized this ambiguity, and recognized that it can be resolved by following the direction given at various times by the Commission. LBP-06-20, slip op at. 26. First and foremost, the Board cited the *Turkey Point* case, where the Commission states that a petitioner must seek a waiver of the rule in order to litigate the issue, or, in the alternative, may petition for a new rulemaking. *Id.* at 23. Second, the Board cited SECY-93-032, a Staff memorandum to the Commission, which stated that litigation would not extend to Category 1 issues unless the rule was waived. *Id.* at 24 (citing SECY 93-032, Memorandum from James M. Taylor, EDO, to the Commissioners (Feb. 9, 1993)). This paper was approved by the Commission. *Id.* (citing Memorandum from Samuel J. Chilk, Secretary, to James M. Taylor, EDO (Apr. 22, 1993)). Finally, the Board cited a colloquy between Commissioner James R. Curtiss and Martin Malsch, the Deputy General Counsel for Licensing and Regulation, wherein the Commissioner was twice assured that a petitioner could not litigate the issue of whether there was new and significant information on a Category 1 issue without first obtaining a waiver of the rule.

Id. at 25 (citing Public Meeting, "Briefing on Status of Issues and Approach to GEIS Rulemaking for Part 51," (Feb 19, 1993) at 14-15).

When two NRC regulations may be in conflict, it is appropriate for the Board to seek interpretive guidance from Commission caselaw, as well as other Commission documents. In this case, in order to resolve the apparent conflict between 10 C.F.R. § 51.53(c)(3)(i) and (iv), the Board appropriately relied upon these sources, which reinforced its reading of *Turkey Point.* LBP-06-20, slip op. at 24-26.

The Attorney General also argues that the Board's interpretation of *Turkey Point* is inconsistent with the NRC's regulatory scheme for evaluating generic environmental impacts of license renewal as contemplated by the Commission. AG Brief at 14. On the contrary, it is the Attorney General's interpretation that is inconsistent with the Commission's regulatory scheme. The Commission has stated on numerous occasions that, absent waiver, generic Category 1 issues are not subject to litigation. *See* discussion *supra* at 9-10. Allowing petitioners to request and receive a hearing based on allegations that license renewal applicants have failed to provide new and significant information regarding a Category 1 issue would undermine the Commission's express intent to avoid litigation of these issues. Therefore, the Board's interpretation of 10 C.F.R. Part 51 properly relied upon regulatory history, is consistent with the NRC's regulatory scheme, and should be affirmed.

C. <u>Turkey Point is Consistent With NEPA</u>

Next, the Attorney General argues that the Board's ruling is erroneous because *Turkey Point* is not consistent with NEPA, and the NRC's scheme for implementing NEPA. AG Brief at 14. In fact, the Attorney General contends that the Commission should reconsider its ruling in *Turkey Point* because that case weakens the agency's NEPA process by shielding licensees from litigation when they fail to comply with 10 C.F.R. § 51.53(c)(3)(iv). *Id.* This protection of licensees, the Attorney General claims, shifts the burden of identifying new and significant

information from the licensees to the public and the NRC Staff, which may decrease the quality of information considered. *Id.*

Turkey Point is consistent with NEPA and the NRC's scheme for implementing NEPA and it is not necessary for the Commission to reconsider it here. In *Turkey Point*, the Commission provided a lengthy justification for this regulatory framework, explaining how it fits within the bounds of NEPA caselaw. 54 NRC at 13-15. The Attorney General ignores this pertinent discussion in his brief by failing to address the Commission's comments. In *Turkey Point*, the Commission noted that its practice of tiering environmental analyses by first performing a generic review, with "findings that address impacts common to all nuclear power plants, supplemented by a narrower review of plant-specific issues, reflects a commonplace NEPA approach." *Id.* at 14 (citing 40 C.F.R. § 1508.28 (Council on Environmental Quality Regulations addressing "tiering" of NEPA documents)).

Next, the Commission cited its "longstanding practice, repeatedly upheld on judicial review" of addressing specific environmental issues generically through rulemaking, because "NEPA does not require agencies to adopt any particular internal decisionmaking structure." *Id.* (citing *Balt. Gas & Elec. Co. v. Natural Resources Defense Council, Inc.*, 462 U.S. 87, 100-01 (1983). In situations, like license renewal, where there are environmental effects that would be essentially similar for all or a commonly identifiable sub-category of nuclear plants, "[a]dministrative efficiency and consistency of decision are both furthered by a generic determination of these effects without needless repetition of the litigation in individual proceedings, which are subject to review by the Commission in any event." Id. at 14 (citing *Balt. Gas & Elec.*, 462 U.S. at 101).

The Commission also relied upon a court of appeals decision, which reached a similar conclusion, that "even where an agency's enabling statute expressly requires it to hold a hearing, the agency may rely on its rulemaking authority to determine issues that do not require

a case-by-case consideration . . . . A contrary holding would require the agency continually to relitigate issues that may be established fairly and efficiently in a single rulemaking proceeding. *Kelly v. Selin*, 42 F.3d 1501, 1511 (6th Cir.), *cert. denied*, 515 U.S. 1159 (1995); *see also Minnesota v. NRC*, 602 F.2d 412, 416-17 (D.C. Cir. 1979) (Where factual issues do not involve particularized situations, an agency may proceed by a comprehensive resolution of the questions rather than relitigating the question in each proceeding in which it is raised). In addition to holding that the use of generic findings does not violate NEPA, each of these decisions also recognizes the ultimate reason for a generic determination: to avoid unnecessarily relitigating generic issues. *See Balt. Gas & Elec.,* 462 U.S. at 101; *Kelly v. Selin*, 42 F.3d at 1511; *Minnesota v. NRC*, 602 F.2d at 416-17.

The Attorney General's appeal fails to explain how *Turkey Point* "weakens the process by shielding licensees from litigation," or "effectively shifts accountability for identifying new and significant information from the licensee to the NRC Staff and the public." *See* AG Brief at 15. Nor does he explain how, if this were so, it would be inconsistent with NEPA. *Id.* The Commission has decided, as a matter of policy, that Category 1 issues should not be litigated in individual hearings. *See* discussion *supra* at 9-10. However, if there is new and significant information regarding a Category 1 issue at an individual plant, a petitioner may simply petition for a waiver of the rule, under 10 C.F.R. § 2.335, and, if successful, proceed to litigate the issue.

If, on the other hand, a petitioner who seeks to challenge the alleged failure of an applicant or the staff to include new and significant information that is generic may file a rulemaking petition. *Turkey Point*, 54 NRC at 11. The Attorney General's brief indicates that he has filed such a petition pursuant to 10 C.F.R. § 2.802. AG Brief at 7-9. The existence of this option further undermines his argument. Assuming, *arguendo,* that there is new and significant information regarding all or a readily identifiable subcategory of nuclear power plants,

the Commission has the authority, consistent with its tiering approach described above, to address this generic new and significant information through a rulemaking. *See Balt. Gas & Elec.*, 462 U.S. 87; *Kelly v. Selin*, 42 F.3d 1501. The Attorney General's argument fails to identify why the Board's ruling is contrary to NEPA, or provide a reason to question the ruling in *Turkey Point*.

The Attorney General apparently accepts "that the Commission has discretion to address the concerns raised in [his] contention through a rulemaking."[9] AG Brief at 2. By recognizing this principle, the Attorney General seems to acknowledge that neither the Commission in *Turkey Point* nor the Board below erred in holding that the Commission may decide to address Category 1 issues generically through rulemaking. Nevertheless, he seeks Commission review of LBP-06-20 to "clarify the considerable confusion created by the *Turkey Point* decision." *Id.* at 3. *Turkey Point* did not create confusion, instead, it provided clarification to the extent that the Attorney General concedes the Commission can address his concerns through a rulemaking petition. The Attorney General has failed to demonstrate that *Turkey Point* is inconsistent with NEPA. Therefore, the Commission should decline to reconsider *Turkey Point* and affirm the Board's decision.

D. <u>The Attorney General's Contention is Inadmissible</u>

As noted above, the Board correctly found the Attorney General's contention inadmissible because it seeks to litigate a Category 1 issue. However, in addition to addressing the Board's basis for its decision to not admit the contention, the Attorney General's brief also addresses issues of admissibility not reached by the Board in its decision, and requests the

---

[9] However, the Attorney General argues that, in evaluating his rulemaking petition, the Commission would not have discretion to determine whether the information he provides is actually new and significant, in order to justify a new rulemaking. *See* AG Brief at 2 ("The Commission has no discretion, however, to deny both this appeal and the rulemaking petition"). The Commission certainly has discretion to determine that the information provided by the Attorney General is not new and significant, in either a rulemaking or an adjudication.

Commission not only reverse the Board's decision, but affirmatively admit the contention for hearing. AG Brief at 16. The Attorney General argues that it "clearly meets" the standards for contention admissibility found in 10 C.F.R. § 2.309(f)(1).

In holding that the Attorney General's contention is inadmissible, the Board limited its decision to the fact that the contention was outside the scope of the proceeding pursuant to *Turkey Point*. The Board did not address whether the contention was otherwise admissible.[10] The Board did not err in finding it unnecessary to address factual claims because it ruled, as a threshold matter, that the contention was not litigable. Thus, the only issue before the Commission on appeal is whether the Board's decision regarding litigation of Category 1 impacts is correct.

The Attorney General's request that the Commission not only reverse the Board's decision, but affirmatively admit the contention ignores the structure of Commission adjudication. The Commission has delegated to the Licensing Board the authority to address, in the first instance, the admissibility of contentions under 10 C.F.R. § 2.309.[11] If the Commission agrees with the Attorney General that the contention is not barred by *Turkey Point*, the correct procedure is to remand the decision to the Board for a complete determination of admissibility under section 2.309. As such, any discussion of whether the contention is otherwise admissible under section 2.309 is premature.

---

[10] "[B]ecause we conclude that, as a matter of law, the failure of an ER to include new and significant information relating to a Category 1 issue is not litigable, we need not determine whether the multiple declarations and documents proffered by the AG in fact provide sufficient information to at least support the admissibility of this contention." LBP-06-20, slip op. at 27-28.

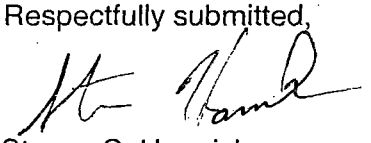
[11] In this case, the Secretary of the Commission referred the Attorney General's hearing request to the Atomic Safety and Licensing Board Panel for appropriate action in accordance with 10 C.F.R. § 2.346(i). *See* Memorandum from Annette L. Vietti-Cook, Secretary, to G. Paul Bollwerk, Chief Administrative Judge, Atomic Safety and Licensing Board Panel, "Requests for Hearing with Respect to the License Renewal Application for the Vermont Yankee Nuclear Power Station," dated June 7, 2006.

The Attorney General also argues that the Commission should apply a recent decision addressing the evaluation of the impacts of terrorism under NEPA, *San Luis Obispo Mothers for Peace v. NRC.* 449 F.3d 1016 (9th Cir. 2006). In rejecting the terrorism aspect of the Attorney General's contention, the Board did not ignore the *Mothers for Peace* case. *See* LBP-06-20, slip op. at 28. Instead, the Board, held that the Attorney General's argument, alleging Entergy failed to provide new and significant information regarding the environmental impacts of terrorism, is not litigable.[12] *Id.* The Attorney General does not explain how the Board could consider the *Mothers for Peace* decision when his contention is not litigable. Therefore, the Attorney General failed to demonstrate error and the Board's decision should be affirmed.

CONCLUSION

For the reasons stated above, the Commission should affirm the Board's decision.

Respectfully submitted,



Steven C. Hamrick
Counsel for NRC Staff

Dated at Rockville, Maryland
this 13th day of October 2006

---

[12] In any event, as the Board recognized, the *Mothers for Peace* decision is not applicable here because the Commission held in *McGuire* that the license renewal GEIS already considered acts of sabotage, unlike the Staff NEPA analysis for the Diablo Canyon Independent Spent Fuel Storage Installation. *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-26, 56 NRC 358, 365 n.24 (2002) (citing GEIS at p. 5-18). In *McGuire*, the Commission stated that "the GEIS concluded that, if such an event were to occur, the resultant core damage and radiological releases would be no worse than those expected for internally initiated events." *Id.*

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
ENTERGY NUCLEAR VERMONT YANKEE, LLC, and ENTERGY NUCLEAR OPERATIONS, INC.	)	Docket No. 50-271-LR
	)	ASLBP No. 06-849-03-LR
	)	
(Vermont Yankee Nuclear Power Station)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the "NRC STAFF'S BRIEF IN OPPOSITION TO MASSACHUSETTS ATTORNEY GENERAL'S APPEAL OF LBP-06-20" in the above-captioned proceeding have been served on the following by electronic mail with copies by deposit in the NRC's internal mail system or, as indicated by an asterisk, by electronic mail with copies by U.S. mail, first class, this 13th day of October 2006.

Administrative Judge
Alex S. Karlin, Chair
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: ask2@nrc.gov

Administrative Judge
Richard E. Wardwell
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: rew@nrc.gov

Administrative Judge
Thomas S. Elleman*
Atomic Safety and Licensing Board Panel
5207 Creedmoor Road, #101
Raleigh, NC 27612
E-mail: elleman@eos.ncsu.edu

Office of the Secretary
Attn: Rulemaking and Adjudications Staff
Mail Stop: O-16C1
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: hearingdocket@nrc.gov

Office of Commission Appellate
Adjudication
Mail Stop: O-16C1
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: OCAAmail@nrc.gov

Sarah Hofmann, Esq.*
Director of Public Advocacy
Department of Public Service
112 State Street - Drawer 20
Montpelier, VT 05620-2601
E-mail: sarah.hofmann@state.vt.us

Diane Curran, Esq.*
Harmon, Curran, Spielberg
& Eisenberg, L.L.P.
1726 M Street, NW., Suite 600
Washington, DC 20036
E-mail: dcurran@harmoncurran.com

Ronald A. Shems, Esq.*
Karen Tyler, Esq.
Shems Dunkiel Kassel & Saunders, PLLC
91 College Street
Burlington, VT 05401
E-mail: rshems@sdkslaw.com
Ktyler@sdkslaw.com

Callie B. Newton, Chair
Gail MacArthur
Lucy Gratwick
Marcia Hamilton
Town of Marlboro
Selectboard
P.O. Box 518
Marlboro, VT 05344
E-mail: cbnewton@sover.net
marcialynn@ev1.net

Marcia Carpentier, Esq.
Atomic Safety and Licensing Board Panel
Mail Stop: T-3F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: mxc7@nrc.gov

Anthony Z. Roisman, Esq.*
National Legal Scholars Law Firm
84 East Thetford Rd.
Lyme, NH 03768
E-mail: aroisman@nationallegalscholars.com

Matthew Brock, Esq.*
Assistant Attorney General
Office of the Massachusetts Attorney
General
Environmental Protection Division
One Ashburton Place, Room 1813
Boston, MA 02108-1598
E-mail: matthew.brock@ago.state.ma.us

Dan MacArthur, Director
Town of Marlboro
Emergency Management
P.O. Box Box 30
Marlboro, VT 05344
E-mail: dmacarthur@igc.org

David R. Lewis, Esq.*
Matias F. Travieso-Diaz
Pillsbury Winthrop Shaw Pittman LLP
2300 N Street, NW
Washington, DC 20037-1128
E-mail: david.lewis@pillsburylaw.com
matias.travieso-diaz@pillsburylaw.com

Mitzi A. Young
Counsel for NRC Staff

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE COMMISSION

In the Matter of	)	
	)	
Entergy Nuclear Operations, Inc.	)	Docket No. 50-271-LR
	)	
(Vermont Yankee Nuclear Power Station)	)	
	)	

MASSACHUSETTS ATTORNEY GENERAL'S
BRIEF ON APPEAL OF LBP-06-20

COMMONWEALTH OF MASSACHUSETTS

By its Attorneys,
THOMAS F. REILLY
ATTORNEY GENERAL

Diane Curran
Harmon Curran, Spielberg & Eisenberg, L.L.P.
1726 M Street N.W., Suite 600
Washington, D.C. 20036
202/328-3500
dcurran@harmoncurran.com

Matthew Brock, Assistant Attorney General
Environmental Protection Division
Office of the Attorney General
One Ashburton Place
Boston, MA 02108
617/727/2200 X 2425
matthew.brock@ago.state.ma.us

October 3, 2006

TABLE OF CONTENTS

TABLE OF AUTHORITIES

Judicial Decisions

Administrative Decisions

Statutes

Federal Rules of Procedure

Regulations

Federal Register Notices

Miscellaneous

October 3, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE COMMISSION

In the Matter of	)	
	)	
Entergy Nuclear Operations, Inc.	)	Docket No. 50-271-LR
	)	
(Vermont Yankee Nuclear Power Station)	)	
	)	

MASSACHUSETTS ATTORNEY GENERAL'S BRIEF ON APPEAL OF LBP-06-20

I. INTRODUCTION

Pursuant to 10 C.F.R. § 2.311, the Attorney General of Massachusetts ("Attorney General") submits this brief on appeal of the LBP-06-20, Memorandum and Order (Ruling on Standing, Contentions, Hearing Procedures, State Statutory Claim, and Contention Adoption) (September 22, 2006) ("LBP-06-20"). The Attorney General appeals the portion of LBP-06-20 which denies admission of the single contention he submitted to the U.S. Nuclear Regulatory Commission ("NRC's" or "Commission") in its proceeding to consider Entergy Nuclear Operations, Inc.'s ("Entergy's") application for renewal of its license to operate the Vermont Yankee nuclear power plant. The contention charges that Entergy's Environmental Report ("ER") fails to satisfy the National Environmental Policy Act ("NEPA") and the NRC's implementing regulations because it does not address new and significant information regarding the significant adverse environmental impacts of continued high-density storage of spent fuel in the Vermont Yankee fuel pool.

The ASLB's sole rationale for refusing to conduct a hearing on the Attorney General's contention is that the Commission's *Turkey Point* decision bars NEPA

consideration of the environmental impacts of spent fuel pool accidents in a license renewal case because spent fuel storage impacts constitute a "Category 1" issue under the NRC's regulations for implementing NEPA. LBP-06-20, slip op. at 21, citing *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 NRC 3, 6-13 (2001) ("*Turkey Point*"). The Commission should reverse LBP-06-20 because *Turkey Point* is inapposite to this case. In the alternative, even if the Commission believes *Turkey Point* applies, the Commission should reconsider *Turkey Point* because it is inconsistent with NEPA and the NRC's own regulatory scheme for implementation of NEPA.

The Attorney General believes the Commission should reverse LBP-06-20 and admit his contention because the contention meets the NRC's admissibility standard. Nevertheless, the Attorney General recognizes that the Commission alternatively has the discretion to address the concerns raised in the Attorney General's contention through a rulemaking. *See Turkey Point,* 54 NRC at 14, citing *Baltimore Gas & Electric v. Natural Resources Defense Council,* 462 U.S. 87, 100-01 (1983). Thus, the Commission may decide whether to reverse LBP-06-20 or grant the Attorney General's August 25, 2006, Rulemaking Petition, in which he seeks, *inter alia,* a generic determination that the environmental impacts of high-density pool storage of spent fuel are significant.[1] The Commission has no discretion, however, to deny both this appeal and the rulemaking petition. The Commission must obey NEPA's non-discretionary requirement to consider significant new information bearing on the environmental impacts of Entergy's proposal

[1] Massachusetts Attorney General's Petition for Rulemaking to Amend 10 C.F.R. Part 51 (August 25, 2006) ("Rulemaking Petition").The NRC has docketed the

to continue storing spent fuel in high-density fuel storage racks in the Vermont Yankee fuel pool.

If the Commission decides to uphold LBP-06-20 and proceed to address the Attorney General's claim through a rulemaking, it nevertheless should clarify the considerable confusion created by the *Turkey Point* decision regarding the rights and obligations of hearing petitioners with respect to the filing of NEPA contentions under 10 C.F.R. § 51.53(c)(3)(iv).

II. FACTUAL AND PROCEDURAL BACKGROUND

A. Attorney General's Contention

On May 26, 2006, the Attorney General submitted a hearing request and contention in the license renewal proceedings for the Vermont Yankee nuclear power plants.[2] The Attorney General's contention challenged the adequacy of Entergy's ER to comply with NEPA's requirement that it address significant new information bearing on the environmental impacts of continued high-density pool storage of spent fuel at the Vermont Yankee plant.[3] The contention was supported by the expert declarations and

---

petition and assigned it Docket No. PRM51-10. Letter from Michael T. Lesar to Diane Curran (September 21, 2006).

[2] Massachusetts Attorney General's Request for a Hearing and Petition to Intervene With Respect to Entergy Nuclear Operations Inc.'s Application for Renewal of the Vermont Yankee Nuclear Plant Operating License, etc.("Hearing Request").

[3] The Attorney General also submitted a virtually identical hearing request in the Pilgrim license renewal case. Massachusetts Attorney General's Request for a Hearing and Petition to Intervene With Respect to Entergy Nuclear Operations Inc.'s Application for Renewal of the Pilgrim Nuclear Plant Operating License, etc. (May 26, 2006). The ASLB recently announced that it in mid-October it expects to issue a decision on standing and admissibility of contentions.

reports of Drs. Gordon Thompson and Jan Beyea regarding the likelihood and consequences of spent fuel pool accidents at the Vermont Yankee nuclear power plant.[4]

The contention asserted that Entergy had not satisfied 10 C.F.R. § 51.53(c)(3)(iv) because its ER did not address new and significant information, presented in government-sponsored studies and an expert report commissioned by the Attorney General, regarding the behavior of spent fuel in high-density storage pools under accident conditions. Hearing Request at 21-23.[5] This significant new information firmly establishes that, across a broad range of scenarios, (a) if the water level in a fuel storage pool drops to the point where the tops of the fuel assemblies are uncovered, the fuel will burn; (b) the fuel will burn regardless of its age; and (c) the fire will propagate to other assemblies in the pool. *Id.*

The information is significant because it contradicts the conclusion of the NRC's previous environmental analyses that the environmental impacts of spent fuel storage are insignificant. Hearing Request at 21-23, citing NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants ("License Renewal GEIS"); NUREG-0757, Generic Environmental Impact Statement for Handling and Storage of Spent Light Water Reactor Fuel (1979) ("1979 GEIS"); Final Rule, Review

---

[4] Thompson, Risks and Risk-Reducing Options Associated with Pool Storage of Spent Nuclear Fuel at the Pilgrim and Vermont Yankee Nuclear Power Plants (May 25, 2006) ("Thompson Report"); Jan Beyea, Report to the Massachusetts Attorney General on the Potential Consequences of a Spent-fuel Pool Fire at the Pilgrim or Vermont Yankee Nuclear Plant (May 25, 2006) ("Beyea Report").

[5] *Id.* The new information consists of Dr. Thompson's expert report (*see* note 4, *supra*); NUREG-1738, *Final Technical Study of Spent Fuel Pool Accident Risk and Decommissioning Nuclear Power Plants* (January 2001) ("NUREG-1738"); and a report by the National Academy of Sciences' ("NAS'") Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, *Safety and Security of Commercial Spent Nuclear Fuel Storage* (The National Academies Press: 2006) ("NAS Report").

and Final Revision of Waste Confidence Decision, 55 Fed. Reg. 38,474 (September 18, 1990) ("Waste Confidence Rule"). The information is new because the NRC did not previously consider it in any of its environmental impact statements regarding the impacts of spent fuel storage. Hearing Request at 24-29, citing License Renewal GEIS, 1979 GEIS, Waste Confidence Rule.

The contention also demonstrated that a range of events the NRC normally addresses in its EISs for the licensing of nuclear power plants could cause a severe pool accident. Hearing Request at 32-33. In addition, the contention demonstrated that a severe accident caused by an intentional attack on a nuclear power plant fuel pool is reasonably foreseeable and therefore should be considered. Hearing Request at 33-47. The Attorney General asked the ASLB to follow a recent decision by the Ninth Circuit of the U.S. Court of Appeals which overturned the Commission's rationale for categorically refusing to consider the impacts of intentional attacks in any EIS. *San Luis Obispo Mothers for Peace v. NRC*, 449 F.3d 1016 (9th Cir. 2006) ("*Mothers for Peace*"). Letter from Diane Curran to Alex Karlin et al, re: Vermont Yankee License Renewal Proceeding, Docket No. 50-271-LR (June 16, 2006) ("Curran Letter to ASLB").

Furthermore, the contention presented new and significant information showing that the consequences of a severe pool accident could be grave, and that the consequences of pool accidents differ in significant respects from the consequences of reactor accidents. Hearing Request at 40-41, 47, citing Beyea Report.

The Attorney General contended that because this new and significant information was not previously considered in the License Renewal GEIS or any other EIS for a nuclear power plant license or spent fuel storage, and because it would

significantly affect the NRC's conclusions regarding the likelihood of severe spent fuel accidents, it must be considered in an EIS or supplemental EIS for any NRC licensing decision that involves high-density pool storage of spent fuel. Hearing Request at 21-23, citing *Marsh v. Oregon Natural Resources Council,* 490 U.S. 360, 374 (1989) ("*Marsh*").

The basis for the contention also provided a detailed discussion of the history of NRC's NEPA consideration of environmental impacts of spent fuel storage, and the nature and the significance of the new information the Attorney General presented in support of his contention. Hearing Request at 23-47. In addition, a discussion of the statutory and regulatory requirements of NEPA and NRC regulations for consideration of new and significant information in the NEPA decision-making process prefaced each contention. Hearing Request at 5-16.

B. Oppositions to Contention

Both Entergy and the NRC Staff opposed the admission of the Attorney General's contention. In addition to claiming that the information presented by the Attorney General is not new or significant, they argued that the Commission has designated the environmental impacts of spent fuel storage as a generic "Category 1" issue exempted from consideration in any individual license renewal proceeding. Entergy's Answer at 10-12, NRC Staff's Answer at 11-13. Citing *Turkey Point*, they argued that the only means by which the Attorney General could obtain a hearing on the environmental impacts of spent fuel storage would be a petition for rulemaking or a waiver petition. *Id.*

The Attorney General defended the admissibility of his contention in a reply brief.[6] In an August 1, 2006, oral argument, the Attorney General also stated that, in the alternative, he planned to submit a rulemaking petition to the Commission. Transcript of oral argument at 79-81.

C. Rulemaking Petition

On August 25, 2006, the Attorney General submitted his Rulemaking Petition, asking the NRC Commissioners to: (a) consider new and significant information showing that the NRC's characterization of the environmental impacts of spent fuel storage as insignificant in the 1996 License Renewal GEIS is incorrect, (b) revoke the regulations which codify that incorrect conclusion and excuse consideration of spent fuel storage impacts in NEPA decision-making documents, (c) issue a generic determination that the environmental impacts of high-density pool storage of spent fuel are significant, and (d) order that any NRC licensing decision that approves high-density pool storage of spent fuel at a nuclear power plant or any other facility must be accompanied by an EIS that addresses (i) the environmental impacts of high-density pool storage of spent fuel at that nuclear plant and (ii) a reasonable array of alternatives for avoiding or mitigating those impacts.

The Rulemaking Petition raises the same substantive concern as the Attorney General's contentions in the Pilgrim and Vermont Yankee license renewal cases: that spent fuel stored in high-density fuel storage pools is much more vulnerable to fire than the License Renewal GEIS concludes. Thus the petition relies on and incorporates by reference the legal and technical

---

[6] Massachusetts Attorney General's Reply to Entergy's and NRC Staff's Responses to Hearing Request and Petition to Intervene With Respect to Vermont Yankee License Renewal Proceeding (June 30, 2006) ("Attorney General's Reply").

assertions made in the Attorney General's contentions. In addition, it supplements the contentions with information about the extent to which the environmental impacts of spent fuel pool storage can be addressed generically and the extent to which they should be considered on a case-by-case basis. Declaration of Dr. Gordon Thompson in Support of Rulemaking Petition (August 23, 2006) (Attachment 2 to Rulemaking Petition).

The Attorney General filed the Rulemaking Petition as a companion to his contentions in the Pilgrim and Vermont Yankee license renewal proceedings, in response to arguments by Entergy and the NRC Staff that *Turkey Point* and NRC regulations that excuse license renewal applicants from addressing the environmental impacts of spent fuel storage in their ERs preclude admission of the contentions unless successfully challenged in a rulemaking petition or waiver petition. *See* discussion above in Section II.B. While the Attorney General believes that his contentions in the Pilgrim and Vermont Yankee proceedings are admissible, he has submitted the Rulemaking Petition in the alternative, in order to ensure that before renewing the operating licenses for the Pilgrim and Vermont Yankee plants, the NRC will address the environmental issues the Attorney General has raised. *Id.* at 17.[7]

The Rulemaking Petition requests the Commission to withhold any decision to renew the operating licenses for the Pilgrim and Vermont Yankee nuclear power plants until the requested rulemaking proceeding has been completed and until the NRC has completed the NEPA process for consideration of environmental impacts of high-density pool storage of spent fuel at the Pilgrim and Vermont Yankee nuclear plants. *Id.* at 3. The Rulemaking

[7] The Attorney General did not file a waiver petition because his concerns clearly do not involve the type of "special circumstances" that must be demonstrated in order to obtain a regulatory waiver under 10 C.F.R. § 2.335(b).

Petition also requests the Commission to suspend the consideration of the Attorney General's contentions in the individual license renewal proceedings for the Pilgrim and Vermont Yankee nuclear power plants. *Id.*

D. LBP-06-20

LBP-06-20 does not address the question of whether the Attorney General's contention satisfies the NRC's admissibility standard. Instead, it denies admission of the Attorney General's contention on the threshold ground that the *Turkey Point* decision precludes admission of an environmental contention regarding a Category 1 issue. LBP-06-20, slip op. at 21. According to the ASLB, the Attorney General's only "options" for raising his NEPA concerns about environmental risks posed by continued high-density pool storage of spent fuel at Vermont Yankee would be to file a petition for rulemaking, provide the information to the Staff ("which can then seek Commission approval to suspend the application of the rules or delay the license renewal proceeding"), or petition for a waiver of 10 C.F.R. Part 51, Appendix B, Table B-1. *Id.*, slip op. at 26.

The ASLB also relies on *Turkey Point* to reject the aspect of the Attorney General's contention which faults Entergy's ER for failing to consider the environmental impacts of intentional attacks on the Vermont Yankee spent fuel storage pool. LBP-06-20, slip op. at 28, citing *Turkey Point,* 54 NRC at 12.[8] Finally, the ASLB relies on *Turkey Point* to reject the portion of the Attorney General's contention seeking consideration of severe accident mitigation alternatives ("SAMAs") for spent fuel pool

[8] In addition, the ASLB relies on the Commission's holding in *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-26, 56 NRC 358, 365 (2002), that contentions regarding environmental impacts of terrorist attacks need not be considered in individual license renewal cases because

accidents, on the ground that SAMAs are not required for spent fuel accidents because they are Category 1 impacts. LBP-06-20, slip op. at 29, citing *Turkey Point,* 54 NRC at 21-22.

Despite following *Turkey Point,* the ASLB points out significant aspects in which the *Turkey Point* decision contradicts the Commission's regulatory scheme for consideration of NEPA issues in licensing adjudications. As the ASLB recognizes, for example, "the essence of virtually all admissible contentions is an allegation that the applicant has failed to address, or has inadequately addressed, some legally required matter." LBP-06-20, slip op. at 22. For a license renewal applicant, "legally required matters" include the clear obligation under 10 C.F.R. § 51.53(c)(3)(iv) to address, in its ER, "new and significant information" regarding Category 1 environmental impacts of which the applicant is aware.[9] "Normally," therefore, an applicant's failure to address new and significant information regarding Category 1 impacts would "give rise to an admissible contention." *Id.* Nevertheless, *Turkey Point* forbids the raising of such a contention. *Id.* at 23.

The ASLB also observes that *Turkey Point* is internally inconsistent: on the one hand it commits to license renewal hearings on the full scope of issues covered by the NRC Staff's review, and on the other hand it narrows the scope of issues in a license renewal hearing to exclude a whole category of issues reviewed by the NRC Staff, *i.e.,*

---

they were already considered in the License Renewal GEIS. LBP-06-20, slip op. at 28-29.

[9] LBP-06-20, slip op. at 22. Similarly, the NRC Staff must consider any significant new information related to Category 1 issues when it prepares the Supplemental Environmental Impact Statement ("SEIS") in support of the license renewal application. *Id.*, citing 10 C.F.R. §§ 51.92(a)(2), 51.95(c)(3); Final Rule,

new and significant information with respect to Category 1 impacts. As the ASLB explains:

> The Commission's ruling in *Turkey Point* (that an applicant's failure to provide new and significant information relating to a Category 1 issue cannot be adjudicated in a license renewal proceeding) seems inconsistent with its statement that '[a]djudicatory hearings in individual license renewal proceedings will share the same scope of issues as our NRC Staff review.' *Turkey Point*, CLI-01-17, 54 NRC at 10 (emphasis added). On the one hand, the ER must include new and significant information relating to Category 1 issues, 10 C.F.R. § 51.53(c)(3)(iv), the Staff must review this information and include any 'significant new circumstances or information' relating to Category 1 issues in supplements to the draft SEIS, 10 C.F.R. § 51.72(a)(2), and the Staff's final SEIS will cover any 'significant new circumstances or information' relating to Category 1 issues, 10 C.F.R. § 51.92(a)(2). On the other hand, absent of waiver of the regulations, those issues cannot be heard in any adjudicatory hearing. Under the *Turkey Point* holding, the permissible scope of a license renewal adjudicatory hearing is narrower than the scope of the Staff's review.

LBP-06-20, slip op. at 26-27 n. 32. The ASLB does not seek to justify or rationalize this inconsistency.

ARGUMENT

III. THE ASLB SHOULD HAVE ADMITTED THE ATTORNEY GENERAL'S CONTENTION.

A. Standard of Review

NRC regulation 10 C.F.R. § 2.311(b) provides that:

> An order denying a petition to intervene and/or request for a hearing admission of a contention is appealable by the requestor/petitioner on the question as to whether the request and/or petition should have been granted.

Here, the ASLB erred by applying *Turkey Point* to this case. *Turkey Point* is inapposite because it does not address the admissibility of a contention that asserts a license renewal applicant's failure to comply with 10 C.F.R. § 51.53(c)(3)(iv). Even assuming for

---

Environmental Review for Renewal of Nuclear Power Plant Operating Licenses, 61 Fed. Reg. 28,467, 28,470 (June 5, 1996).

purposes of argument that *Turkey Point* is applicable to this case, the Commission should reconsider *Turkey Point* because it is inconsistent with NEPA and the NRC's own regulations for conducting adjudications of NEPA issues in license renewal proceedings. The ASLB should have judged the admissibility of the contention and concluded that it meets the NRC's test for admissibility in 10 C.F.R. § 2.309(f).

B. *Turkey Point* is Inapposite to This Case.

Turkey Point is inapposite to this case because it does not address the admissibility of a contention challenging a license renewal applicant's failure to discuss new and significant information bearing on the impacts of license renewal in its ER. In *Turkey Point,* the Commission affirmed the denial of a contention seeking consideration of fuel pool accidents, in part on the ground that spent fuel storage impacts constitute Category 1 impacts that are excused from consideration, and that the petitioner had not filed a waiver petition pursuant to 10 C.F.R. § 2.335(b). 54 NRC at 21-23. The decision gives no indication that the petitioner's contention in that case claimed a violation of 10 C.F.R. § 51.53(c)(3)(iv). Therefore *Turkey Point* establishes no binding precedent regarding the question of whether the Attorney General is entitled to submit a contention regarding Entergy's noncompliance with 10 C.F.R. § 51.53(c)(3)(iv).

C. *Turkey Point* Is Inconsistent With NRC Regulations.

Moreover, the ASLB incorrectly concludes that its interpretation of *Turkey Point* is consistent with the regulatory history of 10 C.F.R. § 51.53(c)(3)(iv). LBP-06-20, slip op. at 24-26. As the ASLB recognized in LBP-06-20, *Turkey Point* limits the scope of issues that are "[n]ormally" subject to litigation under 10 C.F.R. § 2.309(f)(2), the Commission's regulation for litigation of NEPA issues in licensing proceedings. LBP-

06-20, slip op. at 22. In determining whether the regulatory history of 10 C.F.R. § 51.53(c)(3)(iv) supports the limitation on the scope of a license renewal hearing established in *Turkey Point,* one must first look to the regulations themselves. *Wrangler Laboratories, et. al.*, ALAB-951, 33 NRC 505, 513-14 (1991), quoting *Long Island Lighting Co.* (Shoreham Nuclear Power Station, Unit 1), ALAB-900, 28 NRC 275, 288 (1988) ("*Long Island Lighting*"). Neither 10 C.F.R. § 2.309(f)(2) or 10 C.F.R. § 51.53(c)(3)(iv) contains any language exempting Category 1 impacts from the scope of issues that must be addressed in NEPA contentions under 10 C.F.R. § 2.309(f)(2). To the contrary, the NRC's regulation for the admissibility of NEPA contentions "makes clear" that "to the extent an environmental issue is raised in the applicant's ER, an intervenor must file contentions on that document" in order to obtain a hearing on NEPA issues.[10] Nor can any exception to that clear and unequivocal requirement be found in the language of § 51.53(c)(3)(iv), the preamble to the 1989 Final Rule or in the preamble to the 1996 rule containing 10 C.F.R. § 51.53(c)(3)(iv), 61 Fed. Reg. 28,467 (June 5, 1996).

While the ASLB claims that its holding is supported by a SECY memo and a 1993 colloquoy between the Commission and its counsel (LBP-06-20, slip op. at 24-25), these documents may be relied on only to "resolve ambiguities" in the regulations. *Wrangler Laboratories,* 33 NRC at 513-14. Neither 10 C.F.R. § 2.309(f)(2) nor 10 C.F.R. § 51.53(c)(3)(iv) is ambiguous with respect to its scope, however.

---

[10] Final Rule, Rules of Practice for Domestic Licensing Proceeding – Procedural Changes in the Hearing Process, 54 Fed. Reg. 33,168, 33,172 (August 11, 1989) ("1989 Final Procedural Rule"). When it was originally promulgated in 1989, the regulation governing admission of NEPA contentions was codified as 10 C.F.R. § 2.714(b)(2)(iii). In 2004, the same regulation was re-codified as 10 C.F.R. § 2.309(f)(2). Final Rule, Changes to Adjudicatory Process, 69 Fed. Reg. 2,218, 2,240 (January 14, 2004).

Moreover, an interpretation of a regulation should be consistent with the overall regulatory scheme. *Duke Energy Corp.* (Catawba Nuclear Station, Units 1 and 2), LBP-05-10, 61 NRC 241, 299 (2005), *rev'd on other grounds,* CLI-05-14, 61 NRC 359 (2005) ("*Catawba*") (finding that a proposed interpretation of a regulation was inconsistent with both its plain meaning and the "broader context" of the regulatory scheme.) Here, the overall regulatory scheme established by the Commission for license renewal hearings contemplates that the scope of license renewal hearings will be the same as the scope of the NRC Staff's review. Final Rule, Nuclear Power Plant License Renewal; Revisions, 60 Fed. Reg. 22,461, 22,482 n.2 (May 8, 1995) ("The scope of Commission review determines the scope of admissible contentions in a renewal hearing absent a Commission finding under 10 CFR 2.758"). *See also Turkey Point,* 54 NRC at 10; LBP-06-20, slip op. at 26 n.32. Under these standard principles of statutory interpretation, *Turkey Point* may not be interpreted to undermine the Commission's basic regulatory scheme for license renewal hearings.

D. *Turkey Point* Is Inconsistent with NEPA.

If the ASLB has correctly applied *Turkey Point,* the Commission should reconsider *Turkey Point* because it is inconsistent with NEPA and the NRC's regulatory scheme for implementing that statute. *Catawba,* 61 NRC at 299. As discussed in *Marsh,* NEPA is an "action-forcing" statute that requires federal agencies to continue to take a "hard look" at the effects of their proposed actions. *Robertson v. Methow Valley Conservation Council,* 490 U.S. 332, 349 (1989). The agency's obligation to closely scrutinize environmental impacts continues even after those actions have been approved, up until the time the actions are taken. *Marsh,* 490 U.S. at 372-73. Under NRC's

regulatory scheme, license renewal applicants have the initial responsibility of assessing whether new and significant information warrants the supplementation of their previous EISs for their facilities. 10 C.F.R. § 51.53(c)(3)(iv). The NRC demands that the environmental analysis in an ER must be carried out with the same level of rigor as though it were an EIS. 1989 Final Procedural Rule, 54 Fed. Reg. at 33,172 ("Any license or permit application subject to NEPA's impact statement requirement must contain a complete Environmental Report (ER) which is essentially the applicant's proposal for the DEIS.") In contradiction of the regulatory scheme's provision for a rigorous initial environmental review in an ER, *Turkey Point* weakens the process by shielding licensees from litigation when they fail to comply with 10 C.F.R. § 51.53(c)(3)(iv).

By protecting licensees from contentions regarding their compliance with 10 C.F.R. §§ 51.53(c)(3)(iv), *Turkey Point* effectively shifts accountability for identifying new and significant information from the licensee to the NRC Staff and the public. This shift in accountability will not only delay the raising of environmental issues in the decision-making process, but may decrease the quality of information considered, given that licensees have access to a great deal of information about the environmental risks of their plants that is not in the NRC's possession.

E. The Attorney General's Contention is Admissible.

Although LBP-062- does not rule on the admissibility of the Attorney General's contention, in dicta it suggests that the Attorney General more than met the standard for gaining admission of a contention. LBP-06-20, slip op. at 27. While both Entergy and the NRC Staff disputed whether the information Entergy submitted was actually "new," the ASLB's decision emphasizes that "the AG need not prove that the various documents

actually contain new and significant information, but instead need only '[p]rovide a concise statement of the alleged facts or expert opinions which support' the contention and '[p]rovide sufficient information to show that a genuine dispute exists' on this point." LBP-06-20, slip op. at 27, citing 10 C.F.R. § 2.309(f)(1)(v) and (vi).[11] The Attorney General's contention clearly meets this standard. The Commission therefore should reverse LBP-06-20 and admit the contention.

The Commission should also apply the Ninth Circuit's ruling in *Mothers for Peace* by requiring that the scope of the admitted contention includes the adequacy of Entergy's ER to consider the environmental impacts of intentional attacks on the Vermont Yankee spent fuel pool. The Commission should also reconsider its recent decision refusing to apply the Ninth Circuit decision in a license renewal proceeding, *Amergen Energy Company, L.L.C.* (License Renewal for Oyster Creek Nuclear Generating Station), CLI-06-24 (September 6, 2006). In that case, the Commission decided to postpone a ruling on whether it should apply *Mothers for Peace* in the Oyster Creek case, because the time for petitioning for certiorari had not run.

---

[11] In dicta the ASLB also makes the observation that the risks of spent fuel pool accidents "have been studied and debated since 1979." LBP-06-20, slip op. at 27. But the ASLB fails to recognize that (a) unilateral pronouncements by NRC officials on the risks of pool fires do not amount to a debate, (b) the pronouncements are irrelevant to the Vermont Yankee license renewal proceeding because they were not issued in conformance with NEPA's procedural requirements for the issuance of draft environmental impact statements and the taking of public comment. *See* Attorney General's Reply at 19-23. The ASLB's suggestion that the issues raised by the Attorney General are not new because they "have been the subject of substantial litigation" is also without merit. *Id.*, citing *Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), LBP-00-19, 52 NRC 85 (2000), *aff'd*, CLI-01-11, 53 NRC 370 (2001) and cases cited in NRC Staff Response at 16 n.10. The ASLB's ultimate conclusions in the *Harris* case regarding the likelihood of spent fuel pool accidents cannot be applied across the board to Vermont Yankee because of significant differences in the plants' designs. *See* Hearing Request at 24 n.13.

The deadline for petitions for certiorari of the *Mothers for Peace* decision was September 29, and thus the time for appealing the decision has now run. Although the licensee (Pacific Gas & Electric Company) has filed a petition for certiorari, to the Attorney General's knowledge the NRC itself has not appealed the ruling, thus indicating its acceptance of the Ninth Circuit's decision. In any event, the Ninth Circuit issued its mandate on September 12, 2006, and thus the *Mothers for Peace* is now the law in the Ninth Circuit. *Vizcaino v. Microsoft Corporation*, 173 F.3d 713, 719 (9th Cir. 1999) (mandate enforceable in inferior court); *Federal Communications Commission v. Pottsville Broadcasting Co.*, 309 U.S. 134, 145 (1940) (mandate enforceable in administrative agency for correction of legal errors). As such, it constitutes an applicable precedent for other Circuit Courts of Appeals and the Commission. Moreover, the legal effect of the *Mothers for Peace* decision is not stayed by the filing of a petition for certiorari. Fed.R.App.Proc. 41.

Finally, the Commission should consider the prudent approach to the *Mothers for Peace* decision set forth in Commissioner Jaczko's dissenting opinion in the *Oyster Creek* case:

> . . . [T]he NEPA terrorism issue is a significant matter that needs resolution. I believe the agency should conduct a review of the impacts of terrorist attacks on nuclear facilities as part of a NEPA analysis. More importantly, I believe continuing to refuse to consider the environmental impacts of terrorist attacks will subject the agency to unnecessary judicial challenges. Thus, I am fully supportive of all efforts to give this matter the thorough and deliberate review warranted.

Id., slip op. at 19 (dissenting opinion of Commissioner Gregory B. Jaczko).[12]

---

[12] In LBP-06-20, the ASLB concludes that it is not necessary to evaluate the environmental impacts of intentional attacks on the Vermont Yankee spent fuel pool because environmental impacts of sabotage were previously considered in the License Renewal GEIS. LBP-06-20, slip op. at 28-29. In reaching this conclusion, the ASLB

IV. CONCLUSION

For the foregoing reasons, the Commission should reverse LBP-06-20 and order the admission of the Attorney General's contention.

Respectfully submitted,
COMMONWEALTH OF MASSACHUSETTS

By its Attorneys,

THOMAS F. REILLY
ATTORNEY GENERAL

Diane Curran
Harmon Curran, Spielberg & Eisenberg, L.L.P.
1726 M Street N.W., Suite 600
Washington, D.C. 20036
202/328-3500
dcurran@harmoncurran.com

Matthew Brock/DC

Matthew Brock, Assistant Attorney General
Environmental Protection Division
Office of the Attorney General
One Ashburton Place
Boston, MA 02108
617/727-2200
matthew.brock@ago.state.ma.us

October 3, 2006

---

overlooks the fact that environmental impacts of spent fuel pool accidents are distinct in both characteristics and consequences from reactor accidents. *See* Hearing Request at 41-42. Therefore not only are their impacts different, but alternatives for avoidance or mitigation of accidents are different. *Id.*

RAS 12993
RAS 12994

February 1, 2007

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE COMMISSION

In the Matter of Entergy Nuclear Operations, Inc. (Vermont Yankee Nuclear Power Station)	)	Docket No. 50-293-LR
In the Matter of Entergy Nuclear Operations, Inc. (Vermont Yankee Nuclear Power Station)	)	Docket No. 50-271-LR

MASSACHUSETTS ATTORNEY GENERAL'S MOTION FOR RECONSIDERATION AND CLARIFICATION OF CLI-07-03

I. INTRODUCTION

Pursuant to 10 C.F.R. §§ 2.323(e), 2.341, and 2.345, Martha Coakley, the Attorney General of Massachusetts ("Attorney General")[1] requests reconsideration and clarification of CLI-07-03, the U.S. Nuclear Regulatory Commission's ("NRC's" or "Commission's") Memorandum and Order of January 22, 2007. CLI-07-03 affirms decisions by the Atomic Safety and Licensing Boards ("ASLBs") in the Pilgrim and Vermont Yankee license renewal proceedings, which rejected the Attorney General's contentions seeking consideration of new and significant information regarding the

[1] Martha Coakley took the office of Massachusetts Attorney General on January 17, 2007, replacing Thomas F. Reilly.

Template=SECY-041

SECY-02

environmental risks posed by continued high-density pool storage of spent fuel at the Pilgrim and Vermont Yankee plants during their license renewal terms.[2]

The Attorney General seeks reconsideration of CLI-07-03 in three related respects in which it is internally inconsistent, unclear, or potentially prejudicial to the Attorney General's claims. First, CLI-07-03 is unclear with respect to whether the NRC's decision represents final agency action for purposes of review under the Hobbs Act, 28 U.S.C. § 2342. By affirming the ASLBs' dismissal of the Attorney General's contentions, CLI-07-03 could be construed to constitute a final decision with respect to her right to participate in the individual license renewal proceedings for the Pilgrim and Vermont Yankee nuclear power plants. Yet, the NRC concedes that it has not yet resolved the Attorney General's substantive claims under the National Environmental Policy Act (NEPA) with respect to each individual plant and that those issues have yet to be addressed in the Attorney General's petition for rulemaking now pending before the NRC. Absent reconsideration and clarification, CLI-07-03 could be interpreted to trigger a premature decision by the Attorney General whether to file a petition for review in the U.S. Court of Appeals, or alternatively forfeit her right to seek judicial review of the individual license renewal decisions for Pilgrim and Vermont Yankee -- even though these issues may be resolved in the subsequent rulemaking.

Second, the NRC concluded that the Attorney General's request that the NRC apply the results of the final rulemaking petition to the individual Pilgrim and Vermont Yankee facilities is premature, because the individual licensing proceedings may not be

---

[2] *Entergy Nuclear Operations, Inc.* (Pilgrim Nuclear Power Station), LBP-06-23, 64 NRC (October 16, 2006); *Entergy Nuclear Operations, Inc.* (Vermont Yankee Nuclear Power Station), LBP-06-20, 64 NRC 131 (2006).

concluded for a year or more. Yet the NRC did not clarify whether the Attorney General -- absent a judicial challenge now -- could contest a decision by the NRC in the future not to apply the final rulemaking to the two facilities when the licensing proceedings are completed.

Third, more broadly, CLI-07-03 contains apparently conflicting statements with respect to whether, absent a judicial appeal now, the Attorney General may in the future seek enforcement of NEPA in the individual license renewal proceedings for Pilgrim and Vermont Yankee.

Therefore the Attorney General requests reconsideration and clarification of CLI-07-03 to (a) confirm it is a non-final decision with respect to the Attorney General, (b) clarify that the Attorney General continues to have party status in the individual license renewal proceedings until those proceedings are concluded, and (c) further clarify that the Attorney General has the right to seek judicial review, as necessary, to ensure the application of the final rulemaking to the individual license renewal proceedings for Pilgrim and Vermont Yankee.

II. FACTUAL AND PROCEDURAL BACKGROUND

In the spring of 2006, the Attorney General submitted to the NRC's Atomic Safety and Licensing Board ("ASLB") virtually identical hearing requests in the NRC license renewal proceedings for the Pilgrim and Vermont Yankee nuclear plants.[3] In each case, the hearing request included a single contention charging that Entergy Nuclear

[3] Massachusetts Attorney General's Request for a Hearing and Petition to Intervene With Respect to Entergy Nuclear Operations Inc.'s Application for Renewal of the Pilgrim Nuclear Plant Operating License, etc. (May 26, 2006); Massachusetts Attorney General's Request for a Hearing and Petition to Intervene With Respect to

Operations' ("Entergy's") license renewal application is inadequate because it fails to consider significant new information regarding the risk of a catastrophic accident in the plant's high density fuel pool.

In each case, the ASLB rejected the contention on the ground that it impermissibly challenged NRC regulations for implementing NEPA. These regulations preclude consideration of the environmental impacts of spent fuel storage in NRC license renewal proceedings, based on past environmental studies.

The Attorney General appealed the ASLB's decisions in the fall of 2006, arguing that the ASLBs erred in refusing to admit the Attorney General's contentions.[4] The Attorney General also recognized that the Commission has the discretion to resolve the concerns raised in the Attorney General's contentions through a rulemaking proceeding rather than individual adjudications, and the Attorney General is prepared to utilize the rulemaking process in accordance with the NRC directive.[5] However, if the Attorney General does so, she wants to ensure that she will not waive or prejudice her rights to ensure that the Commission will still will meet its non-discretionary NEPA obligation to consider the significant new information offered by the Attorney General and apply the results of the rulemaking, including any regulatory changes, to the license renewal decision for Pilgrim and Vermont Yankee.[6]

Entergy Nuclear Operations Inc.'s Application for Renewal of the Vermont Yankee Nuclear Plant Operating License, etc. (May 26, 2006).

[4] Massachusetts Attorney General's Notice of Appeal of LBP-06-20 and Brief on Appeal of LBP-06-20 (October 3, 2006); Massachusetts Attorney General's Notice of Appeal of LBP-06-23 and Brief on Appeal of LBP-06-23 (October 31, 2006).

[5] Brief on Appeal of LBP-06-20 at 2, Brief on Appeal of LBP-06-23 at 3.

[6] Brief on Appeal of LBP-06-20 at 2-3, Brief on Appeal of LBP-06-23 at 19.

While disagreeing with the ASLBs' conclusion that the contentions were inadmissible, the Attorney General therefore filed a rulemaking petition in the summer of 2006 out of an abundance of caution and to address the alternative rulemaking process.[7] The petition requested consideration of the same substantive issue as the contentions, and indeed was based almost entirely on the contentions. The only difference was that the petition sought generic consideration of the issues rather than seeking to litigate them in each individual license renewal proceeding. The Attorney General described the petition as a "companion" to the contentions filed in the individual license renewal proceedings, and argued that the Commission should withhold any decision to renew the operating licenses for the Pilgrim and Vermont Yankee nuclear power plants until the requested rulemaking proceeding has been completed and until the NRC has completed the NEPA process for consideration of environmental impacts of high-density pool storage of spent fuel at the Pilgrim and Vermont Yankee nuclear plants.[8]

In CLI-07-03, the Commission ruled that the ASLBs in the Pilgrim and Vermont Yankee cases had correctly interpreted the NRC's regulations with respect to the inadmissibility of the Attorney General's contentions.[9] The Commission declined to rule on the Attorney General's request that it withhold final decisions in the Vermont Yankee and Pilgrim license renewal proceedings until the rulemaking petition is resolved, concluding that it was "premature" to make such a ruling because final decisions in those proceedings are not expected for at least another year.[10] The Commission also pointed to

---

[7] Massachusetts Attorney General's Petition for Rulemaking to Amend 10 C.F.R. Part 1 (Docket No. PRM-51-10) (August 25, 2006).

[8] Petition for Rulemaking at 3.

[9] *Id.*, slip op. at 6-7.

[10] *Id.*, slip op. at 9 n.37.

an NRC regulation which allows a petitioner who has filed a petition for rulemaking to "request the Commission to suspend all or any part of any licensing proceeding to which the petitioner is a party pending disposition of the petition for rulemaking."[11] But the Commission did not say whether the Massachusetts Attorney General would be entitled to make a motion under § 2.802 in the future, or to seek judicial review of the denial of that motion, given that the issuance of CLI-07-03 could be construed to have ended her status as a party to the proceeding.

III. ARGUMENT

Pursuant to 10 C.F.R. §§ 2.323(e) and 2.345, the Commission will reconsider a decision upon demonstration of "a compelling circumstance, such as the existence of a clear and material error in a decision, which could not have been reasonably anticipated." In addition, the Commission "will sometimes entertain a reconsideration motion in order to clarify the meaning or intent of language in one of its decisions." *Duke Energy Corporation* (Catawba Nuclear Station, Units 1 and 2), CLI-CLI-04-37, 61 NRC 646, 648 (2004), citing *Curators of the University of Missouri* (TRUMP-S Project), CLI-95-8, 41 NRC 386, 390-91 (1995).

Here, the Commission's intent is unclear with respect to the finality of CLI-07-03. By affirming the ASLB's decisions to reject the Attorney General's "sole contention" in the Pilgrim and Vermont Yankee cases, the Commission could be construed to have taken final action against the Attorney General, and denied her the right to participate as a

[11] *Id.*, citing 10 C.F.R. § 2.802.

party in either of those proceedings.[12] In two other significant aspects, however, the language of CLI-07-03 could be interpreted that the decision is non-final. First, CLI-07-03 acknowledges that its ruling relates only to the appropriate venue for raising the Attorney General's environmental concerns, and that the merits of those concerns have yet to be resolved.[13] Second, in refusing to rule on the Attorney General's request that it withhold final decisions in the Pilgrim and Vermont Yankee cases until the rulemaking petition is resolved, the Commission suggests that at some future date the Attorney General will be entitled, as a "party" to the Pilgrim and Vermont Yankee license renewal proceedings, to move to suspend those proceedings pending completion of the proceeding on the Attorney General's rulemaking petition.[14] If that is the case, then CLI-07-03 would not appear to constitute a final decision.

The lack of clarity regarding the finality of CLI-07-03 is a compelling circumstance because it leaves uncertain two questions: first, does the Attorney General have any continuing rights in the individual license renewal proceedings for Pilgrim and Vermont Yankee if the NRC fails to apply the results of the now-pending petition for rulemaking proceeding to those two individual license renewal decisions? And second, must the Attorney General decide now whether to petition the U.S. Court of Appeals for review of CLI-07-03 and the underlying ASLB decisions in order to protect her right under the Hobbs Act to judicially challenge the Commission's ultimate decision

---

[12] The Attorney General did not seek interested state status under 10 C.F.R. § 2.315, nor does the Attorney General believe it is clear that interested state status would protect her interests in resolution of the claims raised in her contentions.

[13] *Id.*, slip op. at 7.

[14] *Id.*, slip op. at 37 n.9, citing 10 C.F.R. § 2.802.

regarding the merits of her NEPA claims with respect to the renewal of the Pilgrim and Vermont Yankee licenses?

With respect to the question of the Attorney General's continuing right of participation in the Pilgrim and Vermont Yankee cases, NRC caselaw suggests that, if CLI-07-03 is construed to render the Attorney General a non-party, she would not be allowed to use 10 C.F.R. § 2.802 to seek suspension of the Pilgrim and Vermont Yankee license renewal decisions if, at some point in the future, the Commission proposes to renew the Pilgrim and Vermont Yankee licenses before it has completed the proceeding on the petition for rulemaking. *Metropolitan Edison Co.* (Three Mile Island Nuclear Station, Unit No. 1), CLI-83-25, 18 NRC 327, 330 (1983). Yet, it is not reasonable to suppose that the Commission would have offered the remedy of a § 2.802 motion if it were not actually available to the Attorney General.

With respect to the question of finality for purposes of judicial review, *Thermal Ecology Action v. AEC,* 433 F.2d 524, 526 (D.C. Cir. 1970), suggests that, if CLI-07-03 is construed by a reviewing court to be final agency action, then the Attorney General must decide now whether to appeal within 60 days or otherwise forfeit her right of review. But the Commission has not yet resolved the substantive claims of the Attorney General's contentions, and any judicial appeal now may become moot as a result of the subsequent rulemaking proceeding. The Commission also appears to contemplate that the Attorney General will have "party" status for purposes of a motion to suspend the Pilgrim and Vermont Yankee license renewal decisions if it later appears those decisions may issue before the NRC has completed the proceeding on the Attorney General's petition for rulemaking. CLI-07-03, slip op. at 9 n.37.

The Attorney General requests that the Commission reconsider CLI-07-03 and clarify that it is a non-final decision with respect to the Attorney General's right to participate in the Pilgrim and Vermont Yankee license renewal proceedings, for two reasons. First, the Commission has not yet resolved the environmental claims of the Attorney General's contentions on the merits. As the Commission recognizes, it may be necessary for the Attorney General, at some later date, to seek relief from the Commission under 10 C.F.R. § 2.802 or other lawful process in order to ensure that the results of the petition for rulemaking are applied to the individual license renewal decisions for Pilgrim and Vermont Yankee. CLI-07-03 should be revised to establish that the Attorney General has the right, as a party to those cases, to insist that the results of the proceeding on the petition for rulemaking must be applied in the individual license renewal proceedings.

Second, to issue CLI-07-03 as a final decision with respect to the Attorney General's rights of participation in the Pilgrim and Vermont Yankee license renewal proceedings would be wasteful of all the parties' resources. As CLI-07-03 is currently written, the Attorney General may be required to interpret it as a final decision for purposes of the Hobbs Act. If so, to protect her rights, the Attorney General would have to decide now whether to file a petition for review of CLI-07-03, LBP-06-20, and LBP-06-23 within 60 days. In order to conserve the parties' resources, the Commission should amend CLI-07-03 to clearly establish that it is not a final decision for purposes of triggering the obligation to file a petition for review under the Hobbs Act.

IV. CONCLUSION

Accordingly, the Attorney General requests that the Commission reconsider and clarify CLI-07-03 and establish that:

(a) CLI-07-03 is not a final decision with respect to the Attorney General's rights of participation in the Pilgrim and Vermont Yankee license renewal proceedings,

(b) the Commission will treat the Attorney General as a party if the Attorney General later decides to seek to suspend the license renewal decisions for Pilgrim and Vermont Yankee under 10 C.F.R. § 2.802, and

(c) as a party, the Attorney General would be permitted to seek judicial review of any decision by the NRC that fails to make timely application of the results of the proceeding on the Attorney General's petition for rulemaking to the individual license renewal decisions for Pilgrim and Vermont Yankee.

Respectfully submitted,

COMMONWEALTH OF MASSACHUSETTS

By its Attorneys,

_____
ATTORNEY GENERAL
MARTHA COAKLEY

Diane Curran
Harmon Curran, Spielberg & Eisenberg, L.L.P.
1726 M Street N.W., Suite 600
Washington, D.C. 20036
202/328-3500
dcurran@harmoncurran.com

Matthew Brock/DC
Matthew Brock, Assistant Attorney General
Environmental Protection Division
Office of the Attorney General
One Ashburton Place
Boston, MA 02108
617/727-2200
matthew.brock@ago.state.ma.us

February 1, 2007

June 22, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
ENTERGY NUCLEAR VERMONT YANKEE, LLC, and ENTERGY NUCLEAR OPERATIONS, INC.	)	Docket No. 50-271-LR
	)	ASLBP No. 06-849-03-LR
(Vermont Yankee Nuclear Power Station)	)	

NRC STAFF ANSWER OPPOSING MASSACHUSETTS ATTORNEY GENERAL'S REQUEST FOR HEARING AND PETITION FOR LEAVE TO INTERVENE AND PETITION FOR BACKFIT

INTRODUCTION

Pursuant to 10 C.F.R. § 2.309(h)(1), the Staff of the Nuclear Regulatory Commission ("Staff") hereby answers the request for hearing, petition for intervention, and petition for backfit filed by the Attorney General of the Commonwealth of Massachusetts ("MassAG" or "Petitioner") on May 26, 2006.[1] As set forth below, although the MassAG has shown standing to intervene in this proceeding, he has not proffered an admissible contention. Thus, the Petition should be denied. In addition, the Petition for Backfit Order should be dismissed.

BACKGROUND

By letter dated January 25, 2006, as supplemented March 15 and May 15, 2006, Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc. (collectively, "Entergy" or "Applicant") submitted an application, under 10 C.F.R. Part 54, to renew Operating

[1] *See,* "Massachusetts Attorney General's Request for a Hearing and Petition to Intervene with Respect to Entergy Nuclear Operations, Inc.'s Application for Renewal of the Vermont Yankee Nuclear Power Plant Operating License and Petition for Backfit Order Requiring New Design Features to Protect Against Spent Fuel Pool Accidents" ("Petition"), dated May 26, 2006.

License No. DPR-28 for the Vermont Yankee Nuclear Power Station ("VYNPS").[2] The renewal would extend the license for an additional 20 years beyond the current expiration date of midnight on March 21, 2012 to midnight on March 21, 2032.

On March 27, 2006, the NRC published in the *Federal Register* a notice of acceptance for docketing and opportunity for a hearing.[3] In response to this notice, Mass AG timely filed its Petition on May 26, 2006.[4] Three other organizations, the New England Coalition ("NEC"), the Vermont Department of Public Safety ("DPS"), and the Selectboard of the Town of Marlboro, Vermont, submitted petitions requesting a hearing on this matter.[5] On June 8, 2006, this Atomic Safety and Licensing Board ("Licensing Board") was established to preside over the proceeding.[6]

---

[2] *See* Letter from William F. Maguire, Entergy, to the NRC Document Control Desk, "Vermont Yankee Nuclear Power Station, License No. DPR-28 (Docket No. 50-271), License Renewal Application," dated January 25, 2006 (Agencywide Documents Access and Management System ("ADAMS") Accession Nos. ML060300082, ML060300085, ML060300086).

[3] *See* Entergy Nuclear Operations, Inc., Vermont Yankee Nuclear Power Station; Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing Regarding Renewal of Facility Operating License No. DPR-28 for an Additional 20-Year Period, 71 Fed. Reg. 15,220 (March 27, 2006).

[4] Pursuant to the Licensing Board's oral order of June 19, 2006, the deadline for filing this Answer is June 22, 2006.

[5] *See* "New England Coalition's Petition for Leave to Intervene, Request for Hearing, and Contentions," dated May 26, 2006; "Vermont Department of Public Safety's Notice of Intention to Participate and Petition to Intervene" dated May 26, 2006; "Town of Marlboro Selectboard's Request for Hearing in Entergy Vermont Yankee License Extension Proceeding," dated April 27, 2006.

[6] *See* "Establishment of Atomic Safety and Licensing Board," dated June 8, 2006. 71 Fed. Reg. 34,397 (June 14, 2006).

DISCUSSION

I. Request for Hearing and Petition for Intervention

A. Petitioner's Standing

1. Legal Requirements for Standing

A State that seeks to be admitted as a party in a proceeding concerning a facility within its boundaries need not address the Commission's standing requirements, as outlined below. 10 C.F.R. § 2.309(d)(2). However, if a State seeks to be admitted as a party regarding a facility outside its borders, the standing criteria must be addressed.[7]

Any person who requests a hearing or seeks to intervene in a Commission proceeding must demonstrate that he or she has standing to do so. Section 189a(1)(A) of the Atomic Energy Act of 1954, as amended ("AEA" or "Act"), 42 U.S.C. § 2239(a)(1)(A), states:

> In any proceeding under this Act, for the granting, suspending, or amending of any license . . . , the Commission shall grant a hearing upon the request of any person whose interest may be affected by the proceeding, and shall admit any such person as a party to such proceeding.

The Commission's regulations in 10 C.F.R. § 2.309(d)(1) provide that a request for hearing or petition to intervene must state:

> (i) The name, address and telephone number of the petitioner;
>
> (ii) The nature of the requestor's/petitioner's right under the Act to be made a party to the proceeding;
>
> (iii) The nature and extent of the requestor's/petitioner's property, financial or other interest in the proceeding; and
>
> (iv) The possible effect of any decision or order that may be issued in the proceeding on the requestor's/petitioner's interest.

---

[7] Otherwise, a State that has not been admitted as a party under section 2.309, may request to participate as an "interested State" pursuant to section 2.315(c). *See Louisiana Energy Services, L.P.* (National Enrichment Facility) CLI-04-35, 60 NRC 619, 626 (2004). However, participation as an interested state does not itself trigger a hearing. *Northern States Power Co.* (Tyrone Energy Park, Unit 1), CLI-80-36, 12 NRC 523, 527 (1980).

Additionally, the relevant case law provides that, to attain standing, a petitioner must demonstrate that:

> (1) it has suffered a distinct and palpable harm that constitutes injury-in-fact within the zone of interests arguably protected by the governing statute;
>
> (2) the injury can fairly be traced to the challenged action; and
>
> (3) the injury is likely to be redressed by a favorable decision.

See, e.g., Steel Co. v. Citizens for a Better Env't, 523 U.S. 83, 103-04 (1998); *Kelley v. Selin*, 42 F.3d 1501, 1508 (6th Cir. 1995); *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), CLI-99-10, 49 NRC 318, 323 (1999).

To establish standing, there must be an "injury in fact" that is either actual or threatened. *Yankee Atomic Elec. Co.* (Yankee Nuclear Power Station), CLI-98-21, 48 NRC 185, 195 (1998) (citing *Wilderness Soc'y v. Griles*, 824 F.2d 4, 11 (D.C. Cir. 1987)). The injury must be "concrete and particularized," not "conjectural" or "hypothetical." *Sequoyah Fuels Corp. & Gen. Atomics* (Gore, Oklahoma Site), CLI-94-12, 40 NRC 64, 72 (1994). As a result, standing will be denied when the threat of injury is too speculative. *Id.* Furthermore, the alleged "injury in fact" must lie within the "zone of interests" protected by the statutes governing the proceeding; either the AEA or the National Environmental Policy Act ("NEPA"). *Quivira Mining Co.* (Ambrosia Lake Facility, Grants, New Mexico), CLI-98-11, 48 NRC 1, 6 (1998), *aff'd sub nom. Envirocare of Utah, Inc. v. NRC*, 194 F.3d 72 (D.C. Cir. 1999).

Further, a petitioner must also establish a causal nexus between the alleged injury and the challenged action. *Commonwealth Edison Co.* (Zion Nuclear Power Station, Units 1 & 2), LBP-98-27, 48 NRC 271, 276 (1998), *aff'd*, CLI-99-4, 49 NRC 185 (1999). A determination that the injury is fairly traceable to the challenged action, however, does not depend "on whether the cause of the injury flows directly from the challenged action, but whether the chain of causation is plausible." *Sequoyah Fuels*, CLI-94-12, 40 NRC at 75. Finally, the redressability element of

standing requires a petitioner to show that its claimed actual or threatened injury could be cured by some action of the decisionmaker. *Sequoyah Fuels Corp.* (Gore, Oklahoma Site Decommissioning), CLI-01-2, 53 NRC 9, 14 (2001).

Under the long-recognized "proximity presumption" principle, an individual petitioner, or a member of an organization, may base its standing upon a showing that his or her residence, or that of its members, is within the geographical area that might be affected by an accidental release of fission products. This approach "presumes a petitioner has standing to intervene without the need specifically to plead injury, causation, and redressability if the petitioner lives within, or otherwise has frequent contacts with, the zone of possible harm from the nuclear reactor or other source of radioactivity." *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 & 4), LBP-01-6, 53 NRC 138, 146 (2001), *aff'd on other grounds*, CLI-01-17, 54 NRC 3 (2001). The Commission's general rule of thumb in reactor licensing proceedings (that persons who reside or frequent the area within a 50-mile radius of the facility are presumed to have standing) has also been applied to license renewal proceedings by several licensing boards. *See e.g. id.* at 148-49.[8]

The scope of a license renewal proceeding is limited, in both the safety and environmental contexts. Review of safety issues is limited to "a review of the plant structures and components that will require an *aging* management review for the period of extended operation and the plant's systems, structures and components that are subject to an evaluation of time-limited *aging* analyses." *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 & 2; Catawba Nuclear Station, Units 1 & 2), CLI-02-26, 56 NRC 358, 363-64 (2002) (citations omitted) (emphasis in original). *See also Dominion Nuclear Conn., Inc.* (Millstone

---

[8] The Commission has not ruled on this presumption in the context of license renewal. *See Turkey Point,* CLI-01-17, 54 NRC at 20 n. 20; *Duke Energy Corp.* (Oconee Nuclear Station, Units 1, 2 and 3) CLI-99-11, 49 NRC 328, 333 n. 2 (1999).

Nuclear Power Station, Units 2 & 3), LBP-04-15, 60 NRC 81, 90 (2004), *aff'd*, CLI-04-36, 60 NRC 631 (2004); *Baltimore Gas & Elec. Co.* (Calvert Cliffs Nuclear Power Plant, Units 1 & 2), CLI-98-14, 48 NRC 39, 41 (1998); 10 C.F.R. §§ 54.4, 54.21(a) and (c).

The scope of the environmental review is limited in accordance with 10 C.F.R. §§ 51.71(d) and 51.95(c). Consideration of environmental issues in the context of license renewal proceedings is specifically limited by 10 C.F.R. Part 51 and by the NRC's "Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants" (NUREG-1437) ("GEIS"). *See Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 2 and 3), CLI-01-17, 54 NRC 3, 11-13 (2001). A number of environmental issues potentially relevant to license renewal are classified in 10 C.F.R. Part 51, Subpart A, Appendix B, as "Category 1" issues, which means that "the Commission resolved the[se] issues generically for all plants and those issues are not subject to further evaluation in any license renewal proceeding." *Turkey Point*, LBP-01-06, 53 NRC at 152-53, *aff'd*, CLI-01-17, 54 NRC 3. The remaining issues, designated as "Category 2" in Appendix B, must be addressed by the Applicant in its environmental report, and in the NRC's supplemental environmental impact statement for the facility at issue pursuant to 10 C.F.R. §§ 51.71(d), 51.53(c) and 51.95(c). *Id.*

2. <u>MassAG has Demonstrated Standing</u>

The Petitioner does not state whether it is seeking to participate in this proceeding as a party pursuant to 10 C.F.R. § 2.309, or as an interested State agency pursuant to 10 C.F.R. § 2.315(c). However, because it has filed contentions, the Staff addresses its standing to be admitted as a party. Because the facility is not located within the boundaries of Massachusetts, the Petitioner is not exempt from pleading the standing criteria pursuant to 10 C.F.R. § 2.309(d)(2) and must demonstrate that it meets those requirements in order to be admitted as a party.

The Petitioner does not attempt to address each of the Commission's standing requirements specifically. *See* Petition at 4-5. Instead, in a footnote, he claims an interest in this proceeding because VYNPS is less than ten miles from the Massachusetts border and "[a]n accidental offsite release of radioactivity from the [VYNPS] fuel pool during the proposed license renewal term could affect the health and well-being of Massachusetts residents, the integrity of the environment, and the economic welfare of the Commonwealth." Petition at 5 n.1. The Petitioner cites to a previous NRC proceeding as having established that it has standing to participate in hearings regarding the VYNPS spent fuel pool. *Id.* (citing *Vermont Yankee Nuclear Power Corp.* (Vermont Yankee Nuclear Power Station), LBP-87-7, 25 NRC 116, 118 (1987).

The Petition fails to specifically address the Commission's standing requirements. *See* Petition at 4-5. However, under the proximity presumption principle, applicable to renewal proceedings, the petition does not need to specifically address the factors necessary to demonstrate standing by pleading injury, causation, and redressability because a portion of Massachusetts lies within the zone of possible harm from the reactor. *See Turkey Point,* LBP-01-6, 53 NRC at 146. Because of the proximity of Massachusetts to VYNPS, the Staff agrees that the Petitioner has demonstrated standing to participate in this proceeding.

B. Petitioners' Proposed Contention

Even though the MassAG has a right to participate in this matter, he still must submit at least one admissible contention in order to be admitted as a party. 10 C.F.R. § 2.309(d)(2). The MassAG has failed to submit an adequate petition, because the contention submitted is not admissible. Therefore, the Petition should be denied.

1. Legal Standards Governing the Admission of Contentions

To gain admission to a proceeding as a party, in addition to satisfying the criteria for standing, a petitioner must submit at least one admissible contention that meets the requirements of 10 C.F.R. § 2.309(f). *See* 10 C.F.R. § 2.309(a). This regulation requires a petitioner to:

> (i) Provide a specific statement of law or fact to be raised or controverted;
>
> (ii) Provide a brief explanation of the basis for the contention;
>
> (iii) Demonstrate that the issue raised in the contention is within the scope of the proceeding;
>
> (iv) Demonstrate that the issue raised in the contention is material to the findings the NRC must make to support the action that is involved in the proceeding;
>
> (v) Provide a concise statement of the alleged facts or expert opinions which support the requestor's/petitioner's position on the issue and on which the petitioner intends to rely at hearing, together with references to the specific sources and documents on which the requestor/petitioner intends to rely to support its position on the issue; and
>
> (vi) Provide sufficient information to show that a genuine dispute exists with the applicant/licensee on a material issue of law or fact. This information must include references to specific portions of the application (including the applicant's environmental report and safety report) that the petitioner disputes and the supporting reasons for each dispute, or, if the petitioner believes that the application fails to contain information on a relevant matter as required by law, the identification of each failure and the supporting reasons for the petitioner's belief.

10 C.F.R. § 2.309(f)(1). The Commission has emphasized that its rules on contention admissibility are "strict by design." *Dominion Nuclear Conn., Inc.* (Millstone Nuclear Power Station, Units 2 & 3), CLI-01-24, 54 NRC 349, 358 (2001). Failure to comply with any of these requirements is grounds for dismissing a contention. *See Private Fuel Storage,* CLI-99-10, 49 NRC at 325.

The contentions should refer to the specific documents or other sources of which the petitioner is aware and upon which he or she intends to rely in establishing the validity of the contentions. *Millstone*, CLI-01-24, 54 NRC at 358 (citing *Oconee*, CLI-99-11, 49 NRC at 333). Contention admissibility requirements "demand a level of discipline and preparedness on the part of petitioners, 'who must examine the publicly available material and set forth their claims and the support for their claims at the outset.'" *Louisiana Energy Services* (National Enrichment Facility) (*LES*), CLI-04-25, 60 NRC 223, 224-225 (2004). A petitioner must also submit more than "bald or conclusory allegation[s]" of a dispute with the applicant. *Id.*

Properly formatted contentions "must focus on the license application in question, challenging either specific portions of or alleged omissions from the application (including the SAR and ER)." [*LES*] (National Enrichment Facility), LBP-04-14, 60 NRC 40, 57 (2004); *aff'd* CLI-04-25, 60 NRC 223 (2004). *See* 10 C.F.R. § 2.309(f)(1)(vi). Additionally, "Any contention that fails directly to controvert the application or that mistakenly asserts the application does not address a relevant issue can be dismissed." *LES*, LBP-04-14, 60 NRC at 57.

A petitioner must also "present the factual information and expert opinions necessary to support its contention adequately" and failure to provide such an explanation regarding the basis of a proferred contention requires the contention to be rejected. *Id.* at 55. In this regard, "neither mere speculation nor bare assertions alleging that a matter should be considered will suffice to allow the admission of a proferred contention." *Id.* Nor can a Licensing Board "make assumptions of fact that favor the petitioner." *Id.* at 56. Finally, "With limited exception, no rule or regulation of the Commission can be challenged in an adjudicatory proceeding." *Id.* at 54; *See* 10 C.F.R. § 2.335.

2. Petitioner Has Not Proffered a Valid Contention

For the reasons set forth below, Petitioner's proffered contention is not admissible.

Petitioners' Proposed Contention:

> The Vermont Yankee ER does not satisfy the requirements of 10 C.F.R. § 51.53(c)(3)(iv) and NEPA, 42 U.S.C. § 4332 *et seq.*, because it fails to address new and significant information regarding the reasonably foreseeable potential for a severe accident involving nuclear fuel stored in high-density storage racks in the Vermont Yankee fuel pool. Although an NRC-sponsored study conducted as early as 1979 raised the potential for a severe accident in a high-density fuel storage pool if water is partially lost from the pool (NUREG/CR-0649, *Spent Fuel Heatup Following Loss of Water During Storage* (March 1979) ("1979 Sandia Report")), the NRC has failed to take the risk into account in every EIS it has prepared, including the 1979 GEIS on the environmental impacts of fuel storage; the 1990 Waste Confidence rulemaking (Review and Final Revision of Waste Confidence Decision, 55 Fed. Reg. 38,474, 38,481 (September 18, 1990) ("1990 Waste Confidence Rulemaking"); and the 1996 License Renewal GEIS on which the Vermont Yankee license renewal application relies. Moreover, the environmental impacts of a pool accident were not considered in the 1972 EIS issued in support of the original operating license for the Vermont Yankee nuclear power plant (Final Environmental Statement Related to Operation of Vermont Yankee Nuclear Power Station, Boston Edison Company, Docket No. 50-293 (May 1972) ("1972 Vermont Yankee EIS").
>
> Significant new information now firmly establishes that (a) if the water level in a fuel storage pool drops to the point where the tops of the fuel assemblies are uncovered, the fuel will burn, (b) the fuel will burn regardless of its age, (c) the fire will propagate to other assemblies in the pool, and (c) [sic] the fire may be catastrophic. *See* Thompson Report and Beyea Report. This new information has also been confirmed by the NRC Staff in NUREG-1738, *Final Technical Study of Spent Fuel Pool Accident Risk and Decommissioning Nuclear Power Plants* (January 2001) ("NUREG-1738"), and by the National Academies of Sciences. *See* NAS Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, *Safety and Security of Commercial Spent Nuclear Fuel Storage* at 53-54 (The National Academies Press: 2006) ("NAS Report").
>
> Moreover, significant new information, including the attacks of September 11, 2001 and the NRC's response to those attacks, shows that the environmental impacts of intentional destructive

> acts against the Vermont Yankee fuel pool are reasonably foreseeable. Taken together, the potential for severe pool accidents caused by intentional malicious acts and by equipment failures and natural disasters such as earthquakes is not only reasonably foreseeable, but is likely enough to qualify as a "design-basis accident," *i.e.*, an accident that must be designed against under NRC safety regulations. Thompson Report, §§ 6,7,9.
>
> The ER also fails to satisfy 10 C.F.R. § 52.53(c)(3)(iii) because it does not consider reasonable alternatives for avoiding or reducing the environmental impacts of a severe spent fuel accident, *i.e.*, SAMAs. Alternatives that should be considered include re-racking the fuel pool with low-density fuel storage racks and transferring a portion of the fuel to dry storage.

Petition at 21-23. As basis for the contention, the Petitioner states that "new and significant information must be considered in a supplemental Environmental Impact Statement (EIS) because it shows that the impact of an accident in a high-density spent fuel pool (SFP) at Vermont Yankee would be significantly different than the impacts presented in prior EISs." Petition at 23. The Petition alleges that the contention meets the standard in *Harris* for pleading an admissible contention seeking consideration of a severe accident in an EIS. *Id.*

3. Staff Response to the Proposed Contention

The proposed contention is inadmissible because it is outside the scope of license renewal proceedings, is immaterial, and fails to establish that a genuine dispute exists on a material issue of law or fact. *See* 10 C.F.R. § 2.309(f)(1)(i)-(vi) and (f)(2). It also is not supported by credible facts and opinion. It, thus fails to meet the Commission's pleading requirements articulated in 10 C.F.R. § 2.309.

a. The Contention is Outside the Scope of this Proceeding

This contention is inadmissible. It is outside the scope of this proceeding. Pursuant to 10 C.F.R. § 51.53(c)(2), the applicant is not required to provide information regarding the storage and disposal of spent fuel. The issue of the admissibility of contentions concerning SFP accidents in license renewal proceedings was settled by the Commission in the *Turkey*

Point case. *See Turkey Point*, CLI-01-17, 54 NRC 3. In that case, the Petitioner proffered a contention that concerned the risk of severe accidents involving spent fuel caused by aircraft crashes or hurricanes. *Id.* at 6. The contention also raised issues arising from NUREG-1738, the Staff's 2001 study of SFP accident risk at decommissioning reactors[9] and argued that this SFP issue was a Category 2 issue under 10 C.F.R. Part 51, Appendix B. *See Turkey Point*, LBP-01-06, 53 NRC at 164-65. The Licensing Board held that portion of the contention inadmissible because the issue of onsite spent fuel storage is a Category 1 issue that "cannot be examined further in a license renewal proceeding," and is further barred by the Commission's Waste Confidence Rule. *Id.* at 165. On appeal, the Commission affirmed the Board's decision for the reasons given by the Board. *Turkey Point*, CLI-01-17, 54 NRC at 6. The Commission went on to hold that:

> The GEIS's finding encompasses spent fuel accident risks and their mitigation, See GEIS, at xlviii, 6-72 to 6-76, 6-86, 6-92. The NRC has spent years studying in great detail the risks and consequences of potential spent fuel pool accidents, and the GEIS analysis is rooted in these earlier studies. NRC studies and the agency's operational experience support the conclusion that onsite reactor spent fuel storage, which has continued for decades, presents no undue risk to public health and safety. Because the GEIS analysis of onsite spent fuel storage encompasses the risk of accidents, [the] Contention . . . falls beyond the scope of individual license renewal proceedings.

Id. at 21. The Contention is, thus, outside the scope of this proceeding and is, therefore, inadmissible.

To the extent that the Contention insists that the ER should address SAMAs relating to the mitigation of accidents in the SFP, (Petition at 23), that matter was also decided in the *Turkey Point* case. Regarding the admissibility of SFP SAMA contentions, the Commission held:

---

[9] NUREG-1738, Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants, (Feb. 2001).

> Part 51 does provide that "alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives." See Appendix B to Subpart A of Part 51; see also GEIS at 5-106 to 5-116. . . . Part 51's reference to "severe accident mitigation alternatives" applies to nuclear reactor accidents, not spent fuel storage accidents. . . . As we have seen, the GEIS deals with spent fuel storage risks (including accidents) generically, and concludes that "regulatory requirements already in place provide adequate mitigation." GEIS at 6-86, 6-92, xlviii; see also id. at 6- 72 to 6-76.
>
> On the issue of onsite fuel storage, then, the GEIS rejects the need for further consideration of mitigation alternatives at the license renewal stage. Id. Indeed, for all issues designated as Category 1, the Commission has concluded that additional site-specific mitigation alternatives are unlikely to be beneficial and need not be considered for license renewal, See 61 Fed. Reg. at 28,484; GEIS at 1-5, 1-9.

Turkey Point, CLI-01-17, 54 NRC at 21-22. Part 51 treats *all* SFP accidents as Category 1. *Id.* at 22. "All [onsite spent fuel storage] issues, including accident risk, fall outside the scope of license renewal proceedings." *Id.* at 23.

b. <u>The Spent Fuel Pool Accident is Not a Design Basis Accident</u>

Petitioner argues that the accident scenarios set forth in his petition meet the criteria for design basis accidents (DBAs). Petition at 6-8, 32. The problem is that the criterion cited by Petitioner is wrong. Petitioner states that: "In determining which types of accidents constitute design-basis accidents and therefore must be protected against in a nuclear plant's design, the NRC sets a 'threshold' based on probability of the accident." *Id.* at 7. That is incorrect.

The set of accidents that must be addressed as part of the design basis have historically evolved from deterministic rather than probabilistic considerations. *See, e.g.* SECY-77-439, Re: Single Failure Criterion (Aug.17, 1977); 10 C.F.R. Part 50, Appendix A. These include defense-in-depth, redundancy and diversity, and are characterized by the use of the single failure criterion. The single failure criterion is codified in10 C.F.R. Part 50, Appendices A and K. Accordingly, the SFP and related systems have been designed and approved in accordance with this deterministic approach.

In any event, the issue of whether the accident is a DBA not related to license renewal and is, therefore, outside the scope of license renewal.

c. An Adjudicatory Proceeding is Not the Appropriate Forum for Addressing Changes to the Commission's Regulations

In asking this Board to address a spent fuel storage issue, the Petitioner is seeking to have the Board treat the SFP issue as a Category 2 issue. But, the Commission's regulations and precedent require any request to change the categorization of an issue under Appendix B from Category 1 to 2 be brought before the Commission via a petition for rulemaking or a waiver request. *See, e.g., Turkey Point,* CLI-01-17, 54 NRC at 12, *citing* Final Rule, Environmental Review for Renewal of Nuclear Power Plant Operating Licenses, 61 Fed. Reg 28,467, 28,470 (1996). *See also* 10 C.F.R. § 2.335.

As the Commission stated in *Turkey Point:*

> The Commission recognizes that even generic findings sometimes need revisiting in particular contexts. Our rules thus provide a number of opportunities for individuals to alert the Commission to new and significant information that might render a generic finding invalid, either with respect to all nuclear power plants or for one plant in particular. In the hearing process, for example, petitioners with new information showing that a generic rule would not serve its purpose at a particular plant may seek a waiver of the rule. See 10 C.F.R. § 2.758 [now 10 C.F.R. § 2.335] . . . . Petitioners with evidence that a generic finding is incorrect for all plants may petition the Commission to initiate a fresh rulemaking. See 10 C.F.R. § 2.802. Such petitioners may also use the SEIS notice-and-comment process to ask the NRC to forgo use of the suspect generic finding and to suspend license renewal proceedings, pending a rulemaking or updating of the GEIS. See 61 Fed. Reg. at 28,470; GEIS at 1-10 to 1-11.

Turkey Point, CLI-01-17, 54 NRC at 12. The Contention amounts to a request to change the regulation or to ignore it. The request for rule change should be made pursuant to 10 C.F.R. § 2.802. The request that the Board ignore the Commission's regulations is a direct attack on the regulations and can not be the basis for a contention. *See e.g.* 10 C.F.R. § 2.335.

d. The Contention Impermissibly Challenges Commission Regulations

The regulations prohibit attacks on Commission rules and regulations or any portion thereof in adjudicatory proceedings. 10 C.F.R. § 2.335(a). The exception to this rule, that a party may petition for a waiver of the regulation for a particular proceeding on the ground that "special circumstances with respect to the subject matter of the particular proceeding are such that the application of the rule or regulation . . . would not serve the purpose for which the rule was adopted requires that a petition be filed, accompanied by an affidavit stating the special circumstances. *Id.* at (d). If the Licensing Board determines that the petitioner has made a *prima facie* showing, the matter must be certified to the Commission for decision. *Id.* Thus, a proceeding will be subject to the applicable rules and regulations unless a petition for waiver is filed and granted. The Petitioner has not complied with the requirements of 10 C.F.R. § 2.335. Petitioner's proposed contention challenges the GEIS's consideration of spent fuel issues, but he has not offered any special circumstances demonstrating that the relevant GEIS findings do not apply to Vermont Yankee. Therefore, he cannot be heard to object to the applicability of the Commission's rules and regulations.

In his brief, the Petitioner argues that even though 10 C.F.R. § 2.335 prevents him from challenging NRC regulations, he may challenge "factual determinations codified in NRC NEPA regulations . . . under regulations and judicial precedents requiring the consideration of significant new information that undermines those determinations." *See* Petition at 17. Petitioner does not cite any valid authority for this proposition. He refers to 10 C.F.R. § 51.53(c)(3)(iv), which states that "[t]he environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which applicant is aware," as well as some case law, as support for this proposition. *See* Petition at 10-11, 17. While the regulation requires new and significant information to be included in the ER, neither the regulation nor the cases invite a party to attack "factual determinations" codified

in the regulations. Petitioner's position is contrary to the Commission's ruling in *Turkey Point*. *See Turkey Point*, CLI-01-17, 54 NRC at 12.

e. There is no New and Significant Information Regarding the Storage of Spent Fuel on Site

The Petitioner states that the requirement in 10 C.F.R. § 51.53(c)(iv) that the environmental report "contain any new and significant information regarding the environmental impacts of license renewal" mandates that the Applicant address SFP accidents based on alleged "new and significant" information regarding an increase in the risk of a SFP fire at Vermont Yankee. Petition at 1-2 ("That new information not addressed in any previous . . . [EIS] . . . demonstrates that continued storage of spent fuel in high-density storage racks in the Vermont Yankee pool poses a significant and reasonably foreseeable environmental risk of a severe fire and offsite release."), 24-37. In fact, as discussed below, this information is not new and, therefore, need not be included in the Applicant's ER.

The information regarding SFP accidents in the Petition and its supporting documents has been presented to licensing boards and the Commission, as well as to the ACRS and the Staff, in the past by various petitioners and witnesses.[10] The argument that the information is

---

[10] *See, e.g., Vermont Yankee Nuclear Power Corp.*(Vermont Yankee Nuclear Power Station), ALAB-919, 30 NRC 29 36 (1989) (Contention that EA was inadequate because did not consider a "self-sustaining fuel cladding fire" in a SFP with high density racks), *vacated and remanded*, CLI-90-04, 31 NRC 333 (1990), *dismissed* CLI-90-7, 32 NRC 129 (1990); *Pacific Gas & Electric Co.* (Diablo Canyon Nuclear Power Plant, Units 1 and 2),ALAB-880, 26 NRC 449, 456 (1987) (Spent fuel pool reracking proceeding where petitioner raised issue of possibility of zircaloy cladding fire in the event of loss of pool cooling if high density racks in use); *Pacific Gas & Electric Co.* (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation), LBP-02-23, 56 NRC 413, 449-50, 51 (2002) (Petitioner contended that "ER should address new information showing that previous NRC environmental analysis of the risks of high density pool storage of spent fuel considerably underestimate the risk of a spent fuel pool fire" and "[T]echnical studies reviewed by the NRC . . . do not consider the more severe consequences of partial pool drainage in addition to total and instantaneous pool drainage."); *Carolina Power & Light Co.*(Shearon Harris Nuclear Power Plant), LBP-00-19, 52 NRC 85 (2000) (contention alleging that an EIS was required because SFP expansion would create risks that are significantly in excess of accident risks previously evaluated and there is new information showing that there is an increase in the probability and consequences of potential SFP accidents); *Consumers Power Co.* (Big Rock Point Plant), LBP-82-8, 15 NRC 299 (1982) (petitioner contended that if the water level in the SFP drops below the top of the fuel assembly, the fuel rods will overheat, helped by the exothermic steam/Zircaloy oxidation process and Zircaloy may also react with steam.); *Public Service Electric & Gas Co.*

(continued...)

new has been used before, using the same basic information, to licensing boards and the Commission since at least 1999, if not earlier. Since the Commission has known about this information as far back as 1979, as acknowledged by the Petitioner, and since it has been submitted to the Commission on numerous occasions and the Commission has not deemed it to be significant, it cannot, under any interpretation of the word "new," be so considered. In fact, the Staff submits that the majority, if not all of the information (other than the calculations that the witness asserts are site specific), has been presented before. None of it is new or, as discussed below, significant.

The Petitioner claims that the information in NUREG-1738 is new: it is not. The Commission was well aware of it at the time it decided Turkey Point. *See Turkey Point*, CLI-01-17, 54 NRC at 22, n.11. Nor is it significant. As pointed out by the Commission, that study, among others, "concluded that the risk of [spent fuel pool] accidents is acceptably small."[11] *Id.* at 22. Similarly, the 2001 Alvarez report relied upon by Petitioner is not new or

---

[10](...continued)
(Salem Nuclear Generating Station, Unit 1), LBP-80-27, 12 NRC 435, 454-55, (1980) (testimony concerning gross loss of water in SFP, zirconium fire that could spread from freshly discharged fuel to older fuel more likely with denser storage), *aff'd* ALAB-650, 14 NRC 34 (1981); *Commonwealth Edison Co.* (Zion Station, Units 1 and 2), LBP-80-7, 11 NRC 245, 266-67 (1980) (intervenor contended that SFP water could boil away, uncovering the spent fuel, which would heat up rapidly and the exothermic metal-water reaction that ensued would produce large amounts of heat and hydrogen gas, which would explode, releasing radioactivity that would be much more severe than a reactor meltdown).

[11] Petitioner makes the statement that in NUREG-1738, the Staff conceded that if the water in a high density SFP is lost, even if the fuel is one year or more from discharge, the fuel will heat up to a point where the zircaloy cladding will melt and then catch fire. Petition at 62. This statement is incorrect. For purposes of offsite consequence analyses in NUREG-1738, the staff did assume that if the water level in a fuel storage pool drops below the top of the spent fuel, a SFP fire would result (p.3-35, 3-37, and 3-38). However, this was considered a conservative assumption that bounds all sequences that could lead to fuel uncovery, and uncertainties in whether these sequences would lead to a SFP fire. NUREG-1738 actually found that for fuel that has been out of the reactor for 4-5 years, air cooling is sufficient to preclude a zirconium fire (p.A1A-4), but also found that in the event that air cooling is completely obstructed and the fuel is assumed to heat adiabatically (with no heat loss to the surroundings), 5 year old fuel could reach a (the temperature at which the onset of significant fission product release is expected) after 24 hours. NUREG-1738, p.A1A-5. NUREG-1738 found that since a non-negligible decay heat source lasts many years and since configurations ensuring sufficient air flow for cooling cannot be assured, the possibility of reaching the zirconium ignition temperature could not be precluded on a generic basis (ES-x). The conservative assumption that a SFP fire
(continued...)

significant. The Staff prepared, and the Commission approved, a response to the report in 2003, concluding that it was overly conservative and unrealistic and that spent fuel stored is safe and the measures in place to protect the public are adequate.[12]

None of the remaining information cited by Petitioner is new or significant. For example, the possibility of loss of pool water for a variety of reasons is well known, and the types of events cited by Petitioner were considered within previous analyses (e.g., NUREG-1738), and the likelihood of these events progressing unmitigated to a SFP fire was found to be very small.

The Staff's understanding of the frequencies and the consequences of SPF fires has not changed substantially since the potential for SFP accidents with high density racks was first explored in detail as part of Generic Issue 82. *See* NUREG/CR-4982, Severe Accidents in Spent Fuel Pools in Support of Generic Issue 82 (1987); NUREG-1353, Regulatory Analysis for the Resolution of Generic Issue 82, "Beyond Design-basis Accidents in Spent Fuel Pools," (1989). This is demonstrated by a review of the Staff studies summarized below (all prior to September 11, 2001). The Sandia Report (NUREG/CR-0649) reached the conclusion that for certain conditions, the cladding of freshly discharged assemblies would reach the point of ignition. NUREG/CR-0649, Spent Fuel Heatup Following Loss of Water During Storage, (March 1979). The possibility of propagation from assembly to assembly with the involvement of the entire spent fuel pool was not ruled out.

---

[11](...continued)
would occur was made to bound these uncertainties. For purposes of offsite consequence analyses in NUREG-1738, the staff also conservatively assumed that all of the fuel assemblies in the SFP will participate in a SFP fire, and did not credit the possibility that fewer assemblies might be involved in a SFP fire in later years because of substantially lower decay heat in the older assemblies (p.3-31). The staff noted that based on analyses performed up to that time fire propagation is expected to be limited to less than two full cores 1 year after shutdown, and that the assumption that all of the stored fuel participates adds conservatism to the calculation. NUREG-1738, p.3-31.

[12] COMSECY-03-0018, August 7, 2003 (ADAMS Accession No. ML052340740).

Petitioner claims that significant new information now firmly establishes that: (a) if the water level in a fuel storage pool drops to the point where the tops of the fuel assemblies are uncovered, the fuel will burn, (b) the fuel will burn regardless of its age, (c) the fire will propagate to other assemblies in the pool, and (d) the fire will be catastrophic. *See* Petition at 22. The Petition claims that this new information has also been confirmed by the NRC staff in NUREG-1738 and by the National Academies of Sciences (NAS). *See Id.* But these statements provide an inaccurate characterization of the findings of both NUREG-1738 and the National Academies of Sciences. *See* NAS Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, Safety and Security of Commercial Spent Nuclear Fuel Storage, (National Academies Press, 2006). *See* discussion regarding NUREG-1738 in n. 6, *supra*.

The NAS report does not firmly establish the points raised by the Petitioner. Rather than provide definitive conclusions that support the overly-simplified points made by the Petitioner, the calculations described on the referenced pages of the NAS report (NAS Report, p. 53-54) indicate that: (1) the potential for heat build-up in a fuel assembly sufficient to initiate a zirconium cladding fire depends on its decay heat level (which is related to its age) and on the rate at which heat can be transferred to adjacent assemblies and to circulating air or steam, and (2) for some scenarios the fuel could be air cooled within a relatively short time after removal from the reactor, whereas in other scenarios (partial drain-down) fuel cladding might heat up sufficiently to ignite if no mitigative actions are taken. NAS Report, p. 52-54. Without these misrepresentations, the Petitioner cannot demonstrate these studies provide new and significant information.

Petitioner also asserts that there is significant new information, not previously considered by the NRC in any EIS, which shows that the impact of high-density spent fuel pool

storage at Vermont Yankee would be significantly greater than contemplated in prior EISs. *Id.* at 23. But, again, the information cited is not new.

Petitioner cites to information that is he alleges to be new in NUREG-1738, the NAS report, and the Thompson report, stating that all of these documents were written after the issuance of the license renewal GEIS and therefore they qualify as new. But, the information provided in the referenced documents is not "new" in a technical sense. The potential for a severe accident in a high density fuel storage pool was raised in the 1979 Sandia report (NUREG/CR-0649). Additional information regarding the frequencies and consequences of SFP fires became available subsequent to the spent fuel GEIS and prior to the license renewal GEIS (e.g., NUREG/CR-4982 and NUREG-1353). The frequency and consequence information provided in the most recent documents cited by the petitioner (NUREG-1738, the NAS report, and the Thompson report) is not substantially different than that provided in the earlier documents that were available at the time of the license renewal GEIS. *See* NUREG/CR-4982, Table S.1, p.77, Table 4.7, p. 74; NUREG-1353, Table 4.7.1, p.4-36, Table 4.8.2, p. 4-41; NUREG/CR-6451, A.S. Benjamin, et al, Spent Fuel Heatup Following Loss of Water During Storage, (March 1979), Table 4.2, p. 4-3. Thus, this information would not be considered new in a technical sense. In addition, the Thompson report is rife with information that has been presented in previous cases. *See, e.g., Shearon Harris,* LBP-00-19, 52 NRC 85.[13]

Petitioner states that total or partial loss of water from a SFP containing high-density racks will initiate either an air-zirconium or a steam-zirconium exothermic reaction within hours. Petition at 30. This statement implies that a SFP fire is a certainty for either total or partial loss

---

[13] The attempt in the Thompson report (Thompson report at 20) to make it appear that there were only minor divergences between his analysis and the Staff's with respect to SFP fires, inaccurately represents the Staff's position. *See generally, Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), LBP-01-9, 53 NRC 239 (2001).

of water, and that the time-frame for fire initiation is very short. In any event, this is argument on the merits and will not be addressed at this juncture, except to note that, as the petitioners themselves state on page 21 of their petition, the potential for a fire in partial drain-down scenarios was noted even in the 1979 study. Thus, this is not new information.

Petitioner states that once initiated, this reaction could spread to nearby, previously involved, fuel assemblies. *Id.* But the potential for propagation is not new. This also was previously identified and considered in the 1979 study and 1989 staff evaluation (NUREG-1353). Once again, Petitioner has failed to demonstrate the existence of new and significant information.

The list of facts that are not new or significant goes on, and includes:

The Petitioner makes numerous statements and conclusions, that are allegedly supported by the Thompson report. However, the Thompson report itself makes statements and conclusions that are, in turn, totally unsupported. For example, the Petitioner has not provided any new information that would lead to a change in the SFP risk from internal or external events, and has only provided some speculative, unsubstantiated frequency estimates for security events. The petitioner alleges that the frequency of a SFP fire as a result of a reactor accident is 2E-5/y, but there is no technical basis provided for this value, and the actual value, if one could be developed, would be much less.[14]

In addition to being outside the scope of this proceeding and representing an impermissible challenge to the Commission's regulations, the Petitioner's contention fails

---

[14] Petitioner and Thompson state that they are making the reasonable assumption that the conditional probability of a pool fire accompanying an early containment release is 50%, the overall estimated likelihood of a pool fire, excluding acts of malice, is on the order of 2E-5/y. Petition at 32. But, there is no technical basis for the 50% probability value on which this conclusion is based. In addition, as discussed in n. 8, *supra.*, Thompson actually bases his non-malice fire frequency on 1990 risk information, rather than the more recent PRA information. The result is an early release frequency and a fire frequency that is a factor of 40 higher than if he used the more recent PRA information.

substantively, as well. Petitioner has failed to demonstrate the existence of new and significant information that would necessitate the updating of the GEIS for license renewal pursuant to 10 C.F.R. § 51.53(c)(iv). By the Petitioner's own admission, the Commission has been aware of these issues since at least 1979. *See* Petition at 21.

f. Terrorism Issues are Outside the Scope of This Proceeding

The Petitioner states in the proposed contention that there is significant new information, including the attacks of September 11, 2001 and the NRC's response to those attacks, that shows that the environmental impacts of intentional destructive acts against the Vermont Yankee fuel pool are reasonably foreseeable. Petition at 22. Petitioner notes that the 1979 GEIS addressed deliberate attacks on a SFP. *Id.* at 29-30. Petitioner then argues that accidents caused by intentional malicious acts are credible and SFPs are vulnerable to attack. *Id.* at 33-37. Petitioner further argues that the potential for intentional acts can be analyzed qualitatively, and that the reasons given in the GEIS for not addressing terrorism are invalid. *Id.* at 37-41. Finally, the Petitioner addresses the Commission's holdings in *PFS II* and *Diablo Canyon. Id.* at 41-47. *See Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), CLI-02-25, 56 NRC 340 (2002); *Pacific Gas and Electric Co.* (Diablo Canyon ISFSI), CLI-03-12, 58 NRC 185 (2003). Yet, Petitioner ignores the only relevant precedent, in which the Commission specifically addressed the question of terrorism-related issues in license renewal proceedings: *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-26, 56 NRC 358 (2002). In that case, the Commission found that is no need to address terrorism issues in license renewal proceedings, stating that "it is sensible not to devote resources to the likely impact of terrorism during the license renewal period, but instead to concentrate on how to prevent a terrorist attack in the near term at the

already licensed facilities." *McGuire*, CLI-02-26, 56 NRC at 365. In addition, the Commission affirmed that it has adequately address terrorism issues generically in the GEIS.[15]

The Ninth Circuit has recently granted a petition for review of the Commission's decision in *Diablo Canyon*. *See San Luis Obispo Mothers for Peace, et al. v. NRC*, No. 03-74628 (June 2, 2006). The Court's decision upheld the Commission's decision on the Atomic Energy Act issues, but, as to the NEPA issues, concluded that "the NRC's determination that NEPA does not require a consideration of the environmental impact of terrorist attacks does not satisfy reasonableness review," and held that "the EA prepared in reliance on that determination is inadequate and fails to comply with NEPA's mandate." *San Luis Obispo* at 6096. The case was remanded for further proceedings. *Id.* The Court's mandate has not yet issued. By letter dated June 16, 2006, Petitioner and his counsel asked the Board to apply the Ninth Circuit's decision to the instant case.[16] The Staff submits that the decision should not be applied to this case. First, the mandate has not yet issued and the Commission has not determined what action, if any, it may take in response to the decision. Second, the Commission's statements in *McGuire*, cited above, distinguish this license renewal matter from *San Luis Obispo*. Finally, if the Board has any questions regarding whether to apply the case, especially since the case may affect several pending matters, the question should be certified to the Commission.

---

[15] "Even if we were required by law to consider terrorism under NEPA, the NRC has already issued a . . . GEIS that considers sabotage in connection with license renewal. . . . The GEIS concluded that, if such an event were to occur, the resultant core damage and radiological releases would be no worse than those expected for internally initiated events." *Duke* 56 NRC at 365, n.24 (citations omitted).

[16] The Staff questions the propriety of Petitioner's letter request. The Staff submits that any request regarding precedents and legal authorities should have been submitted to the Board in a pleading.

C. Conclusion as to Petition for Intervention

Petitioner has established standing to intervene in this proceeding, but has failed to proffer an admissible contention. The proffered contention is outside the scope of license renewal, is an impermissible challenge to the Commission's rules and regulations, seeks changes in the Commission's regulations, cites no new and significant information, and discusses terrorism, which is outside the scope of this proceeding. Therefore, the Licensing Board should deny the Petition.

II. Petition for Backfit

A. Discussion

The Petitioner filed a Petition for Backfit, asking the Commission to order the backfitting of the SFP at Vermont Yankee to return it to low-density storage and to use dry storage for any overflow. Petition at 48-50. Petitioner seeks a discretionary hearing on the adequacy of any design modifications imposed by the Commission. *Id.* at 50.

The Staff submits that the Petition for Backfit should be dismissed. First, it is directed to the Commission Therefore, it is before the wrong adjudicatory body. Second, as noted by Petitioner, there is no provision in the rules for an adjudicatory hearing on a backfit issue.

Therefore, Petitioner does not have the right to petition for a backfit and the Board does not have the authority to grant such a petition.

B. Conclusion as to Petition for Backfit

Based on the foregoing, the Petition for Backfit should be dismissed.

Respectfully submitted,

Steven C. Hamrick

Steven C. Hamrick
Counsel for NRC Staff

Dated at Rockville, Maryland
this 22th day of June, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
ENTERGY NUCLEAR VERMONT YANKEE, LLC, and ENTERGY NUCLEAR OPERATIONS, INC.	)	Docket No. 50-271-LR
	)	ASLBP No. 06-849-03-LR
	)	
(Vermont Yankee Nuclear Power Station)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the "NRC STAFF ANSWER OPPOSING MASSACHUSETTS ATTORNEY GENERAL'S REQUEST FOR HEARING, PETITION FOR INTERVENTION, AND PETITION FOR BACKFIT" in the above-captioned proceeding have been served on the following by electronic mail with copies by deposit in the NRC's internal mail system or, as indicated by an asterisk, by electronic mail with copies by U.S. mail, first class, this 22nd day of June 2006.

Administrative Judge
Alex S. Karlin, Chair
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: ask2@nrc.gov

Administrative Judge
Richard E. Wardwell
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: rew@nrc.gov

Administrative Judge
Thomas S. Elleman*
Atomic Safety and Licensing Board Panel
5207 Creedmoor Road, #101
Raleigh, NC 27612
E-mail: elleman@eos.ncsu.edu

Office of the Secretary
Attn: Rulemaking and Adjudications Staff
Mail Stop: O-16C1
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: hearingdocket@nrc.gov

Office of Commission Appellate
Adjudication
Mail Stop: O-16C1
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: OCAAmail@nrc.gov

Sarah Hofmann, Esq.*
Director of Public Advocacy
Department of Public Service
112 State Street - Drawer 20
Montpelier, VT 05620-2601
E-mail: sarah.hofmann@state.vt.us

Diane Curran, Esq.*
Harmon, Curran, Spielberg
& Eisenberg, L.L.P.
1726 M Street, NW., Suite 600
Washington, DC 20036
E-mail: dcurran@harmoncurran.com

Ronald A. Shems, Esq.*
Karen Tyler, Esq.
Shems Dunkiel Kassel & Saunders, PLLC
91 College Street
Burlington, VT 05401
E-mail: rshems@sdkslaw.com
Ktyler@sdkslaw.com

Callie B. Newton, Chair
Gail MacArthur
Lucy Gratwick
Marcia Hamilton
Town of Marlboro
Selectboard
P.O. Box 518
Marlboro, VT 05344
E-mail: cbnewton@sover.net
marcialynn@ev1.net

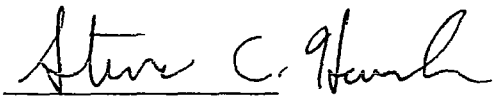
Marcia Carpentier, Esq.
Jonathan M. Rund, Esq.
Atomic Safety and Licensing Board Panel
Mail Stop: T-3F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: mxc7@nrc.gov
Jmr3@nrc.gov

Anthony Z. Roisman, Esq.*
National Legal Scholars Law Firm
84 East Thetford Rd.
Lyme, NH 03768
E-mail: aroisman@nationallegalscholars.com

Matthew Brock, Esq.*
Assistant Attorney General
Office of the Massachusetts Attorney
General
Environmental Protection Division
One Ashburton Place, Room 1813
Boston, MA 02108-1598
E-mail: matthew.brock@ago.state.ma.us

Dan MacArthur, Director
Town of Marlboro
Emergency Management
P.O. Box Box 30
Marlboro, VT 05344
E-mail: dmacarthur@igc.org

David R. Lewis, Esq.*
Matias F. Travieso-Diaz
Pillsbury Winthrop Shaw Pittman LLP
2300 N Street, NW
Washington, DC 20037-1128
E-mail: david.lewis@pillsburylaw.com
matias.travieso-diaz@pillsburylaw.com



Steven C. Hamrick
Counsel for NRC Staff

Dated at Rockville, Maryland,
this 22nd day of June 2006

June 22, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
Entergy Nuclear Vermont Yankee, LLC	)	Docket No. 50-271-LR
and Entergy Nuclear Operations, Inc.	)	ASLBP No. 06-849-03-LR
	)	
(Vermont Yankee Nuclear Power Station)	)	

ENTERGY'S ANSWER TO
THE MASSACHUSETTS ATTORNEY GENERAL'S REQUEST FOR A HEARING, PETITION FOR LEAVE TO INTERVENE, AND PETITION FOR BACKFIT ORDER

I. INTRODUCTION

Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc. (hereinafter collectively referred to as "Entergy") hereby answer and oppose the "Massachusetts Attorney General's Request for a Hearing and Petition for Leave to Intervene With Respect to Entergy Nuclear Operations, Inc.'s Application for Renewal of the Vermont Yankee Nuclear Power Plant Operating License and Petition for Backfit Order Requiring New Design Features to Protect Against Spent Fuel Pool Accidents" dated May 26, 2006 (the "Petition" or "Pet."). The Petition should be denied because the Attorney General has not proffered an admissible contention. With respect to the Petitioner's request for a backfit order, that request is simply beyond the scope of this proceeding.

II. PROCEDURAL BACKGROUND

Entergy submitted its application, dated January 25, 2006, requesting renewal of Operating License DPR-28 for the Vermont Yankee Nuclear Power Station (the "Application"). On March 27, 2006, the Nuclear Regulatory Commission ("NRC" or "Commission") published a Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing

("Notice") regarding Entergy's application. 71 Fed. Reg. 15,220 (Mar. 27, 2006)). The Notice permitted any person whose interest may be affected to file a request for hearing and petition for leave to intervene within 60 days of the notice. Id. at 15,220-21.

The Notice directs that any petition shall set forth with particularity the interest of the petitioner and how that interest may be affected, and must also set forth the specific contentions sought to be litigated. Id. at 15,221. The Notice states:

> Each contention must consist of a specific statement of the issue of law or fact to be raised or controverted. In addition, the requestor/petitioner shall provide a brief explanation of the bases of each contention and a concise statement of the alleged facts or the expert opinion that supports the contention on which the requestor/petitioner intends to rely in proving the contention at the hearing. The requestor/petitioner must also provide references to those specific sources and documents of which the requestor/petitioner is aware and on which the requestor/petitioner intends to rely to establish those facts or expert opinion. The requestor/petitioner must provide sufficient information to show that a genuine dispute exists with the applicant on a material issue of law or fact. Contentions shall be limited to matters within the scope of the action under consideration. The contention must be one that, if proven, would entitle the requestor/petitioner to relief. A requestor/petitioner who fails to satisfy these requirements with respect to at least one contention will not be permitted to participate as a party.

Id. (footnote omitted).

III. STANDING

Entergy does not object to the Massachusetts Attorney General's standing to seek to participate in this proceeding.

IV. STANDARDS FOR ADMISSIBILITY OF CONTENTIONS

A. Contentions Must Be Within the Scope of the Proceeding and May Not Challenge NRC's Rules

As a fundamental requirement, a contention is only admissible if it addresses matters within the scope of the proceeding and does not seek to attack the NRC's regulations governing the proceeding. This fundamental limitation is particularly important in a license renewal

proceeding, because the Commission has conducted extensive rulemaking to define and limit the technical and environmental showing that an applicant must make. As discussed later in this Answer, the Attorney General's contention falls beyond the scope of this proceeding.

10 C.F.R. Part 54 governs the health and safety matters that must be considered in a license renewal proceeding. The Commission has specifically limited this safety review to the matters specified in 10 C.F.R. §§ 54.21 and 54.29(a),[1] which focus on the management of aging of certain systems, structures and components, and the review of time-limited aging evaluations. See Florida Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 N.R.C. 3, 7-8 (2004); Duke Energy Corp. (McGuire Nuclear Station, Units 1 and 2), CLI-02-26, 56 N.R.C. 358, 363 (2002). Thus, the potential effect of aging is the issue that essentially defines the scope of license renewal proceedings. Dominion Nuclear Connecticut, Inc. (Millstone Nuclear Power Station, Units 2 and 3), CLI-04-36, 60 N.R.C. 631, 637 (2004).

The rules in 10 C.F.R. Part 54 are intended to make license renewal a stable and predictable process. 60 Fed. Reg. at 22,461, 22,462, 22,463, 22,485. As the Commission has explained, "We sought to develop a process that would be both efficient, avoiding duplicative assessments where possible, and effective, allowing the NRC Staff to focus its resources on the most significant safety concerns at issue during the renewal term." Turkey Point, CLI-01-17, 54 N.R.C. at 7 (2001). "License renewal reviews are not intended to 'duplicate the Commission's ongoing reviews of operating reactors.'" Id. (citation omitted). To this end, the Commission has

[1] The Commission has stated that the scope of review under its rules determines the scope of admissible issues in a renewal hearing. 60 Fed. Reg. 22,461, 22,482 n.2 (May 8, 1995). "Adjudicatory hearings in individual license renewal proceedings will share the same scope of issues as our NRC Staff review, for our hearing process (like our Staff's review) necessarily examines only the questions our safety rules make pertinent." Turkey Point, CLI-01-17, 54 N.R.C. at 10.

confined 10 C.F.R. Part 54 to those issues uniquely determined to be relevant to the public health and safety during the period of extended operation, leaving all other issues to be addressed by the existing regulatory processes. 60 Fed. Reg. at 22,463. This scope is based on the principle, established in the rulemaking proceedings, that with the exception of the detrimental effects of aging and a few other issues related to safety only during the period of extended operation, the existing regulatory processes are adequate to ensure that the licensing bases of currently-operating plants provide and maintain an adequate level of safety. 60 Fed. Reg. at 22,464, 22,481-82. Consequently, license renewal does not focus on operational issues, because these issues "are effectively addressed and maintained by ongoing agency oversight, review, and enforcement." Millstone, CLI-04-36, 60 N.R.C. at 638 (footnote omitted).

The NRC rules governing environmental matters – which are contained in 10 C.F.R. §§ 51.53(c), 51.95(c), and Appendix B to Part 51 – are similarly intended to produce a more focused and, therefore, more effective review. 61 Fed. Reg. 28,467 (June 5, 1996); Turkey Point, CLI-01-17, 54 N.R.C. at 11. To accomplish this objective, the NRC prepared a comprehensive Generic Environmental Impact Statement ("GEIS") for License Renewal of Nuclear Plants (NUREG-1437) and made generic findings reflected in the GEIS and in Appendix B to 10 C.F.R. Part 51. Those issues that could be resolved generically for all plants are designated as Category 1 issues and are not evaluated further in a license renewal proceeding (absent waiver or suspension of the rule by the Commission based on new and significant information). 61 Fed. Reg. at 28,468, 28,470, 28,474; Turkey Point, CLI-01-17, 54 N.R.C. at 12. The remaining (i.e., Category 2) issues that must be addressed in an applicant's environmental report are defined specifically in 10 C.F.R. § 51.53(c). See generally, Turkey Point, CLI-01-17, 54 N.R.C. at 11-12.

10 C.F.R. § 2.309(f)(1)(iii)-(iv) requires a petitioner to demonstrate that the issue raised by each of its contentions is within the scope of the proceeding and material to the findings that the NRC must make. Licensing boards "are delegates of the Commission" and, as such, they may "exercise only those powers which the Commission has given [them]." Public Service Co. of Indiana (Marble Hill Nuclear Generating Station, Units 1 and 2), ALAB-316, 3 N.R.C. 167, 170 (1976) (footnote omitted); accord Portland General Electric Co. (Trojan Nuclear Plant), ALAB-534, 9 N.R.C. 287, 289-90 n.6 (1979). Accordingly, it is well established that a contention is not cognizable unless it is material to a matter that falls within the scope of the proceeding for which the licensing board has been delegated jurisdiction. Id.; see also Commonwealth Edison Co. (Zion Station, Units 1 and 2), ALAB-616, 12 N.R.C. 419, 426-27 (1980); Commonwealth Edison Co. (Carroll County Site), ALAB-601, 12 N.R.C. 18, 24 (1980).

It is also well established that a petitioner may not demand an adjudicatory hearing to attack generic NRC requirements or regulations. Duke Energy Corp. (Oconee Nuclear Station, Units 1, 2 and 3), CLI-99-11, 49 N.R.C. 328, 334 (1999). "[A] licensing proceeding . . . is plainly not the proper forum for an attack on applicable statutory requirements or for challenges to the basic structure of the Commission's regulatory process." Philadelphia Electric Co. (Peach Bottom Atomic Power Station, Units 2 and 3), ALAB-216, 8 A.E.C. 13, 20, aff'd in part on other grounds, CLI-74-32, 8 A.E.C. 217 (1974) (footnote omitted). Thus, a contention which collaterally attacks a Commission rule or regulation is not appropriate for litigation and must be rejected. 10 C.F.R. § 2.335; Potomac Electric Power Co. (Douglas Point Nuclear Generating Station, Units 1 and 2), ALAB-218, 8 A.E.C. 79, 89 (1974). A contention which "advocate[s] stricter requirements than those imposed by the regulations" is "an impermissible collateral attack on the Commission's rules" and must be rejected. Public Service Co. of New Hampshire

(Seabrook Station, Units 1 and 2), LBP-82-106, 16 N.R.C. 1649, 1656 (1982); see also Arizona Public Service Co. (Palo Verde Nuclear Generating Station, Units 1, 2, and 3), LBP-91-19, 33 N.R.C. 397, 410, aff'd in part and rev'd in part on other grounds, CLI-91-12, 34 N.R.C. 149 (1991). Likewise, a contention that seeks to litigate a generic determination established by Commission rulemaking is "barred as a matter of law." Pacific Gas & Electric Co. (Diablo Canyon Nuclear Power Plant, Units 1 and 2), LBP-93-1, 37 N.R.C. 5, 30 (1993).

These limitations are very germane to this proceeding in that the scope of admissible environmental contentions is constrained by 10 C.F.R. §§ 51.53(c), 51.95(c), and Appendix B to Part 51; and the scope of technical contentions is constrained by 10 C.F.R. Part 54. See Turkey Point, CLI-01-17, 54 N.R.C. at 5-13. See also Florida Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-00-23, 52 N.R.C. 327, 329 (2000); Baltimore Gas & Electric Co. (Calvert Cliffs Nuclear Power Plant, Units 1 and 2), CLI-98-14, 48 N.R.C. 39, 41 (1998), motion to vacate denied, CLI-98-15, 48 N.R.C. 45, 56 (1998); Duke Energy Corp. (Oconee Nuclear Station, Units 1, 2 and 3), CLI-98-17, 48 N.R.C. 123, 125 (1998).

B. Contentions Must Be Specific and Supported By a Basis Demonstrating a Genuine, Material Dispute

In addition to the requirement to address issues within the scope of the proceeding, a contention is admissible only if it provides:

- a "specific statement of the issue of law or fact to be raised or controverted;"
- a "brief explanation of the basis for the contention;"
- a "concise statement of the alleged facts or expert opinions" supporting the contention together with references to "specific sources and documents on which the requestor/petitioner intends to rely to support its position on the issue;" and

000254

- "[s]ufficient information to show that a genuine dispute exists with the applicant/licensee on a material issue of law or fact," which showing must include "references to specific portions of the application (including the applicant's environmental report and safety report) that the petitioner disputes and the supporting reasons for each dispute, or, if the petitioner believes that the application fails to contain information on a relevant matter as required by law, the identification of each failure and the supporting reasons for the petitioner's belief."

10 C.F.R. § 2.309(f)(1)(i), (ii), (v) and (vi). The failure of a contention to comply with any one of these requirements is grounds for dismissing the contention. Palo Verde, CLI-91-12, 34 N.R.C. at 155-56. As discussed later in this Answer, the Massachusetts Attorney General's sole contention does not comply with these requirements.

These pleading standards governing the admissibility of contentions are the result of a 1989 amendment to 10 C.F.R. § 2.714, now § 2.309, which was intended "to raise the threshold for the admission of contentions." 54 Fed. Reg. 33,168 (Aug. 11, 1989); see also Oconee, CLI-99-11, 49 N.R.C. at 334; Palo Verde, CLI-91-12, 34 N.R.C. at 155-56. The Commission has stated that the "contention rule is strict by design," having been "toughened . . . in 1989 because in prior years 'licensing boards had admitted and litigated numerous contentions that appeared to be based on little more than speculation.'" Dominion Nuclear Connecticut, Inc. (Millstone Nuclear Power Station, Units 2 and 3), CLI-01-24, 54 N.R.C. 349, 358 (2001) (citation omitted). The pleading standards are to be enforced rigorously. "If any one . . . is not met, a contention must be rejected." Palo Verde, CLI-91-12, 34 N.R.C. at 155 (citation omitted). A licensing board is not to overlook a deficiency in a contention or assume the existence of missing information. Id.

The Commission has explained that this "strict contention rule" serves multiple purposes, which include putting other parties on notice of the specific grievances and assuring that full

adjudicatory hearings are triggered only by those able to proffer at least some minimal factual and legal foundation in support of their contentions. Oconee, CLI-99-11, 49 N.R.C. at 334. By raising the threshold for admission of contentions, the NRC intended to obviate lengthy hearing delays caused in the past by poorly defined or supported contentions. Id. As the Commission reiterated in incorporating these same standards into the new Part 2 rules, "[t]he threshold standard is necessary to ensure that hearings cover only genuine and pertinent issues of concern and that issues are framed and supported concisely enough at the outset to ensure that the proceedings are effective and focused on real, concrete issues." 69 Fed. Reg. at 2,189-90.

Under these standards, a petitioner is obligated "to provide the [technical] analyses and expert opinion" or other information "showing why its bases support its contention." Georgia Institute of Technology (Georgia Tech Research Reactor, Atlanta, Georgia), LBP-95-6, 41 N.R.C. 281, 305, vacated in part and remanded on other grounds, CLI-95-10, 42 N.R.C. 1, aff'd in part, CLI-95-12, 42 N.R.C. 111 (1995). Where a petitioner has failed to do so, "the [Licensing] Board may not make factual inferences on [the] petitioner's behalf." Id., citing Palo Verde, CLI-91-12, 34 N.R.C. 149. See also Private Fuel Storage, L.L.C. (Independent Spent Fuel Storage Installation), LBP-98-7, 47 N.R.C. 142, 180 (1998) (a "bald assertion that a matter ought to be considered or that a factual dispute exists . . . is not sufficient"; rather "a petitioner must provide documents or other factual information or expert opinion" to support a contention's "proffered bases") (citations omitted).

Further, admissible contentions "must explain, with specificity, particular safety or legal reasons requiring rejection of the contested [application]." Millstone, CLI-01-24, 54 N.R.C. at 359-60. In particular, this explanation must demonstrate that the contention is "material" to the NRC's findings and that a genuine dispute on a material issue of law or fact exists. 10 C.F.R.

§ 2.309(f)(1)(iv), (vi) (emphasis added). The Commission has defined a "material" issue as meaning one where "resolution of the dispute would make a difference in the outcome of the licensing proceeding." 54 Fed. Reg. at 33,172 (emphasis added).

As observed by the Commission, this threshold requirement is consistent with judicial decisions, such as Conn. Bankers Ass'n v. Bd. of Governors, 627 F.2d 245, 251 (D.C. Cir. 1980), which held that:

> [A] protestant does not become entitled to an evidentiary hearing merely on request, or on a bald or conclusory allegation that . . . a dispute exists. The protestant must make a minimal showing that material facts are in dispute, thereby demonstrating that an "inquiry in depth" is appropriate.

Id. (footnote omitted); see also Calvert Cliffs, CLI-98-14, 48 N.R.C. at 41 ("It is the responsibility of the Petitioner to provide the necessary information to satisfy the basis requirement for the admission of its contentions . . . ."). A contention, therefore, is not to be admitted "where an intervenor has no facts to support its position and where the intervenor contemplates using discovery or cross-examination as a fishing expedition which might produce relevant supporting facts." 54 Fed. Reg. at 33,171.[2] As the Commission has emphasized, the contention rule bars contentions where petitioners have what amounts only to generalized suspicions, hoping to substantiate them later, or simply a desire for more time and more information in order to identify a genuine material dispute for litigation. Duke Energy Corp. (McGuire Nuclear Station, Units 1 and 2), CLI-03-17, 58 N.R.C. 419, 424 (2003).

---

[2] See also Duke Power Co. (Catawba Nuclear Station, Units 1 and 2), ALAB-687, 16 N.R.C. 460, 468 (1982), vacated in part on other grounds, CLI-83-19, 17 N.R.C. 1041 (1983) ("[A]n intervention petitioner has an ironclad obligation to examine the publicly available documentary material pertaining to the facility in question with sufficient care to enable [the petitioner] to uncover any information that could serve as the foundation for a specific contention. Stated otherwise, neither Section 189a. of the Act nor Section 2.714 [now 2.309] of the Rules of Practice permits the filing of a vague, unparticularized contention, followed by an endeavor to flesh it out through discovery against the applicant or staff.").

Therefore, under the Rules of Practice, a statement "that simply alleges that some matter ought to be considered" does not provide a sufficient basis for a contention. Sacramento Municipal Utility District (Rancho Seco Nuclear Generating Station), LBP-93-23, 38 N.R.C. 200, 246 (1993), review declined, CLI-94-2, 39 N.R.C. 91 (1994). Similarly, a mere reference to documents does not provide an adequate basis for a contention. Baltimore Gas & Electric Co. (Calvert Cliffs Nuclear Power Plant, Units 1 and 2), CLI-98-25, 48 N.R.C. 325, 348 (1998).

Rather, NRC's pleading standards require a petitioner to read the pertinent portions of the license application, including the safety analysis report and the environmental report, state the applicant's position and the petitioner's opposing view, and explain why it has a disagreement with the applicant. 54 Fed. Reg. at 33,170; Millstone, CLI-01-24, 54 N.R.C. at 358. If the petitioner does not believe these materials address a relevant issue, the petitioner is "to explain why the application is deficient." 54 Fed. Reg. at 33,170; Palo Verde, CLI-91-12, 34 N.R.C. at 156. A contention that does not directly controvert a position taken by the applicant in the license application is subject to dismissal. See Texas Utilities Electric Co. (Comanche Peak Steam Electric Station, Unit 2), LBP-92-37, 36 N.R.C. 370, 384 (1992). Furthermore, an allegation that some aspect of a license application is "inadequate" or "unacceptable" does not give rise to a genuine dispute unless it is supported by facts and a reasoned statement of why the application is unacceptable in some material respect. Florida Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 and 4), LBP-90-16, 31 N.R.C. 509, 521 & n.12 (1990).

V. THE ATTORNEY GENERAL'S CONTENTION DOES NOT MEET THE STANDARDS FOR ADMISSION

The Attorney General's sole contention ("Contention"), which alleges that the Environmental Report is inadequate because it "does not address the environmental impacts of

severe spent fuel pool accidents" (Pet. at 21), is inadmissible because issues associated with the environmental impacts of spent fuel storage, including accident risk and mitigation, are Category 1 issues beyond the scope of this proceeding. The Contention is also inadmissible because it provides no basis demonstrating that the generic findings relating to spent fuel are inapplicable in this proceeding and because it seeks to raise issues concerning the current licensing basis for spent fuel pool storage at Vermont Yankee that are beyond the scope of this proceeding.

Management of on-site spent fuel is a Category 1 environmental issue, based on the generic finding that "the expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available." 10 C.F.R. Part 51, App. B, Table B-1. As the Commission has held,

> The GEIS's finding encompasses spent fuel accident risks and their mitigation. See GEIS at xlviii, 6-72 to 6-76, 6-86, and 6-92. The NRC has spent years studying in great detail the risks and consequences of potential spent fuel pool accidents, and the GEIS analysis is rooted in these earlier studies. NRC studies and the agency's operational experience support the conclusion that onsite reactor spent fuel storage, which has continued for decades, presents no undue risk to public health and safety. Because the GEIS analysis of onsite fuel storage encompasses the risk of accidents, [a contention seeking to raise spent fuel accidents in a license renewal proceeding] falls beyond the scope of individual license renewal proceedings.

Turkey Point, CLI-01-17, 54 N.R.C. at 21.[3]

The analysis in the GEIS includes a finding that "even under the worst probable cause of a loss of spent-fuel pool coolant (a severe seismic-generated accident causing a catastrophic

---

[3] The Commission went on to emphasize that the GEIS covered mitigation of accidents as well as their environmental impacts:

> [T]he GEIS deals with spent fuel storage risks (including accidents) generically, and concludes that "regulatory requirements already in place provide adequate mitigation."

Id. at 21-22 (citations omitted).

failure of the pool), the likelihood of a fuel-cladding fire is highly remote." GEIS at 6-72 – 6-75 (citation omitted).[4] It is well established that under NEPA's rule of reason, agencies are not required to probe remote or speculative consequences or discuss every conceivable alternative to a proposed action. See, e.g., NRDC v. Morton, 458 F.2d 827, 837 (D.C. Cir. 1972). In particular, NEPA does not require consideration of accidents that are remote and speculative. San Luis Obispo Mothers for Peace v. NRC, 751 F.2d 1287, 1300-01 (D.C. Cir. 1984), aff'd on rehearing en banc, 789 F.2d 26 (D.C. Cir.), cert. denied, 479 U.S. 923 (1986); Carolina Envtl. Study Group v. U.S., 510 F.2d 796, 798-800 (D.C. Cir. 1975).

Consequently, the Contention's assertion that the Environmental Report is inadequate because it fails to address the environmental impacts of severe spent fuel accidents (Pet. at 21) is a direct challenge to the generic finding that is codified in Table B-1 of Part 51, as well as to 10 C.F.R. §§ 51.53(c) and 51.95(c), which do not require analysis of Category 1 issues. Because the NRC's rules may not be challenged in individual licensing proceedings (10 C.F.R. § 2.335(a)), this claim is inadmissible.

---

[4] The GEIS' determination that the occurrence of a zirconium spent fuel pool fire is "highly remote" (GEIS at 6-72 – 6-75) references the Commission's 1990 Review and Revision of the Waste Confidence Decision (55 Fed. Reg. 38,474 (Sept. 18 1990)). In its Waste Confidence Decision, the Commission determined that "even if the timing of a spent fuel pool failure were conducive to fire," the likelihood of such a fire would be "extremely rare." 55 Fed. Reg. 38,481 (emphasis added). The Commission reasoned as follows:

> [E]ven if the timing of a spent fuel pool failure were conducive to fire, a fire could occur only with a relatively sudden and substantial loss of coolant – a loss great enough to uncover all or most of the fuel, damaging enough to admit enough air to keep a large fire going, and sudden enough to deny operators the time to restore the pool to a safe condition. Such a severe loss of cooling water is likely to result only from an earthquake well beyond the conservatively estimated earthquake for which reactors are designed. Earthquakes of that magnitude are extremely rare.
>
> The plant specific studies . . . found that, because of the large safety margins inherent in the design and construction of their spent fuel pools, even the more vulnerable older reactors could safely withstand earthquakes several times more severe than their design basis earthquake. Factoring in the annual probability of such beyond-design-basis earthquakes, . . . the average annual probability of a major spent fuel pool fuel pool failure at an operating reactor . . . was calculated at two chances in a million per year of reactor operation.

Id. (emphasis added) (citations omitted).

Furthermore, the Contention's claim that consideration of the environmental impacts of severe spent fuel pool accidents is necessary because of new information (see, e.g., Pet. at 22) does not bring this Category 1 issue within the scope of the proceeding. As an NRC rule, the Category 1 findings in 10 C.F.R. Part 51, Appendix B, Table B-1 are not subject to attack by any means in this proceeding. 10 C.F.R. § 2.335(a). Therefore, if a person believes that there is new and significant information that would alter a Category 1 finding, it should a petition for waiver or rulemaking. As the Commission has stated:

> The Commission recognizes that even generic findings sometimes need revisiting in particular contexts. Our rules thus provide a number of opportunities for individuals to alert the Commission to new and significant information that might render a generic finding invalid either with respect to all nuclear power plants or for one plant in particular. In the hearing process, petitioners with new information showing that a generic rule would not serve its purpose at a particular plant may seek a waiver of the rule. See 10 C.F.R. § [2.335] . . . Petitioners with evidence that a generic finding is incorrect for all plants may petition the Commission to initiate a fresh rulemaking.

Turkey Point, supra, CLI-01-17, 54 N.R.C. at 12 (emphasis added). As explained when this requirement was first proposed,

> Litigation of environmental issues in a hearing will be limited to unbounded category 2 and category 3 issues unless the rule is suspended or waived.

SECY-93-032, 10 C.F.R. Part 51 Rulemaking on Environmental Review for Renewal of Nuclear Power Plant Operating Licenses (Feb. 9, 1993) at 4. The final rule subsequently combined Category 2 and 3 issues (61 Fed. Reg. at 28,474), but made no changes that would alter the treatment of Category 1 issues. Thus, a petitioner who wishes to litigate a Category 1 issue must submit a petition for waiver, pursuant to 10 C.F.R. § 2.335.

Further, the information to which the Contention refers is not new and significant, and therefore would not serve as a basis to waive the Category 1 findings even if the Massachusetts Attorney General had properly submitted a waiver petition. The Contention refers to NUREG-

1738,[5] a report by the National Academy of Sciences concerning spent nuclear fuel storage,[6] and the reports of Drs. Gordon Thompson[7] and Jan Beyea[8] supporting the Contention. Pet. at 22, 24, 30. None of these sources contains new and significant information that mandate the NRC to reconsider its GEIS findings regarding spent fuel storage, nor provides the basis for an admissible contention.

NUREG-1738 considered the potential of spent fuel pool fires in the context of plants undergoing decommissioning (which lack many of the functioning safety systems of an operating nuclear power plant). While NUREG-1738 provided additional information on the potential for spent fuel pool fires, the Attorney General's claim that NUREG-1738 undercuts the rationale of the license renewal GEIS (e.g., Pet. at 30-31) is not supported by that document. None of the information presented in NUREG-1738 controverts the conclusion in the GEIS that the occurrence of a zirconium spent fuel pool fire is "highly remote." See GEIS at 6-72 – 6-75. To the contrary, even after considering the partial drainage and obstructed air flow scenario cited by Dr. Thompson (e.g., NUREG-1738 at A1A-4), NUREG-1738 ultimately concludes that there is a "very low likelihood" of a zirconium pool fire (NUREG-1738 at vii, x, 5-1 and 5-3; emphasis added) – a conclusion that parallels and reconfirms the conclusion of the GEIS that the likelihood of a fuel cladding fire is "highly remote" (GEIS at 6-72 – 6-75).[9]

---

[5] NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk and Decommissioning Nuclear Power Plants" (Jan. 2001) ("NUREG-1738").

[6] National Academy of Sciences Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, "Safety and Security of Commercial Spent Nuclear Fuel Storage" (The National Academies Press: 2006) ("NAS Rept.")

[7] Gordon R. Thompson, "Risks and Risk-Reducing Options Associated with Pool Storage of Spent Nuclear Fuel at the Pilgrim and Vermont Yankee Nuclear Power Plants" (May 25, 2006) ("Thompson Rept.").

[8] Jan Beyea, "Report to the Massachusetts Attorney General on the Potential Consequences of a Spent-Fuel-Pool Fire at the Pilgrim or Vermont Yankee Nuclear Power Plant" (May 25, 2006) ("Beyea Rept.").

[9] The Attorney General's claim that in NUREG 1738 the Staff concluded that "regardless of the age of the fuel in a pool, the fuel will burn shortly after the tops of the fuel assemblies are uncovered" (Pet. at 31 (emphasis added)),

Footnote continued on next page

Likewise the Contention's claim that the 1990 Waste Confidence Decision rulemaking "ignored the risk of pool fires" (Pet. at 27-28) (emphasis added) is patently wrong. Plainly, the Commission considered the risk of pool fires in its Waste Confidence Decision as is evident from the quotation in note 4 supra.[10] Such mischaracterization of a document provides no basis for an admissible contention. See, e.g., Philadelphia Electric Co (Limerick Generating Station, Units 1 and2), ALAB-804, 21 N.R.C. 587, 593 (because cited document "does not support the point for which it is urged," the contention lacks a "cognizable basis"); Dominion Nuclear North Anna, LLC (Early Site Permit for North Anna ESP Site), LBP-04-18, 60 N.R.C. 253, 265 (2004) (documents provided in support of a contention "will be carefully examined by the Board" to determine whether they "supply an adequate basis for the contention").

Footnote continued from previous page

misstates the NUREG's conclusion. Rather, the NUREG's conclusion was that, because of the different variables involved, the possibility of "a zirconium fire cannot be precluded" based solely on the decay time of the fuel. NUREG 1738 at 2-1 – 2-2 (emphasis added). Moreover, the claim that NUREG-1738 presented new and significant information concerning the likelihood that uncovered fuel would ignite and burn (Pet. at 31) ignores the Commission's determination in the Waste Confidence Decision (quoted in note 4, supra) that the likelihood of a spent fuel pool fire is highly remote even assuming the timing of pool failure were conducive to fire initiation. In this respect, the average annual probability of a major spent fuel pool fuel pool failure at an operating reactor referred to by the Commission (in the quotation in note 4, supra) assumed a conditional probability of a Zircaloy cladding fire of "1.0 for PWRs and 0.25 for BWRs" for "high density configurations" of spent fuel storage. NUREG-1353, Regulatory Analysis for the Resolution of Generic Issue 82, "Beyond Design Basis Accidents in Spent Fuel Pools" (April 1989) ("NUREG-1353") at ES-2 and 4-10. The difference between the conditional probabilities for PWRs and BWRs was based on studies that determined significantly lower probabilities for zirconium oxidation for BWR spent fuel than for PWR spent fuel because of the significantly lower decay power for BWR spent fuels and differences in PWR and BWR spent fuel storage configurations. See NUREG-1353 at 4-8 – 4-11.

[10] The Contention (Pet. at 28 n.14) and the Thompson Report (at 16-17) also claim that the technical studies relied upon by the Commission in the Waste Confidence Decision considered only an "instantaneous loss of water from the pool" rather than a partial loss of cooling water. That is not the case (see NUREG-1353 at 4-13 – 4-36), but in any event, as discussed above, NUREG-1738 explicitly considered partial drainage of the pool (as acknowledged by the Contention, e.g., Thompson Rept. at 12) and still reached a conclusion identical to that reached in the Waste Confidence Decision, that a zirconium cladding fire is highly remote.

Similarly, the NAS Report does not provides significant new information mandating the Commission to reconsider its license renewal GEIS.[11] The NAS Report focused on terrorist attacks potentially causing a severe spent fuel accident. As discussed below, the Commission has ruled that NEPA imposes no legal duty on the NRC to consider intentional malevolent acts, and thus the subject of the NAS Report is beyond the scope of this license renewal proceeding. Moreover, the NRC has carefully evaluated the NAS Report, and has acted on the Report's Findings and Recommendations as it deemed appropriate. Most relevant to the issue here, the NRC has concluded, after reviewing the information in the NAS Report, that it continues to generally consider "the likelihood of a zirconium fire capable of causing large releases of radiation into the environment to be extremely low."[12] Thus, the NRC has fully considered the NAS report and found no basis, even in the context of a terrorist attack, to change its conclusion regarding the risks of spent fuel pool fires stated in the GEIS..

---

[11] The Contention (Pet. at 31-32) quotes the NAS Report's summary of the results of various analyses reviewed by the NAS. However, as stated in the NAS Report, the series of studies that it reviewed, dating back to 1979 (and including the technical studies underlying the Commission's Waste Confidence Decision), "[a]ll . . . suggest that a loss-of-pool-coolant event could trigger a zirconium cladding fire in the exposed spent fuel." NAS Rept. at 44. Thus, the fact that a loss-of-pool-coolant event could trigger a zirconium cladding fire in the exposed fuel is plainly not new information, and as noted above, was fully considered in the NRC's Waste Confidence Decision which underlies the license renewal GEIS.

[12] "U.S. Nuclear Regulatory Commission Report to Congress on the National Academy of Sciences Study on the Safety and Security of Commercial Spent Nuclear Fuel Storage" ((Mar. 2005), at 21. ("NRC Rept. on NAS Study") The NRC noted that it had in a February 2002 Order "required licensees to develop specific guidance and strategies to maintain or restore [spent fuel pool] cooling capabilities" in "circumstances associated with the loss of large areas of the plant due to large fires and explosions" and that in a July 2004 letter the NRC directed licensees "to implement additional 'spent fuel mitigative measures,' as appropriate," including "reconfiguration" of the fuel as recommended by the NAS Study. Id. at 6, 17, 21. The cover letter from Nils J. Diaz, Chairman of the NRC, to Senator Domenici, Chairman, Subcommittee on Energy and Water Development, Committee on Appropriations, United States Senate (Mar. 14, 2005) ("Diaz Letter"), forwarding the NAS Report, similarly describes, at page 2 of the letter, the "numerous actions" taken "to enhance the security of spent nuclear fuel." The cover letter from Chairman Diaz to Senator Domenici also noted that, while agreeing with many points raised by the NAS, the NRC believes that, "based on information developed in NRC vulnerability assessments," some scenarios identified by the NAS report "are unreasonable." Diaz Letter at 1. Chairman Diaz further stated that the NRC "disagreed with some NAS recommendations" because "they lacked a sound technical basis," including in particular the "NAS finding that earlier movement of spent fuel from pools into dry storage would be prudent." Id.

The Thompson and Beyea reports repeat arguments that were made in a 2003 paper by Alvarez, et al. (referenced in Thompson Report at 12 and Beyea Report at 3). This article has, however, already been reviewed by the NRC and found to suffer from excessive conservatisms, so that its recommendations do not have a sound technical basis. COMSECY-03-0019, Review of the Paper "Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States," Robert Alvarez et al., January 31, 2003 (To Be Published in Science and Global Security), Aug. 7, 2003, Adams Accession No. ML052340740. No new substantive information responding to the deficiencies identified by the NRC in the Alvarez paper is provided in the Contention or its supporting papers.

For example, the NRC concluded that the Alvarez paper provided "no justification for the postulated probabilities of worst case spent fuel pool damage." The paper offered no "probabilistic analysis of the likelihood" of a terrorist attack, or any other event, leading to severe damage of a spent fuel pool and its fuel, but rather merely postulated such probabilities which were claimed to justify moving the spent fuel to dry cask storage. COMSECY-03-0019, Attachment at 2-4. Dr. Thompson's Report provides no new substantive information regarding the probability of a worst case spent fuel damage scenario involving a terrorist attack. Indeed, the report states that the "record of experience does not allow a statistically valid estimate of this probability." Thompson Rept. at 26. Rather, it claims, without any factual support or explication, that "prudent judgment indicates that a probability of at least one per century is a reasonable assumption for policy purposes." Id. This is the same sophistry that NRC rejected as meaningless in COMSECY-03-0019. See COMSECY-03-0019, Attachment at 2-4. Such speculation neither provides new nor significant information requiring the NRC to reconsider its GEIS findings regarding spent fuel storage, nor supports an admissible contention.

Similarly, the Thompson Report provides no new or significant information regarding non-terrorist events. The report alleges that "non-malicious events that could lead to pool fire" at VYNPS include "(i) an accidental aircraft impact, with or without an accompanying fuel-air explosion or fire; (ii) an earthquake; (iii) dropping of a fuel transfer cask or shipping cask; (iv) a fire inside or outside the plant building; and (v) a severe accident at the adjacent reactor" (Thompson Rept. at 18), but provides no basis indicating that any of these scenarios is sufficiently probable to warrant consideration under NEPA.

With respect to the first four scenarios, the Thompson Report provides no estimated probability of occurrence or any factual basis whatsoever from which even a probability of occurrence could be inferred. The necessary sequence of events by which such scenarios might lead to spent fuel pool fires is not identified, nor is there any discussion of the probability of their occurrence.

Such broad, unsupported claims do not provide the necessary requisite factual basis for an admissible contention, much less provide new information necessary to trigger the NRC's reconsideration of the GEIS conclusions regarding spent fuel storage. See Carolina Power & Light Co. (Shearon Harris Nuclear Power Plant), CLI-01-11, 53 N.R.C. 370, 390 (2001) ("vague references to potential spent fuel catastrophes" do not constitute an admissible contention), affirming Carolina Power & Light Co. (Shearon Harris Nuclear Power Plant), LBP-00-19, 52 N.R.C. 85 (2000). For example, neither the sequence of events by which the dropping of a fuel transfer cask or shipping cask might lead to a spent fuel pool fire nor the likelihood of occurrence of such an accident scenario is discussed in the contention and its supporting documents. Nor is mention made of the fact that VYNPS utilizes a single failure proof crane "with redundant load bearing equipment" designed to prevent the "[a]ccidental dropping of large

pieces of equipment, such as a spent fuel shipping cask." VYNPS Updated Safety Analysis Report ("UFSAR") at 10.3-6.

Likewise, with respect to earthquakes, the report simply suggests – without any factual explication of a sequence or probability – that a severe earthquake that damages the reactor and its supporting systems and causes a core-melt accident "could cause leakage of water from the pool" (Thompson Rept. at 19). The Thompson Report provides no basis to assume that the probability of a seismic event causing a catastrophic failure and drainage of the steel-lined, seismic category 1 spent fuel pool (Application at 2.4-3 – 2.4-4; UFSAR at 10.3-5) is the same as the probability of a seismic event causing core damage. The Thompson Report totally ignores the wholly different nature of the structures (e.g., the thick spent fuel pool walls and floor) and systems involved.[13] Similarly, no factual explication is provided of a sequence or likelihood of a potential accident scenario involving accidental aircraft crash impacts or fires inside or outside the plant.[14] Such vague, unsupported assertions provide no basis for an admissible contention, much less a basis for the NRC to reconsider its GEIS findings regarding spent fuel storage. See, e.g., Shearon Harris, supra, CLI-01-11, 53 N.R.C. at 390 ("vague references to potential spent fuel catastrophes" do not constitute an admissible contention); Georgia Tech, supra, LBP-95-6,

[13] The Commission in the Waste Confidence Decision found that "because of the large safety margins in the design and construction of their spent fuel pools," spent fuel pools could safely withstand earthquakes "several times more severe" than the plant's design basis earthquake. See note 4, supra.

[14] With respect to aircraft crashes, in plant licensing the likelihood of an aircraft impacting the site would have been determined to be less than 1 E-7. See NUREG-0800, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, §§ 2.2.3 & 3.5.1.6. Thus, even without considering the likelihood of occurrence of subsequent events that would be necessary for an aircraft crash to cause a spent fuel pool fire, the likelihood of a spent fuel fire caused by aircraft crashes would be considered remote and speculative for purposes of NEPA. See Carolina Power & Light Co. (Shearon Harris Nuclear Power Plant), LBP-01-9, 53 N.R.C. 239, 268 (2001) (an event with probability of occurrence of 2.0E-07 determined to be remote and speculative); CLI-01-11, 53 N.R.C. at 388 n. 8 (although "Commission has never determined a threshold accident probability figure for imposing the requirement of preparing an EIS," 2.0E-07 is below any such threshold).

41 N.R.C. at 305 (a petitioner is obligated "to provide the [technical] analyses and expert opinion" or other information "showing why its bases support its contention").

With respect to the allegation that "a severe accident at the adjacent reactor" would cause a spent fuel pool fire, the Thompson Report again fails to provide any meaningful information indicating that this scenario is sufficiently probable to warrant further analysis under NEPA, or that it would change the GEIS conclusions regarding spent fuel storage. The Thompson Report merely "assumes that the conditional probability of a spent-fuel-pool fire, given an early release from the adjacent reactor, is 50 percent" and provides no real basis for this speculation. Thompson Rept. at 20 (emphasis added). The Thompson Report asserts that "[s]upport for this assumption is provided by technical studies and opinions submitted to the Atomic Safety and Licensing Board (ASLB) in a license-amendment proceeding in regard to the expansion of spent-fuel-pool capacity at the Harris nuclear power plant," and alleges that "[a]ll three parties to the proceeding – the NRC Staff, Carolina Power & Light, and Orange County – reached the same conclusion on an issue" relevant to the appropriateness of a conditional probability of 50 percent for the VYNPS. Id. (emphasis added). However, the Thompson Report provides no citation to any such support. Moreover, it is clear from the published decisions in the Shearon Harris spent fuel proceeding that Thompson's characterization of the parties' positions and the related findings of the Harris licensing board is inaccurate. No support for such a 50% conditional probability is found in either the Harris licensing board's decision or the technical position taken of the parties described in that decision.

As reflected in Harris, the accident scenario alleged in the Thompson Report of a reactor severe accident causing spent fuel pool fire involves consideration of the probability of a sequence of seven events:[15]

- (1) a degraded core accident;
- (2) containment failure or bypass;
- (3) loss of all spent fuel cooling and makeup systems;
- (4) extreme radiation doses precluding personnel access;
- (5) inability to restart any pool cooling or makeup systems due to extreme radiation doses;
- (6) loss of most or all pool water; and
- (7) initiation of exothermic oxidation reaction in the spent fuel pool.

Shearon Harris, supra, LBP-01-09, 53 N.R.C. at 244-45. The Thompson Report does not address the probability of each of these events at VYNPS, but instead simply assumes a conditional probability of 50% for steps 3 through 7 for VYNPS. As reflected in the licensing board's decision in the Harris proceeding, nowhere did the NRC Staff, CP&L, nor the licensing board itself, conclude that the conditional probability of a spent fuel pool fire was 50% given a severe accident causing the release of radioactivity from the reactor.

Performing a probabilistic risk analysis ("PRA"), CP&L calculated a probability of 7.7 E-06 through step 2 (release of radioactivity into the environment) and an overall probability for a spent fuel fire of 2.78 E-08. LBP-01-9, 53 N.R.C. at 267. This is a factor of more than 35 lower than the release of radioactivity, or in other words, a conditional probability of less than 3% that a severe reactor accident releasing radioactivity would trigger a spent fuel pool fire. The Staff

[15] Four plants had originally been planned for the Harris site, and accordingly, the fuel handling building had been constructed with four spent fuel pools. Initially, only two of the spent fuel pools were utilized to support the single unit at Harris, but in December 1998, CP&L filed an application for a license amendment to increase the spent fuel storage capacity at the plant by adding spent fuel racks and utilizing the two previously inactive spent fuel pools, which triggered the licensing proceeding discussed above. Shearon Harris, supra, LBP-01-09, 53 N.R.C. at 242.

calculated the probability of a significant release (through step 2) to be 1.2 E-05 and an overall probability of a spent fuel fire to be 2.0 E-07. Id. at 254, 256-57, 267. This is a factor of more than 166 lower than the release of radioactivity, or in other words a conditional probability of less than 1% that a severe reactor accident releasing radioactivity would trigger a spent fuel pool fire.[16] The Harris licensing board found the Staff's estimates to be reasonable and supported by the detailed PRA analysis performed by CP&L and found that the probability of the postulated sequence of events resulting in a spent fuel pool fire was "conservatively in the range described by the Staff: 2.0 E-07 per reactor year. . . , or less." Id. at 267 (emphasis added).

Based on this testimony, the licensing board in Harris held that the accident scenario alleged by Dr. Thompson was properly characterized as "remote and speculative" and therefore did not have to be considered in an environmental impact statement. Id. at 271. Thus, the Harris proceeding does not support the Attorney General's assertion that the probability of this accident falls within the range that the NRC considers reasonably foreseeable (see Pet. at 3).

Moreover, several factors underlying the probabilities calculated by the Staff and CP&L, and affirmed by the Harris licensing board, directly contradict unsupported assertions in the Thompson Report. First, contrary to Dr. Thompson's bald claim of 100% certainty that spent fuel cooling would be lost as a result of a degraded core accident and containment failure, the Harris licensing board found, based on persuasive analysis by the Staff, that loss of spent fuel cooling was dominated by a loss of offsite power and "that there are only limited circumstances after containment failure in which cooling would be lost." Id. at 257-58 (emphasis added).

[16] In contrast, the intervenor – based on analysis and report provided by Dr. Thompson – calculated the probability of a significant release of probability (through step 2) to be 1.6 E-05 and an overall probability of a spent fuel fire to be the same, 1.6 E-05, for a conditional probability of 1.0. LBP-01-9, 53 N.R.C. at 267.

Second, analysis by both the Staff and CP&L showed that it would take in the range of at least 10 days without spent fuel cooling before the water in any of the pools would boil off "so as to lower the water level to the top of the fuel storage racks such that makeup" water would be required, and that within this period of time there was a "high" likelihood of success in providing the necessary makeup water to the spent fuel pools. Id. at 262, 264 (emphasis added).[17]

In short, the claim that support for a conditional probability of 50% for a spent fuel pool fire given an accident causing a radiological release from the VYNPS reactor is found in the Harris proceeding is a mischaracterization of that proceeding. On their face, the findings and conclusions of the Harris licensing board belie this claim. It is well established that mischaracterization of the findings or conclusions of a document cannot support the admission of a contention. See, e.g., Limerick, supra, ALAB-804, 21 N.R.C. at 593-94 (because the cited document "does not support the point for which it is urged," the contention lacks a "cognizable basis") Thus, at bottom, the claim of a conditional probability of 50% for a spent fuel pool fire given an accident causing a radiological release from the VYNPS reactor is based on the mere speculation of Dr. Thompson, a person with "little experience in the actual operation of a nuclear power plant or in PRA[s]." Shearon Harris, supra, LBP-01-9, 53 N.R.C. at 251. Such speculation does not provide the basis for an admissible contention, much less new information for the NRC to reconsider its GEIS findings regarding spent fuel storage.

Likewise, the Contention and the supporting documents provide no new information to ameliorate what COMSECY-03-0019 considered to be the unrealistic and excessive

[17] CP&L determined that at least one makeup water lineup was possible with 4 days for all accident-initiating sequences of postulated core damage accident and the Staff conservatively assigned a "conservative probability of 0.1 (10%)" that restoring spent fuel cooling would not be successful. Id.

conservatisms regarding the overestimation of radiation release and overestimation of societal costs associated with a severe spent fuel accident. See COMSECY-03-0019, Attachment at 4-5. The report by Dr. Beyea supplied on these topics uses the same "methodologies outlined" in the Alvarez Report and the 2004 addendum to that Report. Beyea Rept. at 3. The Beyea Report continues to assume releases of 10% and 100% of the spent fuel pool cesium inventory (id. at 9-10) even though such releases, particularly anything approaching 100%, is wholly unrealistic. COMSECY-03-0019, Attachment at 4. Also, an example of the excess conservatisms employed in the calculation of societal damages is the Beyea Report's assumption of a 5% loss in property value for properties extending out 1000 miles from the plant. Beyea Rept. at 9-10. As would be expected, this unsupported and unrealistic assumption, which in essence posits property damage to nearly one-third of the nation, results in estimates of hundreds of billions of dollars of damage. Id. Similarly, the Beyea Report's projection of thousands of cancer deaths appears to be based on contamination affecting a population within a 1000-mile radius (see Beyea Rept. at 30-33), and relies on the remarkable assumption that resuspended radioactivity would cause more cancers than the remediated plume (see id. at 24). Further, Dr. Beyea advocates a supra-linear dose-response curve – a position that is not supported by any recognized advisory authority (e.g., BEIR, NCRP, ICRP, UNSCEAR, NRC, or EPA). In short, the Beyea Report does not provide a reliable, credible assessment of consequences and thus provides no basis to support a re-examination of the risk of spent fuel pool fires. It is well established that NEPA does not require "worst-case analyses" such as those presented in the Beyea Report,[18] and no new information is

[18] Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 354-56 (1989). In that case, the Supreme Court clearly enunciated that NEPA does not require a "worst case analysis" because, among other reasons, worst case analyses would "distort[] the [NEPA] decisionmaking process by overemphasizing highly speculative harms." Id. at 356 (emphasis added). The legal precedent of the Supreme Court's decision in Robertson has been subsequently and repeatedly followed. See, e.g., Edwardsen v. U.S. Dep't of Interior, 268 F.3d 781, 785 (9th Cir. 2001) ("an EIS need not include a worst-case scenario").

provided therein that would mandate the NRC's reconsideration of its GEIS findings regarding spent fuel storage.

In summary, the Attorney General's Contention is not supported by any credible analysis establishing the probability of a spent fuel pool fire or demonstrating that it is sufficiently foreseeable to warrant consideration under NEPA. Further, the Attorney General's Contention is not supported by any credible discussion of the consequences of such an accident. As a result, the Contention provides no basis to suggest that there is a risk warranting further consideration or mitigation.

Further, while the Contention and it supporting materials give passing reference to non-malicious events that allegedly could lead to spent pool fires, the Contention's focus is clearly on loss of cooling water caused by terrorist acts. See Pet. at 33-47. The Commission has ruled, however, that "NEPA imposes no legal duty on the NRC to consider intentional malevolent acts, such as [the September 11, 2001 attacks] on a case-by-case basis in conjunction with commercial power reactor license renewal applications." McGuire, supra, CLI-02-26, 56 N.R.C. at 365 (footnote omitted).

The Attorney General argues that the NRC rationale in excluding consideration of terrorism is not supported, and advances a number of arguments that were recently briefed before the U.S. Court of Appeals for the Ninth Circuit in a proceeding involving the licensing of an independent spent fuel storage installation at the Diablo Canyon Power Station. See Pet. at 42-47. On reply, the Attorney General will no doubt point out that the Ninth Circuit has now held that the NRC should have considered the effects of terrorism in its environmental assessment in that proceeding. San Luis Obispo Mothers for Peace v. NRC, No. 03-74628, slip op. (9th Cir.

June 2, 2006). The Court, however, has not yet issued its mandate,[19] so this decision currently has no effect. Even if this decision becomes effective, it would not affect license renewal proceedings, because the Commission has held:

> Even if we were required by law to consider terrorism under NEPA, the NRC has already issued a Generic Environmental Impact Statement ("GEIS") that considers sabotage in connection with license renewal. . . . The GEIS concluded that, if such an event were to occur, the resultant core damage and radiological release would be no worse than those expected from internally initiated events.

McGuire, CLI-02-26, 56 N.R.C. at 365 n.24 (citations omitted).

Moreover, the Ninth Circuit's decision is inconsistent with Limerick Ecology Action v. NRC, 869 F.2d 719, 741-44 (3d Cir. 1989), which upheld the NRC's determination that the risk of sabotage could not be assessed meaningfully and therefore was unlitigable. Therefore, even if the Ninth Circuit's decision were to become effective, there would be a split in the circuits. Because the Ninth Circuit decision is not controlling, and because the Commission held in McGuire that sabotage is already addressed in the GEIS, Entergy respectfully submits that until the Commission directs otherwise, the Board should continue to follow the NRC's license renewal precedent. In any event, because spent fuel storage is governed by the Waste Confidence Rule and is a Category 1 issue in license renewal, it can be admitted as a contention only if the Commission waives these rules.

Finally, the Contention's request that the Commission issue a backfit order requiring VYNPS to change its spent fuel pool design to the original low-density storage configuration using dry storage for any excess fuel must be rejected as beyond the scope of this license renewal proceeding, as it does not concern aging management of plant systems and components. As

[19] Nor has the time expired within which the NRC or the utility involved may seek rehearing, rehearing *en banc*, or Supreme Court review.

discussed above, in promulgating the license renewal rule the Commission determined that, with the exception of the detrimental effects of aging and a few other issues related to safety only during the period of extended operation, the existing regulatory processes are adequate to ensure that the licensing bases of currently-operating plants provide and maintain an adequate level of safety. 60 Fed. Reg. at 22,464, 22,481-82. Thus, issues concerning the adequacy of the current licensing basis are beyond the scope of license renewal proceedings. Turkey Point, supra, CLI-01-17, 54 N.R.C. at 8-9. For this reason, the Commission has held that on-site storage of spent fuel raises no safety question for license renewal. Id. at 23. Accordingly, the Contention's request for a backfit order to change the plant's spent fuel pool licensing basis must be rejected.

Further, to the extent that the Attorney General is advocating a need to protect against terrorist acts that exceed the design basis threat, its contention is barred by 10 C.F.R. § 50.13.[20] Moreover, to the extent that the Attorney General may be advocating a need to revise the design basis threat, that matter is being addressed by an ongoing rulemaking proceeding in which the Commission has invited public comment on the potential for air-based threats in accordance with section 651(a) of the Energy Policy Act of 2005. 70 Fed. Reg. 67,380-382 (Nov. 7, 2005). The Massachusetts Attorney General has in fact commented, urging the NRC to adopt an attribute for air-based threats,[21] and other comments have raised specific proposals similar to

---

[20] 10 C.F.R. § 50.13 provides as follows:

> An applicant for a license to construct or operate a production or utilization facility, or for an amendment to such license, is not required to provide for design features or other measures for the specific purpose of protection against the effects of (a) attacks and destructive acts, including sabotage, directed against the facility by an enemy of the United States, whether a foreign government, or person, or (b) use or deployment of weapons incident to U.S. defense activities.

[21] Letter from J. Milkey, Mass. Office of the Attorney General, to Secretary, U.S. NRC, Re: Docket No. RIN 3150-AH60 (Jan. 23, 2006), available at http://ruleforum.llnl.gov/cgi-bin/library?source=*&library=dbt_prule_public&file=*&st=prule.

those advanced in the Petition.[22] As has been long held, licensing boards should not accept contentions which are or are about to become the subject of rulemaking. Oconee, supra, CLI-99-11, 49 N.R.C. at 345.[23]

In summary, the Massachusetts Attorney General's Contention seeks to raise an issue that has been resolved generically and is beyond the scope of this proceeding. Because the Massachusetts Attorney General has not petitioned the Commission for a waiver, its contentions may not be entertained. Further, even if this contention were within the scope of the proceeding, it would be inadmissible because it fails to show that the Commission's generic determinations are inapplicable to VYNPS or would not serve their intended purpose, and fails to establish any genuine dispute with a material issue. Finally, the Attorney General's request for a backfit order to modify the current licensing basis for the VYNPS spent fuel pool must be rejected as beyond the scope of this license renewal proceeding.

VI. SELECTION OF HEARING PROCEDURES

Commission rules require the Atomic Safety and Licensing Board designated to rule on the Petition to "determine and identify the specific procedures to be used for the proceeding" pursuant to 10 C.F.R. §§ 2.310 (a)-(h). 10 C.F.R. § 2.310. The regulations are explicit that "proceedings for the . . . renewal . . . of licenses subject to [10 C.F.R. Part 50] may be conducted under the procedures of subpart L." Id. § 2.310(a). The regulations permit the presiding officer to use the procedures in 10 C.F.R. Part 2, Subpart G ("Subpart G") in certain circumstances. Id.

---

[22] See, e.g., Letter from D. Lochbaum and E. Lyman, USC, to A. Vietti-Cook, USNRC (Jan.23, 2006), available at http://ruleforum.llnl.gov/cgi-bin/library?source=*&library=dbt_prule_public&file=*&st=prule.

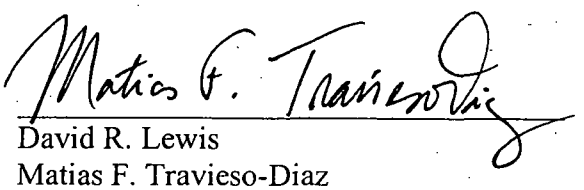
[23] In UCS v. AEC, 499 F.2d. 1069 (D.C. Cir. 1974), the D.C. Circuit upheld the Commission's discretion to exclude issues from consideration in a licensing proceeding when those issues are being considered in a rulemaking proceeding. As a general matter, the NRC clearly has the discretion to define the scope of its proceedings. Bellotti v. NRC, 725 F.2d 1380, 1381 (D.C. Cir. 1983).

§ 2.310(d). It is the proponent of the contentions, however, who has the burden of demonstrating "by reference to the contention and the bases provided and the specific procedures in subpart G of this part, that resolution of the contention necessitates resolution of material issues of fact which may be best determined through the use of the identified procedures." Id. § 2.309(g). The Attorney General did not address the selection of hearing procedures in the Petition and therefore did not satisfy its burden to demonstrate why Subpart G procedures should be used in this proceeding. Accordingly, any hearing should be governed by the procedures of Subpart L.

VII. CONCLUSION

For the reasons stated above, the Massachusetts Attorney General has not proffered an admissible contention in this proceeding. Therefore, its request for hearing should be denied. The Attorney General's petition for a backfit order is beyond the scope of this proceeding and should likewise be denied.

Respectfully Submitted,



David R. Lewis
Matias F. Travieso-Diaz
PILLSBURY WINTHROP SHAW PITTMAN LLP
2300 N Street, N.W.
Washington, DC 20037-1128
Tel. (202) 663-8474

Counsel for Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc.

Dated: June 22, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
Entergy Nuclear Vermont Yankee, LLC	)	Docket No. 50-271-LR
and Entergy Nuclear Operations, Inc.	)	ASLBP No. 06-849-03-LR
	)	
(Vermont Yankee Nuclear Power Station)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "Entergy's Answer to the Massachusetts Attorney General's Request for a Hearing, Petition for Leave to Intervene, and Petition for Backfit Order," dated June 22, 2006, were served on the persons listed below by deposit in the U.S. Mail, first class, postage prepaid, and where indicated by an asterisk by electronic mail, this 22nd day of June, 2006.

*Administrative Judge
Alex S. Karlin, Esq., Chairman
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
ask2@nrc.gov

*Administrative Judge
Dr. Richard E. Wardwell
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
rew@nrc.gov

*Administrative Judge
Dr. Thomas S. Elleman
Atomic Safety and Licensing Board
5207 Creedmoor Road, #101,
Raleigh, NC 27612.
tse@nrc.gov; elleman@eos.ncsu.edu

*Secretary
Att'n: Rulemakings and Adjudications Staff
Mail Stop O-16 C1
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
secy@nrc.gov, hearingdocket@nrc.gov

Office of Commission Appellate Adjudication
Mail Stop O-16 C1
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

*Mitzi A. Young, Esq.
*Steven C. Hamrick, Esq.
Office of the General Counsel
Mail Stop O-15 D21
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
may@nrc.gov; sch1@nrc.gov

*Sarah Hofmann, Esq.
Director of Public Advocacy
Department of Public Service
112 State Street – Drawer 20
Montpelier, VT 05620-2601
Sarah.hofmann@state.vt.us

*Anthony Z. Roisman, Esq.
National Legal Scholars Law Firm
84 East Thetford Road
Lyme, NH 03768
aroisman@nationallegalscholars.com

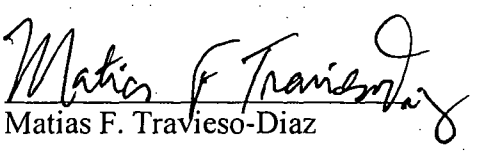
*Ronald A. Shems, Esq.
*Karen Tyler, Esq.
Shems, Dunkiel, Kassel & Saunders, PLLC
9 College Street
Burlington, VT 05401
rshems@sdkslaw.com
ktyler@sdkslaw.com

*Diane Curran, Esq.
Harmon, Curran, Spielberg &Eisenberg, LLP
1726 M Street, N.W., Suite 600
Washington, D.C. 20036
dcurran@harmoncurran.com

*Matthew Brock, Esq.
Assistant Attorney General
Environmental Protection Division
Office of the Attorney General
One Ashburton Place
Boston, MA 02108
Matthew.brock@ago.state.ma.us

Mr. Dan MacArthur
Director, Emergency Management
P.O. Box 30
Marlboro, VY 50344
dmacarthur@igc.org

*Callie B. Newton, Chair
Gail MacArthur
Lucy Gratwick
Town of Marlboro
Selectboard
P.O. Box 518
Marlboro, VT 05344
marcialynn@ev1.net; cbnewton@sover.net


Matias F. Travieso-Diaz

June 22, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
ENTERGY NUCLEAR OPERATIONS, INC.	)	Docket No. 50-293
	)	
	)	ASLBP No. 05-842-03-LR
(Pilgrim Nuclear Power Station)	)	

NRC STAFF ANSWER OPPOSING MASSACHUSETTS ATTORNEY GENERAL'S REQUEST FOR HEARING AND PETITION FOR LEAVE TO INTERVENE AND PETITION FOR BACKFIT ORDER

INTRODUCTION

Pursuant to 10 C.F.R. § 2.309(h)(1), the U.S. Nuclear Regulatory Commission Staff (Staff) hereby answers the request for hearing, petition for intervention and petition for backfit, filed by the Attorney General of the Commonwealth of Massachusetts (MassAG or Petitioner) on May 26, 2006.[1] As set forth below, although the MassAG has shown standing to intervene in this proceeding, he has not proffered an admissible contention. Thus, the Petition should be denied. In addition, the Petition for Backfit Order should be dismissed.

BACKGROUND

By letter dated January 25, 2006, Entergy Nuclear Operations, Inc. (Entergy or Applicant) submitted an application for renewal of Operating License No. DPR-35

[1] *See,* Massachusetts Attorney General's Request for a Hearing and Petition For Leave to Intervene with Respect to Entergy Nuclear Operations, Inc.'s Application for Renewal of the Pilgrim Nuclear Power Plant Operating License and Petition for Backfit Order Requiring New Design Features to Protect Against Spent Fuel Pool Accidents (Petition), May 26, 2006.

for the Pilgrim Nuclear Power Station (Pilgrim) for an additional 20 years.[2] The current operating license for Pilgrim expires June 8, 2012.

On March 27, 2006, the NRC published a notice of acceptance for docketing and opportunity for hearing regarding the license renewal application.[3] In response to this notice, the MassAG filed a timely intervention Petition. The Staff hereby responds in opposition to the MassAG's Petition.

A. REQUEST FOR HEARING AND PETITION FOR INTERVENTION

DISCUSSION

1. Petitioners' Standing

a. Legal Requirements for Standing

Any person who requests a hearing or seeks to intervene in a Commission proceeding must demonstrate that he or she has standing to do so. Section 189a.(1)(A) of the Atomic Energy Act of 1954, as amended ("AEA" or "Act"), 42 U.S.C. § 2239(a)(1)(A), states:

> In any proceeding under this Act, for the granting, suspending, or amending of any license . . . , the Commission shall grant a hearing upon the request of any person whose interest may be affected by the proceeding, and shall admit any such person as a party to such proceeding.

The Commission's regulations in 10 C.F.R. § 2.309(d)(2) provide that a State seeking to participate as a party in a proceeding must submit a request for hearing/petition to intervene that complies with the requirements of 10 C.F.R. § 2.309, including the contention requirements, but need not address standing to intervene in a proceeding for a facility located in that state. 10 C.F.R. § 2.309(d)(2).

---

[2] *See* Letter from Michael A. Balduzzi, Entergy Nuclear Operations, Inc., to U.S. NRC, Re: License Renewal Application, (Jan. 25, 2006).

[3] *See* Pilgrim Nuclear Power Station; Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing Regarding Renewal of Facility Operating License No. DPR-35 for an Additional 20-Year Period, 71 Fed. Reg. 15,222 (Mar. 27, 2006).

b. Petitioner Has Demonstrated Standing to Intervene in this Proceeding.

The MassAG has alleged that he has filed his Petition on behalf of the Commonwealth of Massachusetts and is an elected representative of the Commonwealth. Petition at 1, 4-5. Pilgrim is located within the boundaries of Massachusetts. Therefore, the MassAG need not address standing to participate in this proceeding.

2. Petitioners' Proposed Contentions

Even though the MassAG has a right to participate in this matter, he still must submit at least one admissible contention in order to be admitted as a party. 10 C.F.R. § 2.309(d)(2). The MassAG has failed to submit an adequate Petition, because the contention submitted is not admissible. Therefore, the Petition should be denied.

a. Legal Standards Governing the Admission of Contentions

To gain admission to a proceeding as a party, in addition to satisfying the criteria for standing, a petitioner must submit at least one admissible contention that meets the requirements of 10 C.F.R. § 2.309(f). *See* 10 C.F.R. § 2.309(a). This regulation requires a petitioner to:

> (i) Provide a specific statement of law or fact to be raised or controverted;
>
> (ii) Provide a brief explanation of the basis for the contention;
>
> (iii) Demonstrate that the issue raised in the contention is within the scope of the proceeding;
>
> (iv) Demonstrate that the issue raised in the contention is material to the findings the NRC must make to support the action that is involved in the proceeding;
>
> (v) Provide a concise statement of the alleged facts or expert opinions which support the requestor's/petitioner's position on the issue and on which the petitioner intends to rely at hearing, together with references to the specific sources and documents on which the requestor/petitioner intends to rely to support its position on the issue; and

(vi) Provide sufficient information to show that a genuine dispute exists with the applicant/licensee on a material issue of law or fact. This information must include references to specific portions of the application (including the applicant's environmental report and safety report) that the petitioner disputes and the supporting reasons for each dispute, or, if the petitioner believes that the application fails to contain information on a relevant matter as required by law, the identification of each failure and the supporting reasons for the petitioner's belief.

10 C.F.R. § 2.309(f)(1). The Commission has emphasized that its rules on contention admissibility are "strict by design." *Dominion Nuclear Conn., Inc.* (Millstone Nuclear Power Station, Units 2 & 3), CLI-01-24, 54 NRC 349, 358 (2001). Failure to comply with any of these requirements is grounds for dismissing a contention. *See Private Fuel Storage* (Independent Spent Fuel Storage Installation) (*PFS*), CLI-99-10, 49 NRC 318, 325 (1999).

The contentions should refer to the specific documents or other sources of which the petitioner is aware and upon which he or she intends to rely in establishing the validity of the contentions. *Millstone*, CLI-01-24, 54 NRC at 358 (citing *Oconee*, CLI-99-11, 49 NRC at 333). Contention admissibility requirements "demand a level of discipline and preparedness on the part of petitioners, 'who must examine the publicly available material and set forth their claims and the support for their claims at the outset.'" *Louisiana Energy Services* (National Enrichment Facility) (*LES*), CLI-04-25, 60 NRC 223, 224-225 (2004). A petitioner must also submit more than "bald or conclusory allegation[s]" of a dispute with the applicant. *Id.*

Properly formatted contentions "must focus on the license application in question, challenging either specific portions of or alleged omissions from the application (including the SAR and ER)." [*LES*] (National Enrichment Facility), LBP-04-14, 60 NRC 40, 57 (2004); *aff'd* CLI-04-25, 60 NRC 223 (2004). *See* 10 C.F.R. § 2.309(f)(1)(vi). Additionally, "Any contention

that fails directly to controvert the application or that mistakenly asserts the application does not address a relevant issue can be dismissed." *LES*, LBP-04-14, 60 NRC at 57.

A petitioner must also "present the factual information and expert opinions necessary to support its contention adequately" and failure to provide such an explanation regarding the basis of a proffered contention requires the contention to be rejected. *Id.* In this regard, "neither mere speculation nor bare assertions alleging that a matter should be considered will suffice to allow the admission of a proffered contention." *Id.* at 55. Nor can a Licensing Board "make assumptions of fact that favor the petitioner." *Id.* at 56. Finally, "With limited exception, no rule or regulation of the Commission can be challenged in an adjudicatory proceeding." *Id.* at 54; *See* 10 C.F.R. § 2.335.

3. The Scope of the License Renewal Proceeding.

The scope of a license renewal proceeding is limited, in both the safety and environmental contexts. Review of safety issues is limited to "a review of the plant structures and components that will require an *aging* management review for the period of extended operation and the plant's systems, structures and components that are subject to an evaluation of time-limited *aging* analyses." *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 & 2; Catawba Nuclear Station, Units 1 & 2), CLI-02-26, 56 NRC 358, 363-64 (2002) (citations omitted) (emphasis in original). *See also Dominion Nuclear Conn., Inc.* (Millstone Nuclear Power Station, Units 2 & 3), LBP-04-15, 60 NRC 81, 90 (2004), *aff'd*, CLI-04-36, 60 NRC 631 (2004); *Baltimore Gas & Elec. Co.* (Calvert Cliffs Nuclear Power Plant, Units 1 & 2), CLI-98-14, 48 NRC 39, 41 (1998); 10 C.F.R. §§ 54.4, 54.21(a) and (c).

The scope of the environmental review is limited in accordance with 10 C.F.R. §§ 51.71(d) and 51.95(c). Consideration of environmental issues in the context of license renewal proceedings is specifically limited by 10 C.F.R. Part 51 and by the NRC's

"Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants" (NUREG-1437) ("GEIS"). *See Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 2 and 3) (*Turkey Point*), CLI-01-17, 54 NRC 3, 11-13 (2001). A number of environmental issues potentially relevant to license renewal are classified in 10 C.F.R. Part 51, Subpart A, Appendix B as "Category 1" issues, which means that "the Commission resolved the[se] issues generically for all plants and those issues are not subject to further evaluation in any license renewal proceeding." *Turkey Point*, LBP-01-06, 53 NRC at 152-53, *aff'd*, CLI-01-17, 54 NRC 3. The remaining issues in Appendix B, designated as "Category 2," must be addressed by the Applicant in its environmental report, and in the NRC's supplemental environmental impact statement for the facility at issue pursuant to 10 C.F.R. §§ 51.71(d), 51.53(c) and 51.95(c). *Id.*

b. Petitioner Has Not Proffered a Valid Contention.

For the reasons set forth below, Petitioner's proffered contention is not admissible.

Petitioners' Proposed Contention:

> The Pilgrim ER does not satisfy the requirements of 10 C.F.R. § 51.53(c)(3)(iv) and NEPA, 42 U.S.C. § 4332 *et seq.*, because it fails to address new and significant information regarding the reasonably foreseeable potential for a severe accident involving nuclear fuel stored in high-density storage racks in the Pilgrim fuel pool. Although an NRC-sponsored study conducted as early as 1979 raised the potential for a severe accident in a high-density fuel storage pool if water is partially lost from the pool (NUREG/CR-0649, *Spent Fuel Heatup Following Loss of Water During Storage* (March 1979) ("1979 Sandia Report")), the NRC has failed to take the risk into account in every EIS it has prepared, including the 1979 GEIS on the environmental impacts of fuel storage; the 1990 Waste Confidence rulemaking (Review and Final Revision of Waste Confidence Decision, 55 Fed. Reg. 38,474, 38,481 (September 18, 1990) ("1990 Waste Confidence Rulemaking"); and the 1996 License Renewal GEIS on which the Pilgrim license renewal application relies. Moreover, the environmental impacts of a pool accident were not considered in the 1972 EIS issued in support of the original operating license for the Pilgrim nuclear power plant (Final Environmental Statement

> Related to Operation of Pilgrim Nuclear Power Station, Boston Edison Company, Docket No. 50-293 (May 1972) ("1972 Pilgrim EIS").
>
> Significant new information now firmly establishes that (a) if the water level in a fuel storage pool drops to the point where the tops of the fuel assemblies are uncovered, the fuel will burn, (b) the fuel will burn regardless of its age, (c) the fire will propagate to other assemblies in the pool, and (c) [sic] the fire may be catastrophic. *See* Thompson Report and Beyea Report. This new information has also been confirmed by the NRC Staff in NUREG-1738, *Final Technical Study of Spent Fuel Pool Accident Risk and Decommissioning Nuclear Power Plants* (January 2001) ("NUREG-1738"), and by the National Academies of Sciences. *See* NAS Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, *Safety and Security of Commercial Spent Nuclear Fuel Storage* at 53-54 (The National Academies Press: 2006) ("NAS Report").
>
> Moreover, significant new information, including the attacks of September 11, 2001 and the NRC's response to those attacks, shows that the environmental impacts of intentional destructive acts against the Pilgrim fuel pool are reasonably foreseeable. Taken together, the potential for severe pool accidents caused by intentional malicious acts and by equipment failures and natural disasters such as earthquakes is not only reasonably foreseeable, but is likely enough to qualify as a "design-basis accident," *i.e.,* an accident that must be designed against under NRC safety regulations. Thompson Report, §§ 6,7,9.
>
> The ER also fails to satisfy 10 C.F.R. § 52.53(c)(3)(iii) because it does not consider reasonable alternatives for avoiding or reducing the environmental impacts of a severe spent fuel accident, *i.e.,* SAMAs. Alternatives that should be considered include re-racking the fuel pool with low-density fuel storage racks and transferring a portion of the fuel to dry storage.

Petition at 21-23. As basis for the contention, the Petitioner states that "new and significant information must be considered in a supplemental Environmental Impact Statement (EIS) because it shows that the impact of an accident in a high-density spent fuel pool (SFP) at Pilgrim would be significantly different than the impacts presented in prior EISs." Petition at 23. The Petition alleges that the contention meets the standard in *Harris* for pleading an admissible contention seeking consideration of a severe accident in an EIS. *Id.*

Staff Response to the Proposed Contention :

The proposed contention is inadmissible because it is outside the scope of license renewal proceedings, is immaterial, and fails to establish that a genuine dispute exists on a material issue of law or fact. *See* 10 C.F.R. § 2.309(f)(1)(i)-(vi) and (f)(2). It also is not supported by credible facts and opinion. It, thus fails to meet the Commission's pleading requirements articulated in 10 C.F.R. § 2.309.

The Contention is Outside the Scope of this Proceeding

This contention is inadmissible. It is outside the scope of this proceeding. Pursuant to 10 C.F.R. § 51.53(c)(2), the Applicant is not required to provide information regarding the storage and disposal of spent fuel. The issue of the admissibility of contentions concerning SFP accidents in license renewal proceedings was settled by the Commission in *Turkey Point. See Turkey Point*, CLI-01-17, 54 NRC 3. In that case, the Petitioner proffered a contention that concerned the risk of severe accidents involving spent fuel caused by aircraft crashes or hurricanes. *Id.* at 6. The contention also raised issues arising from NUREG-1738, the Staff's 2001 study of SFP accident risk at decommissioning reactors[4] and argued that this SFP issue was a Category 2 issue under 10 C.F.R. Part 51, Appendix B. *See Turkey Point*, LBP-01-06, 53 NRC at 164-65. The Licensing Board held that portion of the contention inadmissible because the issue of onsite spent fuel storage is a Category 1 issue that "cannot be examined further in a license renewal proceeding," and is further barred by the Commission's Waste Confidence Rule. *Id.* at 165. On appeal, the Commission affirmed the Board's decision for the reasons given by the Board. *Turkey Point*, CLI-01-17, 54 NRC at 6.

---

[4] NUREG-1738, Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants, (Feb. 2001).

The Commission went on to hold that:

> The GEIS's finding encompasses spent fuel accident risks and their mitigation, See GEIS, at xlviii, 6-72 to 6-76, 6-86, 6-92. The NRC has spent years studying in great detail the risks and consequences of potential spent fuel pool accidents, and the GEIS analysis is rooted in these earlier studies. NRC studies and the agency's operational experience support the conclusion that onsite reactor spent fuel storage, which has continued for decades, presents no undue risk to public health and safety. Because the GEIS analysis of onsite spent fuel storage encompasses the risk of accidents, [the] Contention . . . falls beyond the scope of individual license renewal proceedings.

Id. at 21. The Contention is, thus, outside the scope of this proceeding and is, therefore, inadmissible.

To the extent that the Contention insists that the ER should address SAMAs relating to the mitigation of accidents in the SFP, (Petition at 23), that matter was also decided in *Turkey Point*. Regarding the admissibility of SFP SAMA contentions, the Commission held:

> Part 51 does provide that "alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives." *See* Appendix B to Subpart A of Part 51; *see also* GEIS at 5-106 to 5-116. . . . Part 51's reference to "severe accident mitigation alternatives" applies to nuclear reactor accidents, not spent fuel storage accidents. . . . As we have seen, the GEIS deals with spent fuel storage risks (including accidents) generically, and concludes that "regulatory requirements already in place provide adequate mitigation." GEIS at 6-86, 6-92, xlviii; *see also id.* at 6-72 to 6-76.
>
> On the issue of onsite fuel storage, then, the GEIS rejects the need for further consideration of mitigation alternatives at the license renewal stage. Id. Indeed, for all issues designated as Category 1, the Commission has concluded that additional site-specific mitigation alternatives are unlikely to be beneficial and need not be considered for license renewal, *See* 61 Fed. Reg. at 28,484; GEIS at 1-5, 1-9.

Turkey Point, CLI-01-17, 54 NRC at 21-22. Part 51 treats *all* SFP accidents as Category 1. *Id.* at 22. "All [onsite spent fuel storage] issues, including accident risk, fall outside the scope of license renewal proceedings." *Id.* at 23.

The Spent Fuel Pool Accident is Not a Design Basis Accident

Petitioner argues that the accident scenarios set forth in his petition meet the criteria for design-basis accidents (DBAs). Petition at 6-8, 32. The problem is that the criterion cited by Petitioner is wrong. Petitioner states that: "In determining which types of accidents constitute design-basis accidents and therefore must be protected against in a nuclear plant's design, the NRC sets a 'threshold' based on probability of the accident." *Id.* at 7. That is incorrect.

The set of accidents that must be addressed as part of the design-basis have historically evolved from deterministic rather than probabilistic considerations. *See, e.g.* SECY-77-439, Re: Single Failure Criterion (Aug.17, 1977); 10 C.F.R. Part 50, Appendix A. These include defense-in-depth, redundancy and diversity, and are characterized by the use of the single failure criterion. The single failure criterion is codified in10 C.F.R. Part 50, Appendices A and K. Accordingly, the SFP and related systems have been designed and approved in accordance with this deterministic approach.

In any event, the issue of whether the accident is a DBA not related to license renewal and is, therefore, outside the scope of license renewal.

An Adjudicatory Proceeding is Not the Appropriate Forum for Addressing Changes to the Commission's Regulations

In asking this Board to address a spent fuel storage issue, the Petitioner is seeking to have the Board treat the SFP issue as a Category 2 issue. But, the Commission's regulations and precedent require any request to change the categorization of an issue under Appendix B from 1 to 2 be brought before the Commission via a petition for rulemaking or a waiver request. *See, e.g., Turkey Point,* CLI-01-17, 54 NRC at 12, *citing* Final Rule, Environmental Review for Renewal of Nuclear Power Plant Operating Licenses, 61 Fed. Reg 28,467, 28,470 (1996). *See also* 10 C.F.R. § 2.335.

As the Commission stated in *Turkey Point:*

> The Commission recognizes that even generic findings sometimes need revisiting in particular contexts. Our rules thus provide a number of opportunities for individuals to alert the Commission to new and significant information that might render a generic finding invalid, either with respect to all nuclear power plants or for one plant in particular. In the hearing process, for example, petitioners with new information showing that a generic rule would not serve its purpose at a particular plant may seek a waiver of the rule. *See* 10 C.F.R. § 2.758 [now 10 C.F.R. § 2.335] . . . . Petitioners with evidence that a generic finding is incorrect for all plants may petition the Commission to initiate a fresh rulemaking. *See* 10 C.F.R. § 2.802. Such petitioners may also use the SEIS notice-and-comment process to ask the NRC to forgo use of the suspect generic finding and to suspend license renewal proceedings, pending a rulemaking or updating of the GEIS. *See* 61 Fed. Reg. at 28,470; GEIS at 1-10 to 1-11.

Turkey Point, CLI-01-17, 54 NRC at 12. The Contention amounts to a request to change the regulation or to ignore it. The request for rule change should be made pursuant to 10 C.F.R. § 2.802. The request that the Board ignore the Commission's regulations is a direct attack on the regulations and can not be the basis for a contention. *See e.g.* 10 C.F.R. § 2.335.

<u>The Contention Impermissibly Challenges Commission Regulations</u>

The regulations prohibit attacks on Commission rules and regulations or any portion thereof in adjudicatory proceedings. 10 C.F.R. § 2.335(a). The exception to this rule, that a party may petition for a waiver of the regulation for a particular proceeding on the ground that "special circumstances with respect to the subject matter of the particular proceeding are such that the application of the rule or regulation . . . would not serve the purpose for which the rule was adopted" requires that a petition be filed, accompanied by an affidavit stating the special circumstances. *Id.* at (b). If the Licensing Board determines that the petitioner has made a *prima facie* showing, the matter must be certified to the Commission for decision. *Id.* Thus, a proceeding will be subject to the applicable rules and regulations unless a petition for waiver is filed and granted. The Petitioner has not complied with the requirements of 10 C.F.R. § 2.335. Petitioner's proposed contention challenges the GEIS's consideration of spent fuel issues, but

he has not offered any special circumstances demonstrating that the relevant GEIS findings do not apply to Pilgrim. Therefore, he cannot be heard to object to the applicability of the Commission's rules and regulations.

In his brief, the Petitioner argues that even though 10 C.F.R. § 2.335 prevents him from challenging NRC regulations, he may challenge "factual determinations codified in NRC NEPA regulations . . . under regulations and judicial precedents requiring the consideration of significant new information that undermines those determinations." Petition at 17. Petitioner does not cite any valid authority for this proposition. He refers to 10 C.F.R. § 51.53(c)(3)(iv), which states that "[t]he environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which applicant is aware," as well as some case law, as support for this proposition. *See* Petition at 10-11, 17. While the regulation requires new and significant information to be included in the ER, neither the regulation nor the cases invite a party to attack "factual determinations" codified in the regulations. Petitioner's position is contrary to the Commission's ruling in *Turkey Point*. *See Turkey Point*, CLI-01-17, 54 NRC at 12.

<u>There is no New and Significant Information Regarding the Storage of Spent Fuel on Site</u>

The Petitioner states that the requirement in 10 C.F.R. § 51.53(c)(iv) that the environmental report "contain any new and significant information regarding the environmental impacts of license renewal" mandates that the Applicant address SFP accidents based on alleged "new and significant" information regarding an increase in the risk of a SFP fire at Pilgrim. Petition at 1 ("The new information not addressed in any previous EIS demonstrates that continued storage of spent fuel in high-density storage racks in the Pilgrim pool poses a significant and reasonably foreseeable environmental risk of a severe fire and offsite release."),

24-37. In fact, as discussed below, this information is not new and, therefore, need not be included in the Applicant's ER.

The information regarding SFP accidents in the Petition and its supporting documents has been presented to licensing boards and the Commission, as well as to the ACRS and the Staff, in the past by various petitioners and witnesses.[5] The argument that the information is new has been used before, using the same basic information, to licensing boards and the Commission since at least 1999, if not earlier. Since the Commission has known about this information as far back as 1979, as acknowledged by the Petitioner, and since it has been submitted to the Commission on numerous occasions and the Commission has not deemed it to be significant, it cannot, under any interpretation of the word "new", be so considered. In fact, the Staff submits that the majority, if not all of the information (other than the calculations

---

[5] *See, e.g., Vermont Yankee Nuclear Power Corp.*(Vermont Yankee Nuclear Power Station), ALAB-919, 30 NRC 29 36 (1989) (Contention that EA inadequate because it did not consider a "self-sustaining fuel cladding fire" in a SFP with high density racks), *vacated and remanded*, CLI-90-04, 31 NRC 333 (1990), *dismissed* CLI-90-7, 32 NRC 129 (1990); *Pacific Gas & Electric Co.* (Diablo Canyon Nuclear Power Plant, Units 1 and 2),ALAB-880, 26 NRC 449, 456 (1987) (In proceeding for spent fuel pool reracking, petitioner raised issue of possibility of zircaloy cladding fire in the event of loss of pool cooling if high density racks in use.); *Pacific Gas & Electric Co.* (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation), LBP-02-23, 56 NRC 413, 449-50, 51 (2002) (Petitioner contended that "ER should address new information showing that previous NRC environmental analysis of the risks of high density pool storage of spent fuel considerably underestimate the risk of a spent fuel pool fire." "[T]echnical studies reviewed by the NRC . . .do not consider the more severe consequences of partial pool drainage in addition to total and instantaneous pool drainage."); *Carolina Power & Light Co.*(Shearon Harris Nuclear Power Plant), LBP-00-19, 52 NRC 85 (2000) (Contention stating that an EIS was required because SFP expansion would create risks that are significantly in excess of accident risks previously evaluated and there is new information showing that there is an increase in the probability and consequences of potential SFP accidents); *Consumers Power Co.* (Big Rock Point Plant), LBP-82-8, 15 NRC 299 (1982) (Petitioner contended that if the water level in the SFP drops below the top of the fuel assembly, the fuel rods will overheat, helped by the exothermic steam/Zircaloy oxidation process and Zircaloy may also react with steam.); *Public Service Electric & Gas Co.* (Salem Nuclear Generating Station, Unit 1), LBP-80-27, 12 NRC 435, 454-55, (1980) (Testimony concerning gross loss of water in SFP, zirconium fire that could spread from freshly discharged fuel to older fuel more likely with denser storage.), *aff'd* ALAB-650, 14 NRC 34 (1981); *Commonwealth Edison Co.* (Zion Station, Units 1 and 2), LBP-80-7, 11 NRC 245, 266-67 (1980) (Intervenor contended that SFP water could boil away, uncovering the spent fuel, which would heat up rapidly and the exothermic metal-water reaction that ensued would produce large amounts of heat and hydrogen gas, which would explode, releasing radioactivity that would be much more severe than a reactor meltdown.).

that the witness asserts are site specific), has been presented before. None of it is new or, as discussed below, significant.

The Petitioner claims that the information in NUREG-1738 is new: it is not. The Commission was well aware of it at the time it decided *Turkey Point*. *See Turkey Point*, CLI-01-17, 54 NRC at 22, n.11. Nor is it significant. As pointed out by the Commission, that study, among others, "concluded that the risk of [spent fuel pool] accidents is acceptably small."[6] *Id.* at 22. Similarly, the 2001 Alvarez report relied upon by Petitioner is not new or significant. The Staff prepared, and the Commission approved, a response to the report in 2003, concluding that it was overly conservative and unrealistic and that spent fuel stored is safe and the measures in place to protect the public are adequate.[7]

None of the remaining information cited by Petitioner is new or significant. For example, the possibility of loss of pool water for a variety of reasons is well known, and the types of

---

[6] Petitioner makes the statement that in NUREG-1738, the Staff conceded that if the water in a high density SFP is lost, even if the fuel is one year or more from discharge, the fuel will heat up to a point where the zircaloy cladding will melt and then catch fire. Petition at 62. This statement is incorrect. For purposes of offsite consequence analyses in NUREG-1738, the Staff did assume that if the water level in a fuel storage pool drops below the top of the spent fuel, a SFP fire would result (p.3-35, 3-37, and 3-38). However, this was considered a conservative assumption that bounds all sequences that could lead to fuel uncovery, and uncertainties in whether these sequences would lead to a SFP fire. NUREG-1738 actually found that for fuel that has been out of the reactor for 4-5 years, air cooling is sufficient to preclude a zirconium fire (p.A1A-4), but also found that in the event that air cooling is completely obstructed and the fuel is assumed to heat adiabatically (with no heat loss to the surroundings), 5 year old fuel could reach a (the temperature at which the onset of significant fission product release is expected) after 24 hours. NUREG-1738, p.A1A-5. NUREG-1738 found that since a non-negligible decay heat source lasts many years and since configurations ensuring sufficient air flow for cooling cannot be assured, the possibility of reaching the zirconium ignition temperature could not be precluded on a generic basis (ES-x). The conservative assumption that a SFP fire would occur was made to bound these uncertainties. For purposes of offsite consequence analyses in NUREG-1738, the Staff also conservatively assumed that all of the fuel assemblies in the SFP will participate in a SFP fire, and did not credit the possibility that fewer assemblies might be involved in a SFP fire in later years because of substantially lower decay heat in the older assemblies (p.3-31). The Staff noted that based on analyses performed up to that time fire propagation is expected to be limited to less than two full cores one year after shutdown, and that the assumption that all of the stored fuel participates adds conservatism to the calculation. NUREG-1738, p.3-31.

[7] COMSECY-03-0018, (Aug. 7, 2003) (ADAMS Accession No. ML052340740).

events cited by Petitioner were considered within previous analyses (*e.g.*, NUREG-1738), and the likelihood of these events progressing unmitigated to a SFP fire was found to be very small.

The Staff's understanding of the frequencies and the consequences of SPF fires has not changed substantially since the potential for SFP accidents with high density racks was first explored in detail as part of Generic Issue 82. *See* NUREG/CR-4982, Severe Accidents in Spent Fuel Pools in Support of Generic Issue 82 (1987); NUREG-1353, Regulatory Analysis for the Resolution of Generic Issue 82, "Beyond Design-basis Accidents in Spent Fuel Pools," (1989). This is demonstrated by a review of the Staff studies summarized below (all prior to 9/11). The Sandia Report (NUREG/CR-0649) reached the conclusion that for certain conditions, the cladding of freshly discharged assemblies would reach the point of ignition. NUREG/CR-0649, Spent Fuel Heatup Following Loss of Water During Storage, (March 1979). The possibility of propagation from assembly to assembly with the involvement of the entire spent fuel pool was not ruled out.[8]

Petitioner claims that significant new information now firmly establishes that: (a) if the water level in a fuel storage pool drops to the point where the tops of the fuel assemblies are uncovered, the fuel will burn, (b) the fuel will burn regardless of its age, (c) the fire will

---

[8] In his report, Dr. Thompson claims a 50% probability of a SFP fire given an "early release" from the reactor. Within his Table 6-1, Thompson presents values for both large early and medium early release frequencies from the ER. Thompson Report at 49. The ER values are based on the most recent version of the plant-specific PRA. If these values are used, the early release frequency is 1.07E-6/y (based on 6.8E-7/y + 3.9E-7/y), and the fire frequency = 0.5 x 1.07E-6/y = 5E-7/y. *Id.* However, Thompson actually bases his non-malice fire frequency on earlier risk information taken for the IPE and IPEEEs (circa 1990), which is also included in Table 6-1. *Id.* The result (presented in his Table 9-1) is an early release frequency of 4.2E-5/y and a fire frequency of 2.1E-5/y. *Id.* at 57. This is a factor of 40 higher than if he used the more recent PRA information. No basis for using the older risk information is provided. Thus, it would appear that this approach was taken in order to produce the maximum SFP fire frequency.

Thompson also claims a probability of one malicious attack per century, and that this attack will be 100% successful in producing a SFP fire. Thus, the frequency of a SFP at Pilgrim (1 of 104 reactors in the US) is: Fire frequency = 0.01 attack/y x 1.0 fire/attack x 1/104 = 1E-4/y. But he provides no support or basis for this claim.

propagate to other assemblies in the pool, and (d) the fire will be catastrophic. This new information has also been confirmed by the NRC staff in NUREG-1738 and by the National Academies of Sciences (NAS). *Id.* at 22. But these statements provide an inaccurate characterization of the findings of both NUREG-1738 and the National Academies of Sciences. *See* NAS Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, Safety and Security of Commercial Spent Nuclear Fuel Storage, (National Academies Press, 2006). *See* discussion regarding NUREG-1738 in n. 6, *supra.*

The NAS report does not firmly establish the points raised by the Petitioner. Rather than provide definitive conclusions that support the overly-simplified points made by the Petitioner, the calculations described on the referenced pages of the NAS report (NAS report, p. 53-54) indicate that: (1) the potential for heat build-up in a fuel assembly sufficient to initiate a zirconium cladding fire depends on its decay heat level (which is related to its age) and on the rate at which heat can be transferred to adjacent assemblies and to circulating air or steam, and (2) for some scenarios the fuel could be air cooled within a relatively short time after removal from the reactor, whereas in other scenarios (partial drain-down) fuel cladding might heat up sufficiently to ignite if no mitigative actions are taken. NAS Report, p. 52-54. Without these misrepresentations, the Petitioner cannot demonstrate these studies provide new and significant information.

Petitioner also asserts that there is significant new information, not previously considered by the NRC in any EIS, which shows that the impact of high-density spent fuel pool storage at Pilgrim would be significantly greater than contemplated in prior EISs. *Id.* at 23. But, again, the information cited is not new.

Petitioner cites to information that he alleges to be new in NUREG-1738, the NAS report, and the Thompson report, stating that all of these documents were written after the

issuance of the license renewal GEIS and therefore they qualify as new. But, the information provided in the referenced documents is not "new" in a technical sense. The potential for a severe accident in a high-density fuel storage pool was raised in the 1979 Sandia report (NUREG/CR-0649). Additional information regarding the frequencies and consequences of SFP fires became available subsequent to the spent fuel GEIS and prior to the license renewal GEIS (*e.g.*, NUREG/CR-4982 and NUREG-1353). The frequency and consequence information provided in the most recent documents cited by the petitioner (NUREG-1738, the NAS report, and the Thompson report) is not substantially different than that provided in the earlier documents that were available at the time of the license renewal GEIS. *See* NUREG/CR-4982, Table S.1, p.77, Table 4.7, p. 74; NUREG-1353, Table 4.7.1, p.4-36, Table 4.8.2, p. 4-41; NUREG/CR-6451, A.S. Benjamin, et al, Spent Fuel Heatup Following Loss of Water During Storage, (March 1979), Table 4.2, p. 4-3. Thus, this information would not be considered new in a technical sense. In addition, the Thompson report is rife with information that has been presented in previous cases. *See, e.g., Shearon Harris,* LBP-00-19, 52 NRC 85.[9]

Petitioner states that total or partial loss of water from a SFP containing high-density racks will initiate either an air-zirconium or a steam-zirconium exothermic reaction within hours. Petition at 30. This statement implies that a SFP fire is a certainty for either total or partial loss of water, and that the time-frame for fire initiation is very short. In any event, this is argument on the merits and will not be addressed at this juncture, except to note that, as the Petitioners themselves state on page 21 of their Petition, the potential for a fire in partial drain-down scenarios was noted even in the 1979 study. Thus, this is not new information.

---

[9] The attempt in the Thompson report (Thompson report at 20) to make it appear that there were only minor divergences between his analysis and the Staff's with respect to SFP fires, inaccurately represents the Staff's position. *See generally*, Shearon Harris, LBP-01-9, 53 NRC 239.

Petitioner states that once initiated, this reaction could spread to nearby, previously involved, fuel assemblies. *Id.* But the potential for propagation is not new. This also was previously identified and considered in the 1979 study and 1989 Staff evaluation (NUREG-1353). Once again, Petitioner has failed to demonstrate the existence of new and significant information.

The list of facts that are not new or significant goes on, and includes:

The Petitioner makes numerous statements and conclusions, that are allegedly supported by the Thompson report. However, the Thompson report itself makes statements and conclusions that are, in turn, totally unsupported. For example, the Petitioner has not provided any new information that would lead to a change in the SFP risk from internal or external events, and has only provided some speculative, unsubstantiated frequency estimates for security events. The petitioner alleges that the frequency of a SFP fire as a result of a reactor accident is 2E-5/y, but there is no technical basis provided for this value, and the actual value, if one could be developed, would be much less.[10]

In addition to being outside the scope of this proceeding and representing an impermissible challenge to the Commission's regulations, the Petitioner's contention fails substantively, as well. Petitioner has failed to demonstrate the existence of new and significant information that would necessitate the updating of the GEIS for license renewal pursuant to 10 C.F.R. § 51.53(c)(iv). By the Petitioner's own admission, the Commission has been aware of these issues since at least 1979. *See* Petition at 21.

---

[10] Petitioner and Thompson state that they are making the reasonable assumption that the conditional probability of a pool fire accompanying an early containment release is 50%, the overall estimated likelihood of a pool fire, excluding acts of malice, is on the order of 2E-5/y. Petition at 32. But, there is no technical basis for the 50% probability value on which this conclusion is based. In addition, as discussed in n. 8, *supra.*, Thompson actually bases his non-malice fire frequency on 1990 risk information, rather than the more recent PRA information. The result is an early release frequency and a fire frequency that is a factor of 40 higher than if he used the more recent PRA information.

Terrorism Issues are Outside the Scope of This Proceeding

The Petitioner states in the proposed contention that there is significant new information, including the attacks of September 11, 2001 and the NRC's response to those attacks, that shows that the environmental impacts of intentional destructive acts against the Pilgrim fuel pool are reasonably foreseeable. Petition at 22. Petitioner notes that the 1979 GEIS addressed deliberate attacks on a SFP. *Id.* at 29-30. Petitioner then argues that accidents caused by intentional malicious acts are credible and SFPs are vulnerable to attack. *Id.* at 33-37. Petitioner further argues that the potential for intentional acts can be analyzed qualitatively, and that the reasons given in the GEIS for not addressing terrorism are invalid. *Id.* at 37-41. Finally, the Petitioner addresses the Commission's holdings in *PFS II* and *Diablo Canyon. Id.* at 41-47. *See Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), CLI-02-25, 56 NRC 340 (2002); *Pacific Gas and Electric Co.* (Diablo Canyon ISFSI), CLI-03-12, 58 NRC 185 (2003). Yet, Petitioner ignores the only relevant precedent, in which the Commission specifically addressed the question of terrorism-related issues in license renewal proceedings: *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-26, 56 NRC 358 (2002). In that case, the Commission found that is no need to address terrorism issues in license renewal proceedings, stating that "it is sensible not to devote resources to the likely impact of terrorism during the license renewal period, but instead to concentrate on how to prevent a terrorist attack in the near term at the already licensed facilities." *McGuire*, CLI-02-26, 56 NRC at 365. In addition, the Commission affirmed that it has adequately address terrorism issues generically in the GEIS.[11]

---

[11] "Even if we were required by law to consider terrorism under NEPA, the NRC has already issued a . . . GEIS that considers sabotage in connection with license renewal. . . . The GEIS concluded that, if such an event were to occur, the resultant core damage and radiological releases would be no

(continued...)

The Ninth Circuit has recently granted a petition for review of the Commission's decision in *Diablo Canyon*. *See San Luis Obispo Mothers for Peace, et al. v. NRC*, No. 03-74628 (June 2, 2006). The Court's decision upheld the Commission's decision on the Atomic Energy Act issues, but, as to the NEPA issues, concluded that "the NRC's determination that NEPA does not require a consideration of the environmental impact of terrorist attacks does not satisfy reasonableness review," and held that "the EA prepared in reliance on that determination is inadequate and fails to comply with NEPA's mandate." *San Luis Obispo* at 6096. The case was remanded for further proceedings. *Id.* The Court's mandate has not yet issued. By letter dated June 16, 2006, Petitioner and his counsel asked the Board to apply the Ninth Circuit's decision to the instant case.[12] The Staff submits that the decision should not be applied to this case. First, the mandate has not yet issued and the Commission has not determined what action, if any, it may take in response to the decision. Second, the Commission's statements in *McGuire*, cited above, distinguish this license renewal matter from *San Luis Obispo*. Finally, if the Board has any questions regarding whether to apply the case, especially since the case may affect several pending matters, the question should be certified to the Commission.

CONCLUSION AS TO PETITION FOR INTERVENTION

Petitioner has established standing to intervene in this proceeding, but has failed to proffer an admissible contention. The proffered contention is outside the scope of license renewal, is an impermissible challenge to the Commission's rules and regulations, seeks changes in the Commission's regulations, cites no new and significant information, and

---

[11](...continued)
worse than those expected for internally initiated events." *Duke* 56 NRC at 365, n.24 (citations omitted).

[12] The Staff questions the propriety of Petitioner's letter request. The Staff submits that any request regarding precedents and legal authorities should have been submitted to the Board in a pleading.

discusses terrorism, which is outside the scope of this proceeding. Therefore, the Licensing Board should deny the Petition.

B. PETITION FOR BACKFIT

The Petitioner filed a Petition for Backfit, asking the Commission to order the backfitting of the SFP at Pilgrim to return it to low-density storage and to use dry storage for any overflow. Petition at 48-50. Petitioner seeks a discretionary hearing on the adequacy of any design modifications imposed by the Commission. *Id.* at 50.

The Staff submits that the Petition for Backfit should be dismissed. First, it is directed to the Commission. Therefore, it is before the wrong adjudicatory body. Second, as noted by Petitioner, there is no provision in the rules for an adjudicatory hearing on a backfit issue.

Therefore, Petitioner does not have the right to petition for a backfit and the Board does not have the authority to grant such a petition.

CONCLUSION AS TO PETITION FOR BACKFIT

Based on the foregoing, the Petition for Backfit should be dismissed.

Respectfully submitted,

Harry E. Wedewer

for Susan L. Uttal
Counsel for the NRC Staff

Dated at Rockville, Maryland
this 22nd day of June, 2006

June 22, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
	)	Docket No. 50-293-LR
ENTERGY NUCLEAR OPERATIONS, INC.	)	
	)	ASLBP No. 06-848-02-LR
	)	
(Pilgrim Nuclear Power Station)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the "NRC STAFF ANSWER OPPOSING MASSACHUSETTS ATTORNEY GENERAL'S REQUEST FOR HEARING AND PETITION FOR LEAVE TO INTERVENE AND PETITION FOR BACKFIT ORDER" in the above-captioned proceeding have been served on the following by electronic mail and deposit in the U.S. Mail Service or by deposit in the U.S. Nuclear Regulatory Commission's internal mail system as indicated by a single asterisk(*), or by deposit in the U.S. mail system, as indicated by a double asterisk (**) this 22nd day of June, 2006.

Administrative Judge*
Richard F. Cole
Atomic Safety and Licensing Board Panel
Mail Stop: T-3F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: rfc1@nrc.gov

Administrative Judge*
Ann Marshall Young, Chair
Atomic Safety and Licensing Board Panel
Mail Stop: T-3F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: amy@nrc.gov

Diane Curran, Esq.*
Harmon, Curran, Spielberg
& Eisenberg, L.L.P.
1726 M Street, NW., Suite 600
Washington, DC 20036
E-mail: dcurran@harmoncurran.com

Administrative Judge*
Nicholas G. Trikouros
Atomic Safety and Licensing Board Panel
Mail Stop: T-3F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: n.trikouros@att.net

Office of Commission Appellate *
Adjudication
Mail Stop: O-16C1
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: OCAAMail@nrc.gov

Office of the Secretary*
Attn: Rulemaking and Adjudications Staff
Mail Stop: O-16C1
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: hearingdocket@nrc.gov

Atomic Safety and Licensing Board***
Mail Stop: T-3 F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Matthew Brock, Esq.*
Assistant Attorney General
Office of the Massachusetts Attorney General
Environmental Protection Division
One Ashburton Place, Room 1813
Boston, MA 02108-1598
E-mail: matthew.brock@ago.state.ma.us

Molly H. Bartlett, Esq.
52 Crooked Lane
Duxbury, MA 02332
E-mail: mollyhbartlett@hotmail.com

Terence A. Burke, Esq.**
Entergy Nuclear
1340 Echelon Parkway
Mail Stop: M-ECH-62
Jackson, MS 39213

David R. Lewis, Esq.
Paul A. Gaukler, Esq.
Pillsbury, Winthrop, Shaw, Pittman, LLP
2300 N Street, NW
Washington, DC 20037-1137
E-mail: david.lewis@pillsburylaw.com
paul.gaukler@pillsburylaw.com

Town Manager
Town on Plymouth
11 Lincoln St.
Plymouth, MA 02360
E-mail: msylvia@townhall.plymouth.ma.us

Sheila Slocum Hollis
Duane Morris LLP
1667 K Street, NW, Suite 700
Washington, DC 20006
E-mail: sshollis@duanemorris.com

Susan L. Uttal
Counsel for the NRC Staff

June 22, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
Entergy Nuclear Generation Company and	)	Docket No. 50-293-LR
Entergy Nuclear Operations, Inc.	)	ASLBP No. 06-848-02-LR
	)	
(Pilgrim Nuclear Power Station)	)	

ENTERGY'S ANSWER TO THE MASSACHUSETTS ATTORNEY GENERAL'S REQUEST FOR A HEARING, PETITION FOR LEAVE TO INTERVENE, AND PETITION FOR BACKFIT ORDER

I. INTRODUCTION

Entergy Nuclear Generation Company and Entergy Nuclear Operations, Inc. (hereinafter collectively referred to as "Entergy") hereby answer and oppose the "Massachusetts Attorney General's Request for a Hearing and Petition for Leave to Intervene With Respect to Entergy Nuclear Operations, Inc.'s Application for Renewal of the Pilgrim Nuclear Power Plant Operating License and Petition for Backfit Order Requiring New Design Features to Protect Against Spent Fuel Pool Accidents" dated May 26, 2006 (the "Petition" or "Pet."). The Petition should be denied because the Attorney General has not proffered an admissible contention. With respect to the Petitioner's request for a backfit order, that request is simply beyond the scope of this proceeding.

II. PROCEDURAL BACKGROUND

Entergy submitted its application, dated January 25, 2006, requesting renewal of Operating License DPR-35 for the Pilgrim Nuclear Power Station (the "Application"). On March 27, 2006, the Nuclear Regulatory Commission ("NRC" or "Commission") published a

Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing ("Notice") regarding Entergy's application. 71 Fed. Reg. 15,222 (Mar. 27, 2006)). The Notice permitted any person whose interest may be affected to file a request for hearing and petition for leave to intervene within 60 days of the notice. Id.

The Notice directs that any petition shall set forth with particularity the interest of the petitioner and how that interest may be affected, and must also set forth the specific contentions sought to be litigated. Id. at 15,222-23. The Notice states:

> Each contention must consist of a specific statement of the issue of law or fact to be raised or controverted. In addition, the requestor/petitioner shall provide a brief explanation of the bases of each contention and a concise statement of the alleged facts or the expert opinion that supports the contention on which the requestor/petitioner intends to rely in proving the contention at the hearing. The requestor/petitioner must also provide references to those specific sources and documents of which the requestor/petitioner is aware and on which the requestor/petitioner intends to rely to establish those facts or expert opinion. The requestor/petitioner must provide sufficient information to show that a genuine dispute exists with the applicant on a material issue of law or fact. Contentions shall be limited to matters within the scope of the action under consideration. The contention must be one that, if proven, would entitle the requestor/petitioner to relief. A requestor/petitioner who fails to satisfy these requirements with respect to at least one contention will not be permitted to participate as a party.

Id. at 15,233 (footnote omitted).

III. STANDING

Entergy does not challenge the Massachusetts Attorney General's standing in this proceeding (see 10 C.F.R. § 2.309(d)(2)) or the Attorney General's right to participate in this proceeding as a representative of an interested State in accordance with 10 C.F.R. § 2.315(c) if a hearing is held. However, to be admitted as a party, the Attorney General must meet the other requirements applicable to a hearing request, including the requirement to propose at least one admissible contention meeting the NRC's pleading standards. 10 C.F.R. § 2.309(d)(2). As

discussed later in this Answer, the sole contention submitted by the Attorney General is not admissible.

IV. STANDARDS FOR ADMISSIBILITY OF CONTENTIONS

A. Contentions Must Be Within the Scope of the Proceeding and May Not Challenge NRC's Rules

As a fundamental requirement, a contention is only admissible if it addresses matters within the scope of the proceeding and does not seek to attack the NRC's regulations governing the proceeding. This fundamental limitation is particularly important in a license renewal proceeding, because the Commission has conducted extensive rulemaking to define and limit the technical and environmental showing that an applicant must make. As discussed later in this Answer, the Attorney General's contention falls beyond the scope of this proceeding.

10 C.F.R. Part 54 governs the health and safety matters that must be considered in a license renewal proceeding. The Commission has specifically limited this safety review to the matters specified in 10 C.F.R. §§ 54.21 and 54.29(a),[1] which focus on the management of aging of certain systems, structures and components, and the review of time-limited aging evaluations. See Florida Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 N.R.C. 3, 7-8 (2004); Duke Energy Corp. (McGuire Nuclear Station, Units 1 and 2), CLI-02-26, 56 N.R.C. 358, 363 (2002). Thus, the potential effect of aging is the issue that essentially defines the scope of license renewal proceedings. Dominion Nuclear Connecticut, Inc. (Millstone Nuclear Power Station, Units 2 and 3), CLI-04-36, 60 N.R.C. 631, 637 (2004).

---

[1] The Commission has stated that the scope of review under its rules determines the scope of admissible issues in a renewal hearing. 60 Fed. Reg. 22,461, 22,482 n.2 (May 8, 1995). "Adjudicatory hearings in individual license renewal proceedings will share the same scope of issues as our NRC Staff review, for our hearing process (like our Staff's review) necessarily examines only the questions our safety rules make pertinent." Turkey Point, CLI-01-17, 54 N.R.C. at 10.

The rules in 10 C.F.R. Part 54 are intended to make license renewal a stable and predictable process. 60 Fed. Reg. at 22,461, 22,462, 22,463, 22,485. As the Commission has explained, "We sought to develop a process that would be both efficient, avoiding duplicative assessments where possible, and effective, allowing the NRC Staff to focus its resources on the most significant safety concerns at issue during the renewal term." Turkey Point, CLI-01-17, 54 N.R.C. at 7 (2001). "License renewal reviews are not intended to 'duplicate the Commission's ongoing reviews of operating reactors.'" Id. (citation omitted). To this end, the Commission has confined 10 C.F.R. Part 54 to those issues uniquely determined to be relevant to the public health and safety during the period of extended operation, leaving all other issues to be addressed by the existing regulatory processes. 60 Fed. Reg. at 22,463. This scope is based on the principle, established in the rulemaking proceedings, that with the exception of the detrimental effects of aging and a few other issues related to safety only during the period of extended operation, the existing regulatory processes are adequate to ensure that the licensing bases of currently-operating plants provide and maintain an adequate level of safety. 60 Fed. Reg. at 22,464, 22,481-82. Consequently, license renewal does not focus on operational issues, because these issues "are effectively addressed and maintained by ongoing agency oversight, review, and enforcement." Millstone, CLI-04-36, 60 N.R.C. at 638 (footnote omitted).

The NRC rules governing environmental matters – which are contained in 10 C.F.R. §§ 51.53(c), 51.95(c), and Appendix B to Part 51 – are similarly intended to produce a more focused and, therefore, more effective review. 61 Fed. Reg. 28,467 (June 5, 1996); Turkey Point, CLI-01-17, 54 N.R.C. at 11. To accomplish this objective, the NRC prepared a comprehensive Generic Environmental Impact Statement ("GEIS") for License Renewal of Nuclear Plants (NUREG-1437) and made generic findings reflected in the GEIS and in

Appendix B to 10 C.F.R. Part 51. Those issues that could be resolved generically for all plants are designated as Category 1 issues and are not evaluated further in a license renewal proceeding (absent waiver or suspension of the rule by the Commission based on new and significant information). 61 Fed. Reg. at 28,468, 28,470, 28,474; Turkey Point, CLI-01-17, 54 N.R.C. at 12. The remaining (i.e., Category 2) issues that must be addressed in an applicant's environmental report are defined specifically in 10 C.F.R. § 51.53(c). See generally, Turkey Point, CLI-01-17, 54 N.R.C. at 11-12.

10 C.F.R. § 2.309(f)(1)(iii)-(iv) requires a petitioner to demonstrate that the issue raised by each of its contentions is within the scope of the proceeding and material to the findings that the NRC must make. Licensing boards "are delegates of the Commission" and, as such, they may "exercise only those powers which the Commission has given [them]." Public Service Co. of Indiana (Marble Hill Nuclear Generating Station, Units 1 and 2), ALAB-316, 3 N.R.C. 167, 170 (1976) (footnote omitted); accord Portland General Electric Co. (Trojan Nuclear Plant), ALAB-534, 9 N.R.C. 287, 289-90 n.6 (1979). Accordingly, it is well established that a contention is not cognizable unless it is material to a matter that falls within the scope of the proceeding for which the licensing board has been delegated jurisdiction. Id.; see also Commonwealth Edison Co. (Zion Station, Units 1 and 2), ALAB-616, 12 N.R.C. 419, 426-27 (1980); Commonwealth Edison Co. (Carroll County Site), ALAB-601, 12 N.R.C. 18, 24 (1980).

It is also well established that a petitioner may not demand an adjudicatory hearing to attack generic NRC requirements or regulations. Duke Energy Corp. (Oconee Nuclear Station, Units 1, 2 and 3), CLI-99-11, 49 N.R.C. 328, 334 (1999). "[A] licensing proceeding . . . is plainly not the proper forum for an attack on applicable statutory requirements or for challenges to the basic structure of the Commission's regulatory process." Philadelphia Electric Co. (Peach

Bottom Atomic Power Station, Units 2 and 3), ALAB-216, 8 A.E.C. 13, 20, aff'd in part on other grounds, CLI-74-32, 8 A.E.C. 217 (1974) (footnote omitted). Thus, a contention which collaterally attacks a Commission rule or regulation is not appropriate for litigation and must be rejected. 10 C.F.R. § 2.335; Potomac Electric Power Co. (Douglas Point Nuclear Generating Station, Units 1 and 2), ALAB-218, 8 A.E.C. 79, 89 (1974). A contention which "advocate[s] stricter requirements than those imposed by the regulations" is "an impermissible collateral attack on the Commission's rules" and must be rejected. Public Service Co. of New Hampshire (Seabrook Station, Units 1 and 2), LBP-82-106, 16 N.R.C. 1649, 1656 (1982); see also Arizona Public Service Co. (Palo Verde Nuclear Generating Station, Units 1, 2, and 3), LBP-91-19, 33 N.R.C. 397, 410, aff'd in part and rev'd in part on other grounds, CLI-91-12, 34 N.R.C. 149 (1991). Likewise, a contention that seeks to litigate a generic determination established by Commission rulemaking is "barred as a matter of law." Pacific Gas & Electric Co. (Diablo Canyon Nuclear Power Plant, Units 1 and 2), LBP-93-1, 37 N.R.C. 5, 30 (1993).

These limitations are very germane to this proceeding in that the scope of admissible environmental contentions is constrained by 10 C.F.R. §§ 51.53(c), 51.95(c), and Appendix B to Part 51; and the scope of technical contentions is constrained by 10 C.F.R. Part 54. See Turkey Point, CLI-01-17, 54 N.R.C. at 5-13. See also Florida Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-00-23, 52 N.R.C. 327, 329 (2000); Baltimore Gas & Electric Co. (Calvert Cliffs Nuclear Power Plant, Units 1 and 2), CLI-98-14, 48 N.R.C. 39, 41 (1998), motion to vacate denied, CLI-98-15, 48 N.R.C. 45, 56 (1998); Duke Energy Corp. (Oconee Nuclear Station, Units 1, 2 and 3), CLI-98-17, 48 N.R.C. 123, 125 (1998).

B. Contentions Must Be Specific and Supported By a Basis Demonstrating a Genuine, Material Dispute

In addition to the requirement to address issues within the scope of the proceeding, a contention is admissible only if it provides:

- a "specific statement of the issue of law or fact to be raised or controverted;"
- a "brief explanation of the basis for the contention;"
- a "concise statement of the alleged facts or expert opinions" supporting the contention together with references to "specific sources and documents on which the requestor/petitioner intends to rely to support its position on the issue;" and
- "[s]ufficient information to show that a genuine dispute exists with the applicant/licensee on a material issue of law or fact," which showing must include "references to specific portions of the application (including the applicant's environmental report and safety report) that the petitioner disputes and the supporting reasons for each dispute, or, if the petitioner believes that the application fails to contain information on a relevant matter as required by law, the identification of each failure and the supporting reasons for the petitioner's belief."

10 C.F.R. § 2.309(f)(1)(i), (ii), (v) and (vi). The failure of a contention to comply with any one of these requirements is grounds for dismissing the contention. Palo Verde, CLI-91-12, 34 N.R.C. at 155-56. As discussed later in this Answer, the Massachusetts Attorney General's sole contention does not comply with these requirements.

These pleading standards governing the admissibility of contentions are the result of a 1989 amendment to 10 C.F.R. § 2.714, now § 2.309, which was intended "to raise the threshold for the admission of contentions." 54 Fed. Reg. 33,168 (Aug. 11, 1989); see also Oconee, CLI-99-11, 49 N.R.C. at 334; Palo Verde, CLI-91-12, 34 N.R.C. at 155-56. The Commission has stated that the "contention rule is strict by design," having been "toughened . . . in 1989 because in prior years 'licensing boards had admitted and litigated numerous contentions that appeared to

be based on little more than speculation.'" Dominion Nuclear Connecticut, Inc. (Millstone Nuclear Power Station, Units 2 and 3), CLI-01-24, 54 N.R.C. 349, 358 (2001) (citation omitted). The pleading standards are to be enforced rigorously. "If any one . . . is not met, a contention must be rejected." Palo Verde, CLI-91-12, 34 N.R.C. at 155 (citation omitted). A licensing board is not to overlook a deficiency in a contention or assume the existence of missing information. Id.

The Commission has explained that this "strict contention rule" serves multiple purposes, which include putting other parties on notice of the specific grievances and assuring that full adjudicatory hearings are triggered only by those able to proffer at least some minimal factual and legal foundation in support of their contentions. Oconee, CLI-99-11, 49 N.R.C. at 334. By raising the threshold for admission of contentions, the NRC intended to obviate lengthy hearing delays caused in the past by poorly defined or supported contentions. Id. As the Commission reiterated in incorporating these same standards into the new Part 2 rules, "[t]he threshold standard is necessary to ensure that hearings cover only genuine and pertinent issues of concern and that issues are framed and supported concisely enough at the outset to ensure that the proceedings are effective and focused on real, concrete issues." 69 Fed. Reg. at 2,189-90.

Under these standards, a petitioner is obligated "to provide the [technical] analyses and expert opinion" or other information "showing why its bases support its contention." Georgia Institute of Technology (Georgia Tech Research Reactor, Atlanta, Georgia), LBP-95-6, 41 N.R.C. 281, 305, vacated in part and remanded on other grounds, CLI-95-10, 42 N.R.C. 1, aff'd in part, CLI-95-12, 42 N.R.C. 111 (1995). Where a petitioner has failed to do so, "the [Licensing] Board may not make factual inferences on [the] petitioner's behalf." Id., citing Palo Verde, CLI-91-12, 34 N.R.C. 149. See also Private Fuel Storage, L.L.C. (Independent Spent

Fuel Storage Installation), LBP-98-7, 47 N.R.C. 142, 180 (1998) (a "bald assertion that a matter ought to be considered or that a factual dispute exists . . . is not sufficient"; rather "a petitioner must provide documents or other factual information or expert opinion" to support a contention's "proffered bases") (citations omitted).

Further, admissible contentions "must explain, with specificity, particular safety or legal reasons requiring rejection of the contested [application]." Millstone, CLI-01-24, 54 N.R.C. at 359-60. In particular, this explanation must demonstrate that the contention is "material" to the NRC's findings and that a genuine dispute on a material issue of law or fact exists. 10 C.F.R. § 2.309(f)(1)(iv), (vi) (emphasis added). The Commission has defined a "material" issue as meaning one where "resolution of the dispute would make a difference in the outcome of the licensing proceeding." 54 Fed. Reg. at 33,172 (emphasis added).

As observed by the Commission, this threshold requirement is consistent with judicial decisions, such as Conn. Bankers Ass'n v. Bd. of Governors, 627 F.2d 245, 251 (D.C. Cir. 1980), which held that:

> [A] protestant does not become entitled to an evidentiary hearing merely on request, or on a bald or conclusory allegation that . . . a dispute exists. The protestant must make a minimal showing that material facts are in dispute, thereby demonstrating that an "inquiry in depth" is appropriate.

Id. (footnote omitted); see also Calvert Cliffs, CLI-98-14, 48 N.R.C. at 41 ("It is the responsibility of the Petitioner to provide the necessary information to satisfy the basis requirement for the admission of its contentions . . . ."). A contention, therefore, is not to be admitted "where an intervenor has no facts to support its position and where the intervenor contemplates using discovery or cross-examination as a fishing expedition which might produce

relevant supporting facts." 54 Fed. Reg. at 33,171.[2] As the Commission has emphasized, the contention rule bars contentions where petitioners have what amounts only to generalized suspicions, hoping to substantiate them later, or simply a desire for more time and more information in order to identify a genuine material dispute for litigation. Duke Energy Corp. (McGuire Nuclear Station, Units 1 and 2), CLI-03-17, 58 N.R.C. 419, 424 (2003).

Therefore, under the Rules of Practice, a statement "that simply alleges that some matter ought to be considered" does not provide a sufficient basis for a contention. Sacramento Municipal Utility District (Rancho Seco Nuclear Generating Station), LBP-93-23, 38 N.R.C. 200, 246 (1993), review declined, CLI-94-2, 39 N.R.C. 91 (1994). Similarly, a mere reference to documents does not provide an adequate basis for a contention. Baltimore Gas & Electric Co. (Calvert Cliffs Nuclear Power Plant, Units 1 and 2), CLI-98-25, 48 N.R.C. 325, 348 (1998).

Rather, NRC's pleading standards require a petitioner to read the pertinent portions of the license application, including the safety analysis report and the environmental report, state the applicant's position and the petitioner's opposing view, and explain why it has a disagreement with the applicant. 54 Fed. Reg. at 33,170; Millstone, CLI-01-24, 54 N.R.C. at 358. If the petitioner does not believe these materials address a relevant issue, the petitioner is "to explain why the application is deficient." 54 Fed. Reg. at 33,170; Palo Verde, CLI-91-12, 34 N.R.C. at 156. A contention that does not directly controvert a position taken by the applicant in the license application is subject to dismissal. See Texas Utilities Electric Co. (Comanche Peak

---

[2] See also Duke Power Co. (Catawba Nuclear Station, Units 1 and 2), ALAB-687, 16 N.R.C. 460, 468 (1982), vacated in part on other grounds, CLI-83-19, 17 N.R.C. 1041 (1983) ("[A]n intervention petitioner has an ironclad obligation to examine the publicly available documentary material pertaining to the facility in question with sufficient care to enable [the petitioner] to uncover any information that could serve as the foundation for a specific contention. Stated otherwise, neither Section 189a. of the Act nor Section 2.714 [now 2.309] of the Rules of Practice permits the filing of a vague, unparticularized contention, followed by an endeavor to flesh it out through discovery against the applicant or staff.").

Steam Electric Station, Unit 2), LBP-92-37, 36 N.R.C. 370, 384 (1992). Furthermore, an allegation that some aspect of a license application is "inadequate" or "unacceptable" does not give rise to a genuine dispute unless it is supported by facts and a reasoned statement of why the application is unacceptable in some material respect. Florida Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 and 4), LBP-90-16, 31 N.R.C. 509, 521 & n.12 (1990).

V. THE ATTORNEY GENERAL'S CONTENTION DOES NOT MEET THE STANDARDS FOR ADMISSION

The Attorney General's sole contention ("Contention"), which alleges that the Environmental Report is inadequate because it "does not address the environmental impacts of severe spent fuel pool accidents" (Pet. at 21), is inadmissible because issues associated with the environmental impacts of spent fuel storage, including accident risk and mitigation, are Category 1 issues beyond the scope of this proceeding. The Contention is also inadmissible because it provides no basis demonstrating that the generic findings relating to spent fuel are inapplicable in this proceeding and because it seeks to raise issues concerning the current licensing basis for spent fuel pool storage at Pilgrim that are beyond the scope of this proceeding.

Management of on-site spent fuel is a Category 1 environmental issue, based on the generic finding that "the expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available." 10 C.F.R. Part 51, App. B, Table B-1. As the Commission has held,

> The GEIS's finding encompasses spent fuel accident risks and their mitigation. See GEIS at xlviii, 6-72 to 6-76, 6-86, and 6-92. The NRC has spent years studying in great detail the risks and consequences of potential spent fuel pool accidents, and the GEIS analysis is rooted in these earlier studies. NRC studies and the agency's operational experience support the conclusion that onsite reactor spent fuel storage, which has continued for decades, presents no undue risk to

> public health and safety. Because the GEIS analysis of onsite fuel storage encompasses the risk of accidents, [a contention seeking to raise spent fuel accidents in a license renewal proceeding] falls beyond the scope of individual license renewal proceedings.

Turkey Point, CLI-01-17, 54 N.R.C. at 21.[3]

The analysis in the GEIS includes a finding that "even under the worst probable cause of a loss of spent-fuel pool coolant (a severe seismic-generated accident causing a catastrophic failure of the pool), the likelihood of a fuel-cladding fire is highly remote." GEIS at 6-72 – 6-75 (citation omitted).[4] It is well established that under NEPA's rule of reason, agencies are not required to probe remote or speculative consequences or discuss every conceivable alternative to a proposed action. See, e.g., NRDC v. Morton, 458 F.2d 827, 837 (D.C. Cir. 1972). In particular, NEPA does not require consideration of accidents that are remote and speculative. San Luis Obispo Mothers for Peace v. NRC, 751 F.2d 1287, 1300-01 (D.C. Cir. 1984), aff'd on

---

[3] The Commission went on to emphasize that the GEIS covered mitigation of accidents as well as their environmental impacts:

> [T]he GEIS deals with spent fuel storage risks (including accidents) generically, and concludes that "regulatory requirements already in place provide adequate mitigation."

Id. at 21-22 (citations omitted).

[4] The GEIS's determination that the occurrence of a zirconium spent fuel pool fire is "highly remote" (GEIS at 6-72 – 6-75) references the Commission's 1990 Review and Revision of the Waste Confidence Decision (55 Fed. Reg. 38,474 (Sept. 18 1990)). In its Waste Confidence Decision, the Commission determined that "even if the timing of a spent fuel pool failure were conducive to fire," the likelihood of such a fire would be "extremely rare." 55 Fed. Reg. 38,481 (emphasis added). The Commission reasoned as follows:

> [E]ven if the timing of a spent fuel pool failure were conducive to fire, a fire could occur only with a relatively sudden and substantial loss of coolant – a loss great enough to uncover all or most of the fuel, damaging enough to admit enough air to keep a large fire going, and sudden enough to deny operators the time to restore the pool to a safe condition. Such a severe loss of cooling water is likely to result only from an earthquake well beyond the conservatively estimated earthquake for which reactors are designed. Earthquakes of that magnitude are extremely rare.
>
> The plant specific studies . . . found that, because of the large safety margins inherent in the design and construction of their spent fuel pools, even the more vulnerable older reactors could safely withstand earthquakes several times more severe than their design basis earthquake. Factoring in the annual probability of such beyond-design-basis earthquakes, . . . the average annual probability of a major spent fuel pool fuel pool failure at an operating reactor . . . was calculated at two chances in a million per year of reactor operation.

Id. (emphasis added) (citations omitted).

rehearing en banc, 789 F.2d 26 (D.C. Cir.), cert. denied, 479 U.S. 923 (1986); Carolina Envtl. Study Group v. U.S., 510 F.2d 796, 798-800 (D.C. Cir. 1975).

Consequently, the Contention's assertion that the Environmental Report is inadequate because it fails to address the environmental impacts of severe spent fuel accidents (Pet. at 21) is a direct challenge to the generic finding that is codified in Table B-1 of Part 51, as well as to 10 C.F.R. §§ 51.53(c) and 51.95(c), which do not require analysis of Category 1 issues. Because the NRC's rules may not be challenged in individual licensing proceedings (10 C.F.R. § 2.335(a)), this claim is inadmissible.

Furthermore, the Contention's claim that consideration of the environmental impacts of severe spent fuel pool accidents is necessary because of new information (see, e.g., Pet. at 22) does not bring this Category 1 issue within the scope of the proceeding. As an NRC rule, the Category 1 findings in 10 C.F.R. Part 51, Appendix B, Table B-1 are not subject to attack by any means in this proceeding. 10 C.F.R. § 2.335(a). Therefore, if a person believes that there is new and significant information that would alter a Category 1 finding, it should a petition for waiver or rulemaking. As the Commission has stated:

> The Commission recognizes that even generic findings sometimes need revisiting in particular contexts. Our rules thus provide a number of opportunities for individuals to alert the Commission to new and significant information that might render a generic finding invalid either with respect to all nuclear power plants or for one plant in particular. In the hearing process, petitioners with new information showing that a generic rule would not serve its purpose at a particular plant may seek a waiver of the rule. See 10 C.F.R. § [2.335] . . . Petitioners with evidence that a generic finding is incorrect for all plants may petition the Commission to initiate a fresh rulemaking.

Turkey Point, supra, CLI-01-17, 54 N.R.C. at 12 (emphasis added). As explained when this requirement was first proposed,

> Litigation of environmental issues in a hearing will be limited to unbounded category 2 and category 3 issues unless the rule is suspended or waived.

SECY-93-032, 10 C.F.R. Part 51 Rulemaking on Environmental Review for Renewal of Nuclear Power Plant Operating Licenses (Feb. 9, 1993) at 4. The final rule subsequently combined Category 2 and 3 issues (61 Fed. Reg. at 28,474), but made no changes that would alter the treatment of Category 1 issues. Thus, a petitioner who wishes to litigate a Category 1 issue must submit a petition for waiver, pursuant to 10 C.F.R. § 2.335.

Further, the information to which the Contention refers is not new and significant, and therefore would not serve as a basis to waive the Category 1 findings even if the Massachusetts Attorney General had properly submitted a waiver petition. The Contention refers to NUREG-1738,[5] a report by the National Academy of Sciences concerning spent nuclear fuel storage,[6] and the reports of Drs. Gordon Thompson[7] and Jan Beyea[8] supporting the Contention. Pet. at 22, 24, 30. None of these sources contain new and significant information that mandate the NRC to reconsider its GEIS findings regarding spent fuel storage, nor provides the basis for an admissible contention.

NUREG-1738 considered the potential of spent fuel pool fires in the context of plants undergoing decommissioning (which lack many of the functioning safety systems of an operating nuclear power plant). While NUREG-1738 provided additional information on the

---

[5] NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk and Decommissioning Nuclear Power Plants" (Jan. 2001) ("NUREG-1738").

[6] National Academy of Sciences Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, "Safety and Security of Commercial Spent Nuclear Fuel Storage" (The National Academies Press: 2006) ("NAS Rept.").

[7] Gordon R. Thompson, "Risks and Risk-Reducing Options Associated with Pool Storage of Spent Nuclear Fuel at the Pilgrim and Vermont Yankee Nuclear Power Plants" (May 25, 2006) ("Thompson Rept.").

[8] Jan Beyea, "Report to the Massachusetts Attorney General on the Potential Consequences of a Spent-Fuel-Pool Fire at the Pilgrim or Vermont Yankee Nuclear Power Plant" (May 25, 2006) ("Beyea Rept.").

potential for spent fuel pool fires, the Attorney General's claim that NUREG-1738 undercuts the rationale of the license renewal GEIS (e.g., Pet. at 30-31) is not supported by that document. None of the information presented in NUREG-1738 controverts the conclusion in the GEIS that the occurrence of a zirconium spent fuel pool fire is "highly remote." See GEIS at 6-72 – 6-75. To the contrary, even after considering the partial drainage and obstructed air flow scenario cited by Dr. Thompson (e.g., NUREG-1738 at A1A-4), NUREG 1738 ultimately concludes that there is a "very low likelihood" of a zirconium pool fire (NUREG-1738 at vii, x, 5-1 and 5-3; emphasis added) – a conclusion that parallels and reconfirms the conclusion of the GEIS that the likelihood of a fuel cladding fire is "highly remote" (GEIS at 6-72 – 6-75).[9]

Likewise the Contention's claim that the 1990 Waste Confidence Decision rulemaking "ignored the risk of pool fires" (Pet. at 27-28) (emphasis added) is patently wrong. Plainly, the Commission considered the risk of pool fires in its Waste Confidence Decision as is evident from the quotation in note 4 supra.[10] Such mischaracterization of a document provides no basis

---

[9] The Attorney General's claim that in NUREG 1738 the Staff concluded that "regardless of the age of the fuel in a pool, the fuel will burn shortly after the tops of the fuel assemblies are uncovered" (Pet. at 31 (emphasis added)), misstates the NUREG's conclusion. Rather, the NUREG's conclusion was that, because of the different variables involved, the possibility of a " a zirconium fire cannot be precluded" based solely on the decay time of the fuel. NUREG 1738 at 2-1 – 2-2 (emphasis added). Moreover, the claim that NUREG-1738 presented new and significant information concerning the likelihood that uncovered fuel would ignite and burn (Pet. at 31) ignores the Commission's determination in the Waste Confidence Decision (quoted in note 4, supra) that the likelihood of a spent fuel pool fire is highly remote even assuming the timing of pool failure were conducive to fire initiation. In this respect, the average annual probability of a major spent fuel pool fuel pool failure at an operating reactor referred to by the Commission (in the quotation in note 4, supra) assumed a conditional probability of a Zircaloy cladding fire of "1.0 for PWRs and 0.25 for BWRs" for "high density configurations" of spent fuel storage. NUREG-1353, Regulatory Analysis for the Resolution of Generic Issue) 82, "Beyond Design Basis Accidents in Spent Fuel Pools" (April 1989) ("NUREG-1353") at ES-2 and 4-10. The difference between the conditional probabilities for PWRs and BWRs was based on studies that determined significantly lower probabilities for zirconium oxidation for BWR spent fuel than for PWR spent fuel because of the significantly lower decay power for BWR spent fuels and differences in PWR and BWR spent fuel storage configurations. See NUREG-1353 at 4-8 – 4-11.

[10] The Contention (Pet. at 28 n.10) and the Thompson Report (at 16-17) also claim that the technical studies relied upon by the Commission in the Waste Confidence Decision considered only an "instantaneous loss of water from the pool" rather than a partial loss of cooling water. That is not the case (see NUREG-1353 at 4-13 – 4-36), but in any event, as discussed above, NUREG-1738 explicitly considered partial drainage of the pool (as

Footnote continued on next page

for an admissible contention. See, e.g., Philadelphia Electric Co (Limerick Generating Station, Units 1 and2), ALAB-804, 21 N.R.C. 587, 593 (because cited document "does not support the point for which it is urged," the contention lacks a "cognizable basis"); Dominion Nuclear North Anna, LLC (Early Site Permit for North Anna ESP Site), LBP-04-18, 60 N.R.C. 253, 265 (2004) (documents provided in support of a contention "will be carefully examined by the Board" to determine whether they "supply an adequate basis for the contention").

Similarly, the NAS Report does not provides significant new information mandating the Commission to reconsider its license renewal GEIS.[11] The NAS Report focused on terrorist attacks potentially causing a severe spent fuel accident. As discussed below, the Commission has ruled that NEPA imposes no legal duty on the NRC to consider intentional malevolent acts, and thus the subject of the NAS Report is beyond the scope of this license renewal proceeding. Moreover, the NRC has carefully evaluated the NAS Report, and has acted on the Report's Findings and Recommendations as it deemed appropriate. Most relevant to the issue here, the NRC has concluded, after reviewing the information in the NAS Report, that it continues to generally consider "the likelihood of a zirconium fire capable of causing large releases of radiation into the environment to be extremely low."[12] Thus, the NRC has fully considered the

---

Footnote continued from previous page

acknowledged by the Contention, e.g., Thompson Rept. at 12) and still reached a conclusion identical to that reached in the Waste Confidence Decision, that a zirconium cladding fire is highly remote.

[11] The Contention (Pet. at 31-32) quotes the NAS Report's summary of the results of various analyses reviewed by the NAS. However, as stated in the NAS Report, the series of studies that it reviewed, dating back to 1979 (and including the technical studies underlying the Commission's Waste Confidence Decision), "[a]ll . . . suggest that a loss-of-pool-coolant event could trigger a zirconium cladding fire in the exposed spent fuel." NAS Rept. at 44. Thus, the fact that a loss-of-pool-coolant event could trigger a zirconium cladding fire in the exposed fuel is plainly not new information, and as noted above, was fully considered in the NRC's Waste Confidence Decision which underlies the license renewal GEIS.

[12] "U.S. Nuclear Regulatory Commission Report to Congress on the National Academy of Sciences Study on the Safety and Security of Commercial Spent Nuclear Fuel Storage" ((Mar. 2005), at 21. ("NRC Rept. on NAS Study") The NRC noted that the NRC had in a "February 2002 Order "required licensees to develop specific

Footnote continued on next page

NAS report and found no basis, even in the context of a terrorist attack, to change its conclusion regarding the risks of spent fuel pool fires stated in the GEIS.

The Thompson and Beyea reports repeat arguments that were made in a 2003 paper by Alvarez, et al. (referenced in Thompson Report at 12 and Beyea Report at 3). This article has, however, already been reviewed by the NRC and found to suffer from excessive conservatisms, with the result that its recommendations do not have a sound technical basis. COMSECY-03-0019, Review of the Paper "Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States," Robert Alvarez et. al., January 31, 2003 (To Be Published in Science and Global Security), Aug. 7, 2003, Adams Accession No. ML052340740. No new substantive information responding to the deficiencies identified by the NRC in the Alvarez paper is provided in the Contention or its supporting papers.

For example, the NRC concluded that the Alvarez paper provided "no justification for the postulated probabilities of worst case spent fuel pool damage." The paper offered no "probabilistic analysis of the likelihood" of a terrorist attack, or any other event, leading to severe damage of a spent fuel pool and its fuel, but rather merely postulated such probabilities

---

Footnote continued from previous page

guidance and strategies to maintain or restore [spent fuel pool] cooling capabilities" in "circumstances associated with the loss of large areas of the plant due to large fires and explosions" and that in a July 2004 letter the NRC directed licensees "to implement additional 'spent fuel mitigative measures,' as appropriate," including "reconfiguration" of the fuel as recommended by the NAS Study. Id. at 6, 17, 21. The cover letter from Nils J. Diaz, Chairman of the NRC, to Senator Domenici, Chairman, Subcommittee on Energy and Water Development, Committee on Appropriations, United States Senate (Mar. 14, 2005) ("Diaz Letter"), forwarding the NAS Report, similarly describes, at page 2 of the letter, the "numerous actions" taken "to enhance the security of spent nuclear fuel."

The cover letter from Chairman Diaz to Senator Domenici also noted that, while agreeing with many points raised by the NAS, the NRC believes that, "based on information developed in NRC vulnerability assessments," "some scenarios" identified by the NAS report "are unreasonable." Diaz Letter at 1. Chairman Diaz further stated that the NRC "disagreed with some NAS recommendations" because "they lacked a sound technical basis," including in particular the "NAS finding that earlier movement of spent fuel from pools into dry storage would be prudent." Id.

which were claimed to justify moving the spent fuel to dry cask storage. COMSECY-03-0019, Attachment at 2-4. Dr. Thompson's Report provides no new substantive information regarding the probability of a worst case spent fuel damage scenario involving a terrorist attack. Indeed, the report states that the "record of experience does not allow a statistically valid estimate of this probability." Thompson Rept. at 26. Rather, it claims, without any factual support or explication, that "prudent judgment indicates that a probability of at least one per century is a reasonable assumption for policy purposes." Id. This is the same sophistry that NRC rejected as meaningless in COMSECY-03-0019. See COMSECY-03-0019, Attachment at 2-4. Such speculation provides neither new and significant information requiring the NRC to reconsider its GEIS findings regarding spent fuel storage, nor supports an admissible contention.

Similarly, the Thompson Report provides no new or significant information regarding non-terrorist events. The report alleges that "non-malicious events that could lead to pool fire" at Pilgrim include "(i) an accidental aircraft impact, with or without an accompanying fuel-air explosion or fire; (ii) an earthquake; (iii) dropping of a fuel transfer cask or shipping cask; (iv) a fire inside or outside the plant building; and (v) a severe accident at the adjacent reactor" (Thompson Rept. at 18), but provides no basis indicating that any of these scenarios is sufficiently probable to warrant consideration under NEPA.

With respect to the first four scenarios, the Thompson Report provides no estimated probability of occurrence nor any factual basis whatsoever from which even a probability of occurrence could be inferred. The necessary sequence of events by which such scenarios might lead to spent fuel pool fires is not identified, nor is there any discussion of the probability of their occurrence.

Such broad, unsupported claims do not provide the necessary requisite factual basis for an admissible contention, much less provide new information necessary to trigger the NRC's reconsideration of the GEIS conclusions regarding spent fuel storage. See Carolina Power & Light Co. (Shearon Harris Nuclear Power Plant), CLI-01-11, 53 N.R.C. 370, 390 (2001) ("vague references to potential spent fuel catastrophes" do not constitute an admissible contention), affirming Carolina Power & Light Co. (Shearon Harris Nuclear Power Plant), LBP-00-19, 52 N.R.C. 85 (2000). For example, neither the sequence of events by which the dropping of a fuel transfer cask or shipping cask might lead to a spent fuel pool fire nor the likelihood of occurrence of such an accident scenario is discussed in the Contention and its supporting documents. Nor is mention made of the precautions taken at Pilgrim to minimize the possibility of a dropped cask, nor of the energy absorbing system included in the cask handling area of the spent fuel pool which ensures that damage to the spent fuel pool from a dropped cask "will not result in a leakage rate greater than the pool makeup capability." PNPS Updated Safety Analysis Report ("UFSAR") at 10.3-7.

Likewise, with respect to earthquakes, the report simply suggests – without any factual explication of a sequence or probability – that a severe earthquake that damages the reactor and its supporting systems and causes a core-melt accident "could cause leakage of water from the pool" (Thompson Rept. at 19). The Thompson Report provides no basis to assume that the probability of a seismic event causing a catastrophic failure and drainage of the steel-lined, seismic category 1 spent fuel pool (Application at 2.4-3 – 2.4-4; UFSAR at § 10.3) is the same as the probability of a seismic event causing core damage. The Thompson Report totally ignores the wholly different nature of the structures (e.g., the thick spent fuel pool walls and floor) and

systems involved.[13] Similarly, no factual explication is provided of a sequence or likelihood of a potential accident scenario involving accidental aircraft crash impacts or fires inside or outside the plant.[14] Such vague, unsupported assertions provide no basis for an admissible contention, much less a basis for the NRC to reconsider its GEIS findings regarding spent fuel storage. See, e.g., Shearon Harris, supra, CLI-01-11, 53 N.R.C. at 390 ("vague references to potential spent fuel catastrophes" do not constitute an admissible contention); Georgia Tech, supra, LBP-95-6, 41 N.R.C. at 305 (a petitioner is obligated "to provide the [technical] analyses and expert opinion" or other information "showing why its bases support its contention").

With respect to the allegation that "a severe accident at the adjacent reactor" would cause a spent fuel pool fire, the Thompson Report again fails to provide any meaningful information indicating that this scenario is sufficiently probable to warrant further analysis under NEPA, or that it would change the GEIS conclusions regarding spent fuel storage. The Thompson Report merely "assumes that the conditional probability of a spent-fuel-pool fire, given an early release from the adjacent reactor, is 50 percent" and provides no real basis for this speculation Thompson Rept. at 20 (emphasis added). The Thompson Report asserts that "[s]upport for this assumption is provided by technical studies and opinions submitted to the Atomic Safety and Licensing Board (ASLB) in a license-amendment proceeding in regard to the expansion of spent-

[13] The Commission in the Waste Confidence Decision found that "because of the large safety margins in the design and construction of their spent fuel pools," spent fuel pools could safely withstand earthquakes "several times more severe" than the plant's design basis earthquake. See note 4, supra.

[14] With respect to aircraft crashes, in plant licensing the likelihood of an aircraft impacting the site would have been determined to be less than 1 E-7. See NUREG-0800, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, §§ 2.2.3 & 3.5.1.6. Thus, even without considering the likelihood of occurrence of subsequent events that would be necessary for an aircraft crash to cause a spent fuel pool fire, the likelihood of a spent fuel fire caused by aircraft crashes would be considered remote and speculative for purposes of NEPA. See Carolina Power & Light Co. (Shearon Harris Nuclear Power Plant), LBP-01-9, 53 N.R.C. 239, 268 (2001) (an event with probability of occurrence of 2.0E-07 determined to be remote and speculative); CLI-01-11, 53 N.R.C. at 388 n. 8 (although "Commission has never determined a threshold accident probability figure for imposing the requirement of preparing an EIS," 2.0E-07 is below any such threshold).

fuel-pool capacity at the Harris nuclear power plant," and alleges that "[a]ll three parties to the proceeding – the NRC Staff, Carolina Power & Light, and Orange County – reached the same conclusion on an issue" relevant to the appropriateness of a conditional probability of 50 percent for Pilgrim. Id. (emphasis added). However, the Thompson Report provides no citation to any such support. Moreover, it is clear from the published decisions in the Shearon Harris spent fuel proceeding that Thompson's characterization of the parties' positions and the related findings of the Harris licensing board is inaccurate. No support for such a 50% conditional probability is found in either the Harris licensing board's decision or the technical position of the parties described in that decision.

As reflected in Harris, the accident scenario alleged in the Thompson Report of a reactor severe accident causing spent fuel pool fire involves consideration of the probability of a sequence of seven events:[15]

- (1) a degraded core accident;
- (2) containment failure or bypass;
- (3) loss of all spent fuel cooling and makeup systems;
- (4) extreme radiation doses precluding personnel access;
- (5) inability to restart any pool cooling or makeup systems due to extreme radiation doses;
- (6) loss of most or all pool water; and
- (7) initiation of exothermic oxidation reaction in the spent fuel pool.

Shearon Harris, supra, LBP-01-09, 53 N.R.C. at 244-45. The Thompson Report does not address the probability of each of these events at Pilgrim, but instead simply assumes a conditional

[15] Four plants had originally been planned for the Harris site, and accordingly, the fuel handling building had been constructed with four spent fuel pools. Initially, only two of the spent fuel pools were utilized to support the single unit at Harris, but in December 1998, CP&L filed an application for a license amendment to increase the spent fuel storage capacity at the plant by adding spent fuel racks and utilizing the two previously inactive spent fuel pools, which triggered the licensing proceeding discussed above. Shearon Harris, supra, LBP-01-09, 53 N.R.C. at 242.

probability of 50% for steps 3 through 7 for Pilgrim. As reflected in the licensing board's decision in the Harris proceeding, nowhere did the NRC Staff, CP&L, nor the licensing board itself, conclude that the conditional probability of a spent fuel pool fire was 50% given a severe accident causing the release of radioactivity from the reactor.

Performing a probabilistic risk analysis ("PRA"), CP&L calculated a probability of 7.7 E-06 through step 2 (release of radioactivity into the environment) and an overall probability for a spent fuel fire of 2.78 E-08. LBP-01-9, 53 N.R.C. at 267. This is a factor of more than 35 lower than the release of radioactivity, or in other words, a conditional probability of less than 3% that a severe reactor accident releasing radioactivity would trigger a spent fuel pool fire. The Staff calculated the probability of a significant release (through step 2) to be 1.2 E-05 and an overall probability of a spent fuel fire to be 2.0 E-07. Id. at 254, 256-57, 267. This is a factor of more than 166 lower than the release of radioactivity, or in other words a conditional probability of less than 1% that a severe reactor accident releasing radioactivity would trigger a spent fuel pool fire.[16] The Harris licensing board found the Staff's estimates to be reasonable and supported by the more detailed PRA analysis performed by CP&L and found that the probability of the postulated sequence of events resulting in a spent fuel pool fire was "conservatively in the range described by the Staff: 2.0 E-07 per reactor year. . . , or less." Id. at 267 (emphasis added).

Based on this testimony, the licensing board in Harris held that the accident scenario alleged by Dr. Thompson was properly characterized as "remote and speculative" and therefore did not have to be considered in an environmental impact statement. Id. at 271. Thus, the Harris

[16] In contrast, the intervenor – based on analysis and report provided by the same Dr. Thompson – calculated the probability of a significant release of probability (through step 2) to be 1.6 E-05 and an overall probability of a spent fuel fire to be the same, 1.6 E-05, for a conditional probability of 1.0. LBP-01-9, 53 N.R.C. at 267.

proceeding does not support the Attorney General's assertion that the probability of this accident falls within the range that the NRC considers reasonably foreseeable (see Pet. at 3).

Moreover, several factors underlying the probabilities calculated by the Staff and CP&L, and affirmed by the Harris licensing board, directly contradict unsupported assertions in the Thompson Report. First, contrary to Dr. Thompson's bald claim of 100% certainty that spent fuel cooling would be lost as a result of a degraded core accident and containment failure, the Harris licensing board found, based on persuasive analysis by the Staff, that loss of spent fuel cooling was dominated by a loss of offsite power and "that there are only limited circumstances after containment failure in which cooling would be lost." Id. at 257-58 (emphasis added). Second, analysis by both the Staff and CP&L showed that it would take in the range of at least 10 days without spent fuel cooling before the water in any of the pools would boil off "so as to lower the water level to the top of the fuel storage racks such that makeup" water would be required, and that within this period of time there was a "high" likelihood of success in providing the necessary makeup water to the spent fuel pools. Id. at 262, 264 (emphasis added).[17]

In short, the claim that support for a conditional probability of 50% for a spent fuel pool fire given an accident causing a radiological release from the Pilgrim reactor is found in the Harris proceeding is a mischaracterization of that proceeding. On their face, the findings and conclusions of the Harris licensing board belie this claim. It is well established that mischaracterization of the findings or conclusions of a document cannot support the admission of a contention. See, e.g., Limerick, supra, ALAB-804, 21 N.R.C. at 593-94 (because the cited

[17] CP&L determined that at least one makeup water lineup was possible with 4 days for all accident-initiating sequences of postulated core damage accident and the Staff conservatively assigned a "conservative probability of 0.1 (10%)" that restoring spent fuel cooling would not be successful. Id.

document "does not support the point for which it is urged," the contention lacks a "cognizable basis") Thus, at bottom, the claim of a conditional probability of 50% for a spent fuel pool fire given an accident causing a radiological release from the Pilgrim reactor is based on the mere speculation of Dr. Thompson, a person with "little experience in the actual operation of a nuclear power plant or in PRA[s]." Shearon Harris, supra, LBP-01-9, 53 N.R.C. at 251. Such speculation does not provide the basis for an admissible contention, much less new information for the NRC to reconsider its GEIS findings regarding spent fuel storage.

Likewise, the Contention and the supporting documents provide no new information to ameliorate what COMSECY-03-0019 considered to be the unrealistic and excessive conservatisms regarding the overestimation of radiation release and overestimation of societal costs associated with a severe spent fuel accident. See COMSECY-03-0019, Attachment at 4-5. The report by Dr. Beyea supplied on these topics uses the same "methodologies outlined" in the Alvarez Report and the 2004 addendum to that Report. Beyea Rept. at 3. The Beyea Report continues to assume releases of 10% and 100% of the spent fuel pool cesium inventory (id. at 9-10) even though such releases, particularly anything approaching 100%, is wholly unrealistic. COMSECY-03-0019, Attachment at 4. Also, an example of the excess conservatisms employed in the calculation of societal damages is the Beyea Report's assumption of a 5% loss in property value for properties extending out 1000 miles from the plant. Beyea Rept. at 9-10. As would be expected, this unsupported and unrealistic assumption, which in essence posits property damage to nearly one-third of the nation, results in estimates of hundreds of billions of dollars of damage. Id. Similarly, the Beyea Report's projection of thousands of cancer deaths appears to be based on contamination affecting a population within a 1000-mile radius (see Beyea Rept. at 30-33), and relies on the remarkable assumption that resuspended radioactivity would cause more

cancers than the remediated plume (see id. at 24). Further, Dr. Beyea advocates a supra-linear dose-response curve – a position that is not supported by any recognized advisory authority (e.g., BEIR, NCRP, ICRP, UNSCEAR, NRC, or EPA). In short, the Beyea Report does not provide a reliable, credible assessment of consequences and thus provides no basis to support a re-examination of the risk of spent fuel pool fires. It is well established that NEPA does not require "worst-case analyses" such as those presented in the Beyea Report,[18] and no new information is provided therein that would mandate the NRC's reconsideration of its GEIS findings regarding spent fuel storage.

In summary, the Attorney General's Contention is not supported by any credible basis establishing the probability of a spent fuel pool fire or demonstrating that it is sufficiently foreseeable to warrant consideration under NEPA. Further, the Attorney General's Contention is not supported by any credible discussion of the consequences of such an accident. As a result, the Contention provides no basis to suggest that there is a risk warranting further consideration or mitigation.

Further, while the Contention and it supporting materials give passing reference to non-malicious events that allegedly could lead to spent pool fires, the Contention's focus is clearly on loss of cooling water caused by terrorist acts. See Pet. at 33-47. The Commission has ruled, however, that "NEPA imposes no legal duty on the NRC to consider intentional malevolent acts, such as [the September 11, 2001 attacks] on a case-by-case basis in conjunction with commercial

[18] Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 354-56 (1989). In that case, the Supreme Court clearly enunciated that NEPA does not require a "worst case analysis" because, among other reasons, worst case analyses would "distort[] the [NEPA] decisionmaking process by overemphasizing highly speculative harms." Id. at 356 (emphasis added). The legal precedent of the Supreme Court's decision in Robertson has been subsequently and repeatedly followed. See, e.g., Edwardsen v. U.S. Dep't of Interior, 268 F.3d 781, 785 (9th Cir. 2001) ("an EIS need not include a worst-case scenario").

power reactor license renewal applications." McGuire, supra, CLI-02-26, 56 N.R.C. at 365 (footnote omitted).

The Attorney General argues that the NRC rationale in excluding consideration of terrorism is not supported, and advances a number of arguments that were recently briefed before the U.S. Court of Appeals for the Ninth Circuit in a proceeding involving the licensing of an independent spent fuel storage installation at the Diablo Canyon Power Station. See Pet. at 42-47. On reply, the Attorney General will no doubt point out that the Ninth Circuit has now held that the NRC should have considered the effects of terrorism in its environmental assessment in that proceeding. San Luis Obispo Mothers for Peace v. NRC, No. 03-74628, slip op. (9th Cir. June 2, 2006). The Court, however, has not yet issued its mandate,[19] so this decision currently has no effect. Even if this decision becomes effective, it would not affect license renewal proceedings, because the Commission has held:

> Even if we were required by law to consider terrorism under NEPA, the NRC has already issued a Generic Environmental Impact Statement ("GEIS") that considers sabotage in connection with license renewal. . . . The GEIS concluded that, if such an event were to occur, the resultant core damage and radiological release would be no worse than those expected from internally initiated events.

McGuire, CLI-02-26, 56 N.R.C. at 365 n.24 (citations omitted).

Moreover, the Ninth Circuit's decision is inconsistent with Limerick Ecology Action v. NRC, 869 F.2d 719, 741-44 (3d Cir. 1989), which upheld the NRC's determination that the risk of sabotage could not be assessed meaningfully and therefore was unlitigable. Therefore, even if the Ninth Circuit's decision were to become effective, there would be a split in the circuits. Because the Ninth Circuit decision is not controlling, and because the Commission held in

[19] Nor has the time expired within which the NRC or the utility involved may seek rehearing, rehearing *en banc*, or Supreme Court review.

McGuire that sabotage is already addressed in the GEIS, Entergy respectfully submits that until the Commission directs otherwise, the Board should continue to follow the NRC's license renewal precedent. In any event, because spent fuel storage is governed by the Waste Confidence Rule and is a Category 1 issue in license renewal, it can be admitted as a contention only if the Commission waives these rules.

Finally, the Contention's request that the Commission issue a backfit order requiring Pilgrim to change its spent fuel pool design to the original low-density storage configuration using dry storage for any excess fuel must be rejected as beyond the scope of this license renewal proceeding, as it does not concern aging management of plant systems and components. As discussed above, in promulgating the license renewal rule the Commission determined that, with the exception of the detrimental effects of aging and a few other issues related to safety only during the period of extended operation, the existing regulatory processes are adequate to ensure that the licensing bases of currently-operating plants provide and maintain an adequate level of safety. 60 Fed. Reg. at 22,464, 22,481-82. Thus, issues concerning the adequacy of the current licensing basis are beyond the scope of license renewal proceedings. Turkey Point, supra, CLI-01-17, 54 N.R.C. at 8-9. For this reason, the Commission has held that on-site storage of spent fuel raises no safety question for license renewal. Id. at 23. Accordingly, the Contention's request for a backfit order to change the plant's spent fuel pool licensing basis must be rejected.

Further, to the extent that the Attorney General is advocating a need to protect against terrorist acts that exceed the design basis threat, its contention is barred by 10 C.F.R. § 50.13.[20]

---

[20] 10 C.F.R. § 50.13 provides as follows::

> An applicant for a license to construct or operate a production or utilization facility, or for an amendment to such license, is not required to provide for design features or other measures for the specific purpose

Footnote continued on next page

Moreover, to the extent that the Attorney General may be advocating a need to revise the design basis threat, that matter is being addressed by an ongoing rulemaking proceeding in which the Commission has invited public comment on the potential for air-based threats in accordance with section 651(a) of the Energy Policy Act of 2005. 70 Fed. Reg. 67,380-382 (Nov. 7 2005). The Massachusetts Attorney General has in fact commented, urging the NRC to adopt an attribute for air-based threats,[21] and other comments have raised specific proposals similar to those advanced in the Petition.[22] As has been long held, licensing boards should not accept contentions which are or are about to become the subject of rulemaking. Oconee, supra, CLI-99-11, 49 N.R.C. at 345.[23]

In summary, the Massachusetts Attorney General's Contention seeks to raise an issue that has been resolved generically and is beyond the scope of this proceeding. Because the Massachusetts Attorney General has not petitioned the Commission for a waiver, its contentions may not be entertained. Further, even if this contention were within the scope of the proceeding, it would be inadmissible because it fails to show that the Commission's generic determinations are inapplicable to Pilgrim or would not serve their intended purpose, and fails to establish any genuine dispute with a material issue. Finally, the Attorney General's request for a backfit order

---

Footnote continued from previous page

of protection against the effects of (a) attacks and destructive acts, including sabotage, directed against the facility by an enemy of the United States, whether a foreign government, or person, or (b) use or deployment of weapons incident to U.S. defense activities.

[21] Letter from J. Milkey, Mass. Office of the Attorney General, to Secretary, U.S. NRC, Re: Docket No. RIN 3150-AH60 (Jan. 23, 2006), available at http://ruleforum.llnl.gov/cgi-bin/library?source=*&library=dbt_prule_public&file=*&st=prule.

[22] See, e.g., Letter from D. Lochbaum and E. Lyman, USC, to A. Vietti-Cook, USNRC (Jan.23, 2006), available at http://ruleforum.llnl.gov/cgi-bin/library?source=*&library=dbt_prule_public&file=*&st=prule.

[23] In UCS v. AEC, 499 F.2d. 1069 (D.C. Cir. 1974), the D.C. Circuit upheld the Commission's discretion to exclude issues from consideration in a licensing proceeding when those issues are being considered in a rulemaking proceeding. As a general matter, the NRC clearly has the discretion to define the scope of its proceedings. Bellotti v. NRC, 725 F.2d 1380, 1381 (D.C. Cir. 1983).

to modify the current licensing basis for the Pilgrim spent fuel pool must be rejected as beyond the scope of this license renewal proceeding.

VI. SELECTION OF HEARING PROCEDURES

Commission rules require the Atomic Safety and Licensing Board designated to rule on the Petition to "determine and identify the specific procedures to be used for the proceeding" pursuant to 10 C.F.R. §§ 2.310 (a)-(h). 10 C.F.R. § 2.310. The regulations are explicit that "proceedings for the . . . renewal . . . of licenses subject to [10 C.F.R. Part 50] may be conducted under the procedures of subpart L." Id. § 2.310(a). The regulations permit the presiding officer to use the procedures in 10 C.F.R. Part 2, Subpart G ("Subpart G") in certain circumstances. Id. § 2.310(d). It is the proponent of the contentions, however, who has the burden of demonstrating "by reference to the contention and bases provided and the specific procedures in subpart G of this part, that resolution of the contention necessitates resolution of material issues of fact which may be best determined through the use of the identified procedures." Id. § 2.309(g). The Attorney General did not address the selection of hearing procedures in the Petition and therefore did not satisfy its burden to demonstrate why Subpart G procedures should be used in this proceeding. Accordingly, any hearing should be governed by the procedures of Subpart L.

VII. CONCLUSION

For the reasons stated above, the Massachusetts Attorney General has not proffered an admissible contention in this proceeding. Therefore, its request for hearing should be denied. The Attorney General's petition for a backfit order is beyond the scope of this proceeding and should likewise be denied.

Respectfully Submitted,

David R. Lewis
Paul A. Gaukler
PILLSBURY WINTHROP SHAW PITTMAN LLP
2300 N Street, N.W.
Washington, DC 20037-1128
Tel. (202) 663-8474

Counsel for Entergy Nuclear Generation Company
and Entergy Nuclear Operations, Inc.

Dated: June 22, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
Entergy Nuclear Generation Company and	)	Docket No. 50-293-LR
Entergy Nuclear Operations, Inc.	)	ASLBP No. 06-848-02-LR
	)	
(Pilgrim Nuclear Power Station)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "Entergy's Answer to the Massachusetts Attorney General's Request for a Hearing, Petition for Leave to Intervene, and Petition for Backfit Order," dated June 22, 2006, were served on the persons listed below by deposit in the U.S. Mail, first class, postage prepaid, and where indicated by an asterisk by electronic mail, this 22nd day of June, 2006.

*Administrative Judge
Ann Marshall Young, Esq., Chair
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
amy@nrc.gov

*Administrative Judge
Dr. Richard F. Cole
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
rfc1@nrc.gov

*Administrative Judge
Dr. Nicholas G. Trikouros
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
ngt@nrc.gov; n.trikouros@att.net

*Secretary
Att'n: Rulemakings and Adjudications Staff
Mail Stop O-16 C1
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
secy@nrc.gov, hearingdocket@nrc.gov

Office of Commission Appellate
Adjudication
Mail Stop O-16 C1
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

*Susan L. Uttal, Esq.
*Harry E. Wedewer, Esq.
Office of the General Counsel
Mail Stop O-15 D21
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
slu@nrc.gov; hew@nrc.gov

*Diane Curran, Esq.
Harmon, Curran, Spielberg, and Eisenberg, L.L.P.
1726 M Street, N.W., Suite 600
Washington, D.C. 20036
dcurran@harmoncurran.com

*Matthew Brock, Esq.
Assistant Attorney General
Environmental Protection Division
Office of the Attorney General
One Ashburton Place
Boston, MA 02108
Matthew.brock@ago.state.ma.us

*Molly H. Bartlett, Esq.
52 Crooked Lane
Duxbury, MA 02332
mollyhbartlett@hotmail.com

*Ms. Mary Lampert
148 Washington Street
Duxbury, MA 02332
lampert@adelphia.net

*Sheila Slocum Hollis, Esq
Duane Morris LLP
1667 K Street, N.W.
Suite 700
Washington, D.C. 20006
sshollis@duanemorris.com

*Mr. Mark D. Sylvia
Town Manager
Town of Plymouth
11 Lincoln St.
Plymouth MA, 02360
msylvia@townhall.plymouth.ma.us

Paul A. Gaukler

HARMON, CURRAN, SPIELBERG & EISENBERG, LLP
1726 M Street, NW, Suite 600 Washington, DC 20036 (202) 328-3500 (202) 328-6918 fax

June 16, 2006

Ann Marshall Young, Chair
Richard F. Cole, Administrative Judge
Nicholas G. Trikouros, Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: *Pilgrim License Renewal Proceeding, Docket No. 50-293 LR*

Dear Administrative Judges,

On May 26, 2006, Massachusetts Attorney General Thomas F. Reilly submitted a hearing request and petition to intervene in this proceeding.[1] The Hearing Request included a contention asserting that Entergy Nuclear Operations Inc.'s environmental report for the Pilgrim nuclear power plant license renewal application fails to satisfy U.S. Nuclear Regulatory Commission ("NRC") regulations or the National Environmental Policy Act ("NEPA") because it does not address the environmental impacts of spent fuel pool accidents, including accidents caused by intentional and malicious acts. We are writing to notify you of a recent decision by the U.S. Court of Appeals for the Ninth Circuit which has a direct bearing on the contention, *San Luis Obispo Mothers for Peace v. Nuclear Regulatory Commission,* No. 03-74628 (June 2, 2006) ("*Mothers for Peace*"). A copy of the decision is enclosed.

In *Mothers for Peace,* the Court reversed a 2003 decision by the NRC Commissioners that had denied the intervenors a hearing on the question of whether NEPA required preparation of an environmental impact statement to evaluate the impacts of an intentional attack on a proposed independent spent fuel storage facility at the Diablo Canyon nuclear power plant. *Pacific Gas & Electric Company* (Diablo Canyon ISFSI), CLI-03-1, 57 NRC 1 (2003) ("*Diablo Canyon*"). The Court ruled that the Commission's rationale for refusing to consider the environmental impacts of intentional malicious attacks against nuclear facilities, as set forth in *Diablo Canyon* and *Private Fuel Storage* (Independent Spent Fuel Storage Installation), CLI-02-25, 56 NRC 340 (2002) ("*PFS*"), fails to meet NEPA's reasonableness standard. *Id.,* slip op. at 6096. The Court also determined that the question of whether intentional attacks on nuclear facilities are reasonably foreseeable is a question of law rather than a question of fact. *Id.,* slip op. at

[1] Massachusetts Attorney General's Request for a Hearing and Petition to Intervene With Respect to Entergy Nuclear Operations Inc.'s Application for Renewal of the Pilgrim Nuclear Plant Operating License, etc. (May 26, 2006) ("Hearing Request").

6081-83. Finally, the Court held that as a matter of law, "the possibility of terrorist attack is not so 'remote and highly speculative' as to be beyond NEPA's requirements." *Id.*, slip op. at 6089, quoting *PFS*, 56 NRC at 349. The Court remanded the case to the NRC for further proceedings. *Id.*, slip op. at 6096.

Accordingly, the Attorney General requests that the Atomic Safety and Licensing Board apply the *Mothers for Peace* decision by ruling that the environmental impacts of an intentional attack on the Pilgrim fuel storage pool must be addressed in an EIS, or seek appropriate guidance from the Commission.

Sincerely,

Diane Curran

Matthew Brock /DC

Matthew Brock, Assistant Attorney General
Environmental Protection Division
Office of the Attorney General
One Ashburton Place
Boston, MA 02108

Cc w/enclosure: Service list

HARMON, CURRAN, SPIELBERG & EISENBERG, LLP
1726 M Street, NW, Suite 600 Washington, DC 20036 (202) 328-3500 (202) 328-6918 fax

June 16, 2006

Alex S. Karlin, Chair
Thomas S. Elleman, Administrative Judge
Richard E. Warwell, Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: *Vermont Yankee License Renewal Proceeding, Docket No. 50-271-LR*

Dear Administrative Judges,

On May 26, 2006, Massachusetts Attorney General Thomas F. Reilly submitted a hearing request and petition to intervene in this proceeding.[1] The Hearing Request included a contention asserting that Entergy Nuclear Operations Inc.'s environmental report for the Vermont Yankee nuclear power plant license renewal application fails to satisfy U.S. Nuclear Regulatory Commission ("NRC") regulations or the National Environmental Policy Act ("NEPA") because it does not address the environmental impacts of spent fuel pool accidents, including accidents caused by intentional and malicious acts. We are writing to notify you of a recent decision by the U.S. Court of Appeals for the Ninth Circuit which has a direct bearing on the contention, *San Luis Obispo Mothers for Peace v. Nuclear Regulatory Commission,* No. 03-74628 (June 2, 2006) ("*Mothers for Peace*"). A copy of the decision is enclosed.

In *Mothers for Peace,* the Court reversed a 2003 decision by the NRC Commissioners that had denied the intervenors a hearing on the question of whether NEPA required preparation of an environmental impact statement to evaluate the impacts of an intentional attack on a proposed independent spent fuel storage facility at the Diablo Canyon nuclear power plant. *Pacific Gas & Electric Company* (Diablo Canyon ISFSI), CLI-03-1, 57 NRC 1 (2003) ("*Diablo Canyon*"). The Court ruled that the Commission's rationale for refusing to consider the environmental impacts of intentional malicious attacks against nuclear facilities, as set forth in *Diablo Canyon* and *Private Fuel Storage* (Independent Spent Fuel Storage Installation), CLI-02-25, 56 NRC 340 (2002) ("*PFS*"), fails to meet NEPA's reasonableness standard. *Id.*, slip op. at 6096. The Court also determined that the question of whether intentional attacks on nuclear facilities are

[1] Massachusetts Attorney General's Request for a Hearing and Petition to Intervene With Respect to Entergy Nuclear Operations Inc.'s Application for Renewal of the Vermont Yankee Nuclear Plant Operating License, etc. (May 26, 2006) ("Hearing Request").

reasonably foreseeable is a question of law rather than a question of fact. *Id.*, slip op. at 6081-83. Finally, the Court held that as a matter of law, "the possibility of terrorist attack is not so 'remote and highly speculative' as to be beyond NEPA's requirements." *Id.*, slip op. at 6089, quoting *PFS*, 56 NRC at 349. The Court remanded the case to the NRC for further proceedings. *Id.*, slip op. at 6096.

Accordingly, the Attorney General requests that the Atomic Safety and Licensing Board apply the *Mothers for Peace* decision by ruling that the environmental impacts of an intentional attack on the Vermont Yankee fuel storage pool must be addressed in an EIS, or seek appropriate guidance from the Commission.

Sincerely,

Diane Curran

Matthew Brock/DC

Matthew Brock, Assistant Attorney General
Environmental Protection Division
Office of the Attorney General
One Ashburton Place
Boston, MA 02108

Cc w/enclosure: Service list

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE COMMISSION

In the Matter of	)	
	)	
Entergy Nuclear Operations, Inc.	)	Docket No. 50-293
	)	
(Pilgrim Nuclear Power Station)	)	
	)	

MASSACHUSETTS ATTORNEY GENERAL'S REQUEST FOR A HEARING AND PETITION FOR LEAVE TO INTERVENE WITH RESPECT TO ENTERGY NUCLEAR OPERATIONS INC.'S APPLICATION FOR RENEWAL OF THE PILGRIM NUCLEAR POWER PLANT OPERATING LICENSE
AND
PETITION FOR BACKFIT ORDER REQUIRING NEW DESIGN FEATURES TO PROTECT AGAINST SPENT FUEL POOL ACCIDENTS

By Massachusetts Attorney General Thomas F. Reilly
Through his Attorneys,

Diane Curran
Harmon Curran, Spielberg & Eisenberg, L.L.P.
1726 M Street N.W., Suite 600
Washington, D.C. 20036
202/328-3500
dcurran@harmoncurran.com

Matthew Brock, Assistant Attorney General
Environmental Protection Division
Office of the Attorney General
One Ashburton Place
Boston, MA 02108
617/727-2200
matthew.brock@ago.state.ma.us

May 26, 2006

TABLE OF CONTENTS

TABLE OF AUTHORITIES

Judicial Decisions

NRC Decisions

Statutes

Regulations

Federal Register Notices

NRC Documents

Miscellaneous

I. INTRODUCTION AND EXECUTIVE SUMMARY

On behalf of the Commonwealth of Massachusetts, Attorney General Thomas F. Reilly ("Massachusetts Attorney General" or "Petitioner") petitions to intervene and requests the U.S. Nuclear Regulatory Commission ("NRC" or "Commission") to grant an adjudicatory hearing on Entergy Nuclear Operations, Inc.'s ("Entergy's") application for renewal of its license to operate the Pilgrim nuclear power plant. He files this petition pursuant to the notice of opportunity for a hearing published at 71 Fed. Reg. 15,222 (March 27, 2006), Section 189a of the Atomic Energy Act ("AEA") [42 U.S.C. § 2239(a)], and 10 C.F.R. § 2.309.

Through its application, Entergy seeks approval to operate the Pilgrim plant an additional 20 years past its expiration date of 2012. As a general matter the Attorney General does not oppose Entergy's renewal application, and he acknowledges that nuclear power provides an important component of the New England energy supply. At the same time, however, he wants to ensure that the NRC does not grant the license renewal before Entergy and the NRC address the risk of a severe accident in the Pilgrim spent fuel pool and comply with federal laws for the protection of public health, safety, and the environment.

As detailed below in the Petitioner's contention (*see* Section V below), Entergy's license renewal application fails to comply with the National Environmental Policy Act's ("NEPA's") requirement that it address significant new information bearing on the environmental impacts of operating the Pilgrim nuclear power plant during a license renewal term. That new information, not addressed in any previous Environmental Impact Statement ("EIS") for the Pilgrim nuclear plant or any other nuclear power plant,

demonstrates that continued storage of spent fuel in high-density storage racks in the Pilgrim pool poses a significant and reasonably foreseeable environmental risk of a severe fire and offsite release of a large amount of radioactivity. Entergy's failure to take account of this new information is inconsistent with NEPA's major requirement that environmental decisions must take new information into account if the information shows that a proposed action will affect the quality of the human environment "in a significant manner or to a significant extent not already considered." *Marsh v. Oregon Natural Resources Council,* 490 U.S. 360, 374 (1989) ("*Marsh*").

Entergy's application also fails to satisfy the AEA's fundamental requirement to ensure safe operation of the Pilgrim plant during the license renewal term because it does not include adequate design measures to prevent the occurrence of a pool fire or to reduce its consequences. Therefore, pursuant to 10 C.F.R. § 50.109(a)(5), the Attorney General petitions the Commission to require that Entergy backfit the Pilgrim design to eliminate or substantially mitigate the risk of a pool fire. The choice of design measure for the backfit should be informed by the consideration of backfit design alternatives in an EIS.

The Attorney General's hearing request and backfit petition arise from the safety and environmental risks posed by Entergy's plan to continue to use "high-density" racks for storage of spent fuel in the Pilgrim fuel pool. When the Pilgrim plant was originally licensed in 1972, "low-density" racks were used to store spent fuel in the pool. The open construction of these racks allowed cooling fluid to flow freely all around and over the spent fuel assemblies stored in the pool. Under several license amendments granted between 1972 and 1994, the NRC has allowed Entergy to pack fuel more and more densely into the pool, using "high-density" storage racks. By the time the current license

term expires in 2012, Entergy will have accumulated some three thousand fuel assemblies in the Pilgrim fuel pool, amounting to approximately forty million curies of radioactive isotopes. If the fuel pool were to suffer a loss of water sufficient to uncover the tops of the fuel assemblies, the dense configuration of the high-density racks would inhibit the flow of water, air or steam over the fuel assemblies, causing some of the fuel to ignite within hours. The fire could then propagate within the pool, and the burning of fuel assemblies could lead to a large atmospheric release of radioactive isotopes, contaminating a large land area for decades and at a heavy cost to public health and the economy.

While such a catastrophic accident is unlikely, its probability falls within the range that NRC considers reasonably foreseeable. Therefore it is not a speculative or worst-case event. Pool water could also be lost if the pool were the subject of an intentional attack, a risk that can no longer be ignored after the attacks of September 11, 2001. Yet, neither Entergy nor the NRC has addressed the safety and environmental impacts of a pool fire in any EIS, nor is the Pilgrim plant designed to avoid a pool fire accident.

Although it has long been known that high-density pool storage of spent fuel could potentially lead to a serious accident, the scientific information on such risks has continued to develop in recent years, including through technical studies by the Commission's own staff, independent expert analyses, and a study by the National Academies of Sciences. Increased appreciation for the potential for an intentional attack on nuclear facilities has also changed our consideration of that risk. Despite the NRC's acknowledgment of concern about such a risk, and despite the known vulnerability of

fuel pools to fire if they are intentionally drained, the agency has not addressed the potential safety and environmental impacts of attacks involving fuel pools. *Marsh* and NRC regulations require that prior to licensing Pilgrim, the NRC must prepare an EIS that addresses significant new information regarding the safety and environmental impacts of a pool fire. This information was not available to the NRC when earlier EISs relevant to license renewal were prepared. Under NEPA, the EIS must also weigh reasonably available alternatives for avoiding or mitigating a pool fire, such as combined low-density pool storage and dry storage of spent fuel.

The AEA also requires the NRC to protect against the unreasonable risk of a pool fire in its license renewal decision for Pilgrim. *Petition for Emergency and Remedial Action,* CLI-78-6, 7 NRC 400, 404 (1978) ("*Petition for Emergency and Remedial Action*"). Therefore, the NRC must not only assess the impacts of pool fires in an EIS, it must require Entergy to change the design or operations of the plant to prevent a pool fire from occurring.

II. THE MASSACHUSETTS ATTORNEY GENERAL HAS STANDING TO INTERVENE IN THIS PROCEEDING AND REQUEST A BACKFIT ORDER.

Section 189a of the AEA, 42 U.S.C. § 2239(a)(1), provides that:

> In any proceeding under this Act, for the granting, suspending, revoking, or amending of any license . . . the Commission shall grant a hearing upon the request of any person whose interest may be affected by the proceeding, and shall admit any person as a party to such a proceeding.

As the Atomic Safety and Licensing Board ("ASLB") recently ruled, NRC regulations implementing Section 189a "establish that a State has standing when a proceeding involves a 'facility located within [the State's] boundaries.'" *Amergen Energy Company, L.L.C.* (License Renewal for Oyster Creek Nuclear Generating Station), LBP-06-07, __

NRC __, slip op. at 2-3 (February 27, 2006), citing 10 C.F.R. § 2.309(d)(2)(ii). Accordingly, no further demonstration of standing by the Petitioner is required. *Id.*

As an elected representative of the citizens of the Commonwealth of Massachusetts, Attorney General Reilly also has the right to participate in this proceeding as a representative of an interested State. 10 C.F.R. § 2.315(c). *See also Vermont Yankee Nuclear Power Corporation* (Vermont Yankee Nuclear Power Station), LBP-87-7, 25 NRC 116, 118 (1987).

III. STATUTORY AND REGULATORY FRAMEWORK

The two statutes that govern this hearing request and backfit petition are NEPA and the AEA. The AEA sets minimum standards for safe and secure operation of nuclear facilities, while NEPA requires NRC to consider and attempt to avoid or mitigate significant adverse environmental impacts of licensing those facilities. Although the statutes have some overlapping concerns, they establish independent requirements. *Limerick Ecology Action v. NRC,* 869 F.2d 719, 729-30 (3rd Cir. 1989) (holding that the AEA does not preclude NEPA).

It is "unreasonable to suppose that [environmental] risks are automatically acceptable, and may be imposed upon the public by virtue of the AEA, merely because operation of a facility will conform to the Commission's basic health and safety standards." *Limerick Ecology Action v. NRC,* quoting *Citizens for Safe Power v. NRC,* 524 F.2d 1291, 1299 (D.C. Cir. 1975). NEPA goes beyond the AEA, by requiring the consideration of alternatives for reducing or avoiding adverse environmental impacts of NRC licensing actions. *Limerick Ecology Action v. NRC,* citing 10 C.F.R. § 51.71(d).

A. Atomic Energy Act Safety Requirements

1. AEA requirements for protection of public safety

The AEA prohibits the NRC from issuing a license to operate a nuclear power plant if it would be "inimical to the common defense and security or to the health and safety of the public." 42 U.S.C. § 2133(d). Public safety is "the first, last, and a permanent consideration in any decision on the issuance of a construction permit or a license to operate a nuclear facility." *Petition for Emergency and Remedial Action,* 7 NRC at 404, citing *Power Reactor Development Corp. v. International Union of Electrical Radio and Machine Workers,* 367 U.S. 396, 402 (1961) ("*Power Reactor Development Corp.*").

2. NRC requirements for protection against design-basis accidents

NRC regulations for implementation of the AEA provide that a nuclear power plant must be designed against accidents that are "anticipated during the life of the facility." *See* 10 C.F.R. § 50.34(a)(4), which provides that a construction permit application for a nuclear power plant must include:

> a preliminary analysis and evaluation of the design and performance of structures, systems, and components of the facility with the objective of assessing the risk to public health and safety resulting from operation of the facility and including determination of the margins of safety during normal operations and transient conditions anticipated during the life of the facility, and the adequacy of structures, systems, and components provided for the prevention of accidents and the mitigation of the consequences of accidents.

These "anticipated" accidents, against which nuclear power plants must be designed, are called "design-basis accidents." *See* NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants at 5-1 (1996) ("License Renewal GEIS"). Design-basis accidents include low-frequency but credible events. *Id.* at 5-2.

In determining which types of accidents constitute design-basis accidents and therefore must be protected against in a nuclear plant's design, the NRC sets a "threshold" based on probability of the accident. The NRC has held that reactor core accidents with a "realistic probability" (*i.e.*, a non-conservative probability) of at least one in ten million per year (10^{-7}) must be included in the design-basis. *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), CLI-01-22, 54 NRC 255, 259-60 (2001) ("*PFS I*"), citing *Metropolitan Edison Co.* (Three Mile Island Nuclear Station, Unit 2), ALAB-692, 16 NRC 921 (1982); *Consumers Power Co.* (Big Rock Point Plant), LBP-84-32, 20 NRC 601, 639-52 (1984).[1]

The NRC designates accidents that are more complex and less likely than design-basis accidents as "severe accidents." License Renewal GEIS at 5-1 (severe accidents are "those involving multiple failures of equipment or function and, therefore, whose likelihood is generally lower than design-basis accidents but whose consequences may be higher"). Although severe accidents are "beyond the substantial coverage of design-basis events," they constitute "the major risk to the public associated with radioactive releases from nuclear power plant accidents." Policy Statement on Severe Accidents Regarding Future Designs and Existing Plants, 50 Fed. Reg. 32,138, 32,139 (August 8, 1985) ("Severe Accident Policy Statement").

The Commission has made a generic determination that nuclear plants can be operated safely, despite the potential for severe accidents. Severe Accident Policy

---

1 *But see Vermont Yankee Nuclear Power Corp.* (Vermont Yankee Nuclear Power Station), CLI-90-4, 31 NRC 333, 334 (1990), in which the Commission refused to rule out NEPA consideration of an accident probability of 10^{-4} per year as remote and speculative. Under the *PFS I* ruling, an accident with a probability of 10^{-4} would be well within the range of a design-basis accident. Therefore, not only should it have been considered credible for purposes of preparing an EIS, but it should have been included in the design-basis for the facility.

Statement, 50 Fed. Reg. at 32,139-40. *See also* Final Rule, Nuclear Power Plant License Renewal, 56 Fed. Reg. 64,943, 64,948-49 (December 13, 1991). Nevertheless, the Commission has an ongoing program to address severe accidents in the context of its regulatory program for protection of public health and safety under the Atomic Energy Act, and pledges to act upon any new information that calls the safety finding into question. *Id.* As provided by the Severe Accident Policy Statement:

> Should significant new safety information become available, from whatever source, to question the conclusion of 'no undue risk,' then the technical issues thus identified would be resolved by the NRC under its backfit policy and other existing procedures, including the possibility of generic rulemaking where this is justified.

50 Fed. Reg. at 32,139.

3. Standard for license renewal

Section 2133(c) of the Atomic Energy Act allows the NRC to renew nuclear power licenses. Although the AEA does not set a safety standard for license renewal, the Commission generally interprets the AEA to require that it "must have 'reasonable assurance' that public health and safety are not endangered by its licensing actions." *Petition for Emergency and Remedial Action,* 7 NRC at 404, citing *Power Reactor Development Corp.,* 367 U.S. at 402.

In the license renewal rulemaking, the Commission made a determination that:

> With the exception of age-related degradation unique to license renewal and possibly some few other issues related to safety only during extended operation, the regulatory process is adequate to ensure that the licensing bases of all currently operating plants provide and maintain an acceptable level of safety for operation so that operation will not be inimical to public health and safety or common defense and security.

56 Fed. Reg. at 64,946. Thus, other than with respect to aging issues, the NRC does not inquire into safety issues in the license renewal process.

If significant new information becomes available with respect to a safety issue unrelated to the aging of the plant, the NRC does not permit it to be raised in the license renewal hearing. Preamble to Final License Renewal Rule, 56 Fed. Reg. at 64,946. Instead, the NRC requires that the issue must be addressed under the NRC policy for backfitting the design of operating reactors in 10 C.F.R. § 50.109, or under "other existing procedures, including the possibility of generic rulemaking." *Id.*[2]

B. NEPA Statutory and Regulatory Requirements

1. General NEPA requirements

a. NEPA requirement to prepare an EIS

NEPA is the "basic charter for protection of the environment." 40 C.F.R. § 1500.1. Its fundamental purpose is to "help public officials make decisions that are based on understanding of environmental consequences, and take decisions that protect, restore and enhance the environment." *Id.* NEPA requires federal agencies to examine the environmental consequences of their actions *before* taking those actions, in order to ensure "that important effects will not be overlooked or underestimated only to be discovered after resources have been committed or the die otherwise cast." *Robertson v. Methow Valley Citizens Council* (*Robertson*), 490 U.S. 332, 349 (1989).

The primary method by which NEPA ensures that its mandate is met is the "action-forcing" requirement for preparation of an EIS, which assesses the environmental impacts of the proposed action and weighs the costs and benefits of alternative actions. *Id.*, 490 U.S. at 350-51. An EIS must be searching and rigorous, providing a "hard look"

---

2 Among these options the Massachusetts Attorney General has elected to request a backfit to design the Pilgrim plant against pool fires. *See* Section VI. below.

at the environmental consequences of the agency's proposed action. *Id.* at 349; *Marsh,* 490 U.S. at 374.

b. NEPA requirement to supplement an EIS

The completion of an EIS for a proposed action does not end an agency's responsibility to weigh the environmental impacts of a proposed action. *Marsh,* 490 U.S. at 371-72. As the Supreme Court recognized in *Marsh,* it would be incongruous with NEPA's "action-forcing" purpose to allow an agency to put on "blinders to adverse environmental effects," just because the EIS has been completed. *Id.* Accordingly, up until the point when the agency is ready to take the proposed action, it must supplement the EIS if there is new information showing that the remaining federal action will affect the quality of the human environment "in a significant manner or to a significant extent not already considered." 490 U.S. at 374.

c. NEPA requirement that an EIS must consider reasonably foreseeable impacts of nuclear accidents.

The environmental impacts that must be considered in an EIS include "reasonably foreseeable" impacts which have "catastrophic consequences, even if their probability of occurrence is low." 40 C.F.R. § 1502.22(b)(1). The Commission has held that probability is the "key" to determine whether an accident is "reasonably foreseeable" or whether it is "remote and speculative" and therefore need not be considered in an EIS. *Vermont Yankee Nuclear Power Corp.* (Vermont Yankee Nuclear Power Station), CLI-90-7, 32 NRC 129, 131 (1990). *See also Limerick Ecology Action v. NRC,* 869 F.2d at 745, citing *Vermont Yankee Nuclear Power Corp. v. Natural Resources Defense Council, Inc.,* 435 U.S. 519, 551 (1978).

In the spectrum of accidents that might be considered in an EIS for a nuclear power plant license, there is no dispute that "design-basis accidents," *i.e.*, accidents against which a nuclear plant must be designed under the AEA's requirement to protect public health and safety against "undue risk," are reasonably foreseeable and therefore must be considered. Thus, almost since the passage of NEPA the NRC has included consideration of the environmental impacts of design-basis accidents in its EISs. *Limerick Ecology Action v. NRC,* 869 F.2d 719, 726 (3rd Cir. 1989), citing 36 Fed. Reg. 22,851 (1971).

In 1980, following the Three Mile Island accident, the Commission also began to consider the environmental impacts of severe or "beyond design-basis" accidents in its EISs. *Id.,* citing Statement of Interim Policy, Nuclear Power Plant Accident Considerations Under the National Environmental Policy Act of 1969, 45 Fed. Reg. 40,101 (1980). In contested cases the Commission has required intervenors to address the quantitative probability of severe accidents for which they seek consideration in an EIS. *See, e.g., Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), CLI-01-11, 53 NRC 370, 387 (2001) ("Harris"). While the Commission has not established a threshold for the level of accident probability considered "reasonably foreseeable," in *Harris* the Commission affirmed a decision by the ASLB approving the NRC Staff's probability estimate of 10^{-7} for a particular accident scenario and ruling that the accident was "remote and speculative." *Id.* at 388 n.8. (*But see* Section III.A.2 above.)

2. NRC's procedures for preparation of ER and EIS

NRC's NEPA procedures require the NRC to prepare an EIS for any major licensing action significantly affecting the quality of the human environment. 10 C.F.R.

§§ 51.71, 51.91. Before the EIS is prepared, however, the NRC's regulations require that the license applicant must prepare what amounts to a first draft of the EIS, *i.e.*, the environmental report ("ER"). 10 C.F.R. § 51.53(c)(2), *Duke Power Co.* (Catawba Nuclear Station, Units 1 and 2), CLI-83-19, 17 NRC 1041, 1049 (1983) (noting that "as a practical matter, much of the information in an Applicant's ER is used in the [Draft EIS]"). The ER generally must address all the same impacts, alternatives, and other environmental issues that will be addressed later in the NRC's EIS. *Compare* 10 C.F.R. § 51.53(c)(2) with 10 C.F.R. § 51.71.

3. NRC's NEPA procedures for license renewal

a. NRC reliance on License Renewal GEIS in individual license renewal proceedings

NRC regulations for the implementation of NEPA do not require the preparation of a complete ER and EIS for every nuclear power plant license renewal application. Instead, the NRC relies on the License Renewal GEIS, prepared in 1996, to evaluate most of the environmental impacts of license renewal. *See* 10 C.F.R. §§ 51.53(c)(3)(i), 51.71(d).

The License Renewal GEIS and NRC's environmental regulations for license renewal-related NEPA issues separate environmental impacts, including accidents, into two major categories: Category 1 or "generic" impacts, and Category 2 or "plant-specific" impacts. *Duke Energy Corporation* (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-14, 55 NRC 278, 290 (2002) ("*McGuire/Catawba*"). Environmental impacts are listed according to their category in Table B-1 of Appendix B to Subpart A of 10 C.F.R. Part 51.

For Category 1 impacts, the NRC considers the License Renewal GEIS analysis

sufficient, and no further analysis is required in the Environmental Report and EIS that are prepared at the time of the license renewal application. 10 C.F.R. §§ 51.53(c)(3)(i), 51.71, 51.95(c). For Category 2 impacts, the NRC has determined that impacts and alternatives cannot be fully addressed in the Generic EIS and therefore must be addressed in the site-specific ER and EIS. *McGuire/Catawba,* 55 NRC at 290; *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 NRC 3, 12 (2001).

b. NRC discussion of accident impacts in License Renewal GEIS

The License Renewal GEIS purports to address both design-basis accidents and severe accidents. With respect to design-basis accidents, the GEIS provides a brief statement that the impacts of design-basis accidents were considered in the original EIS for each nuclear power plant, and that the design was found adequate to "accommodate" those accidents. License Renewal GEIS at 5-11. Moreover, the GEIS asserts that the consequences of design-basis accidents are not expected to change significantly as a result of aging of the plant. *Id.* Therefore, the GEIS does not provide a further discussion of design-basis accidents. *Id.* These impacts are also classified as "Category 1 in Table B-1 of Appendix B to Subpart A of 10 C.F.R. Part 51.

With respect to severe or beyond design-basis accidents, the License Renewal GEIS discusses the potential consequences of an array of severe accidents identified in various studies, primarily the NRC's most recent and comprehensive probabilistic analysis of nuclear power plant accidents, NUREG-1150, Severe Accident Risks for Five U.S. Nuclear Power Plants (1990). While recognizing the possibility that the likelihood of some severe accidents may be so low as to be "remote and speculative" and therefore

not necessary to discuss in an EIS, the License Renewal GEIS does not exclude any severe accidents on the ground of their estimated probability. Severe accidents are classified as "Category 2" impacts in Table B-1 of Appendix B to Subpart A of 10 C.F.R. Part 51.

The License Renewal GEIS does not include any discussion of how deliberate and malicious attacks on nuclear power plants may increase the likelihood or consequences of severe accidents. The NRC declines to address the topic on the grounds that (a) NRC security regulations provide reasonable assurance that the risk from sabotage is small; (b) although their probability is not quantifiable, acts of sabotage are "not reasonably expected"; and (c) even if such an event were to occur, resultant core damage and radiological releases would be "no worse than those expected from internally initiated events." License Renewal GEIS at 5-18.[3]

The License Renewal GEIS is consistent with the NRC's long-established policy of refusing to examine the environmental impacts of deliberate malicious acts on the ground that it could not make a "meaningful assessment of the risks of sabotage." *Philadelphia Electric Co.* (Limerick Generating Station, Units1 and 2), ALAB-819, 22 NRC 681, 697-701 (1985) ("*Limerick Appeal Board Decision*"), *aff'd on this ground and rev'd on other grounds, Limerick Ecology Action v. NRC,* 869 F.2d 719, 743-44 (3rd Cir. 1989). Even the attacks of September 11, 2001, did not cause the NRC to change this policy, which it reiterated in *Private Fuel Storage, L.L.C.* (Independent Spent Fuel

3 The NRC's failure to discuss impacts of deliberate and malicious acts in the License Renewal GEIS is a departure from the 1979 GEIS, in which the NRC examined the impacts of attacks on spent fuel pools, albeit not in light of significant new information about the risks of pool fires, NUREG-0575, Handling and Storage of Spent Light Water Power Reactor Fuel (1979) ("1979 GEIS"). *See* discussion in Section V.B.1.c, below.

Storage Installation, CLI-02-25, 56 NRC 340 (2002) ("*PFS II*") and *Pacific Gas & Electric Company* (Diablo Canyon ISFSI), CLI-03-12, 58 NRC 185 (2003) ("*Diablo Canyon*").[4] *Diablo Canyon* has been appealed to the U.S. Court of Appeals for the 9th Circuit, where a decision is pending. Moreover, to the extent that *PFS II* and *Diablo Canyon* are based on factual determinations that should be re-evaluated in a new EIS in light of significant new information, the policy is subject to challenge in this proceeding. 10 C.F.R. § 51.53(c)(3)(iv). *See* discussion below in Section III.B.3.c.

c. NRC requirement to supplement License Renewal GEIS

Consistent with *Marsh,* 490 U.S. at 374, NRC regulation 10 C.F.R. § 51.53(c)(3)(iv) requires that an environmental report "must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware." Thus, the conclusions of the License Renewal GEIS are subject to modification in individual license renewal proceedings if new and significant information, not evaluated in the License Renewal GEIS, shows that the environmental impacts of license renewal are greater than concluded in the License Renewal GEIS.

d. NRC requirement to consider alternatives in site-specific ER and EIS

For any environmental impacts that do not fall into Category 1, a license renewal applicant must consider "alternatives for reducing adverse impacts," including severe accidents. 10 C.F.R. § 51.53(c)(3)(iii), citing 10 C.F.R. § 51.45(c). This requirement

---

4 For other decisions applying the NRC's policy against considering the environmental impacts of terrorism and sabotage, *see Duke Cogema Stone & Webster* (Savannah River Mixed Oxide Fuel Fabrication Facility), CLI-02-24, 56 NRC 335 (2002); *Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Unit 1), CLI-02-27, 56 NRC 367 (2002); *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2), Catawba Nuclear Station, Units 1 and 2), CLI-02-26, 56 NRC 358 (2002).

also applies to the draft and final EIS for each individual license renewal application. 10 C.F.R. § 51.71(d), 51.91.

As the Commission explained in the preamble to the final rule for environmental review of license renewal applications, the alternatives that must be considered include severe accident mitigation alternatives ("SAMAs"). Final Rule, Environmental Review for Renewal of Nuclear Power Plant Operating Licenses, 61 Fed. Reg. 28,467, 28,480-81 (June 5, 1996). This requirement is:

> based on the Commission's NEPA regulations that require a review of severe [accident] mitigation alternatives in its environmental impact statements (EISs) and supplements to EISs, as well as a previous court decision that required review of severe mitigation alternatives (referred to as SAMDAs) at the operating license stage. See, Limerick Ecology Action v. NRC, 869 F.2d 719 (3d Cir. 1989).

61 Fed. Reg. at 28,481. In addition, the Commission noted that while each licensee was in the process of performing an individual plant examination ("IPE") to "look for plant vulnerabilities to internally initiated events" and a separate IPE "for externally initiated events (IPEEE)," the program had not been completed in time to include the results in an EIS or supplemental EIS. *Id.* Thus, the ER and EIS for each individual license renewal application must include consideration of SAMAs. *Id.*

C. Atomic Energy Act Public Hearing Requirements for License Renewal Decisions.

Section 189a of the AEA requires the NRC to provide interested members of the public with a prior opportunity for a hearing on any decision regarding the issuance or amendment of a nuclear facility license. 42 U.S.C. § 2239(a)(1)(A). While the AEA does not establish a specific right to a hearing for license renewal proceedings, the Commission has determined that a hearing should be granted because renewal of an

operating license "is essentially the granting of a license." Proposed Rule, Nuclear Power Plant License Renewal, 55 Fed. Reg. 29,043, 29,052 (July 17, 1990).

In order to be admitted as an intervenor to an NRC adjudicatory licensing proceeding, including a license renewal proceeding, a petitioner must file "contentions" that provide "sufficient information to show that a genuine dispute exists with the applicant/licensee on a material issue of law or fact." 10 C.F.R. § 2.309(f)(vi). Contentions raising questions of compliance with NRC safety requirements must be based on the application, and contentions raising questions of compliance with NEPA must be based on the applicant's ER. 10 C.F.R. § 2.309(f).

Pursuant to 10 C.F.R. § 2.335, contentions may not challenge NRC regulations. However, factual determinations codified in NRC NEPA regulations may be challenged under regulations and judicial precedents requiring the consideration of significant new information that undermines those determinations. *See* discussion above in Sections III.B.1.b and III.B.3.c. In addition, contentions may challenge fact-based statements of NRC policy that were established without notice or opportunity for public comment. *Limerick Ecology Action v. NRC,* 869 F.2d at 733-39.[5]

---

5 In the *Limerick* proceeding, which took place in the 1980s, the Intervenor submitted a contention challenging the NRC's pronouncement in an EIS that it would not consider the environmental impacts of sabotage against a proposed nuclear plant because it lacked any meaningful method of assessing the likelihood of sabotage events at a proposed nuclear power plant. 849 F.2d at 743. The Court upheld the NRC's holding that the Intervenor "failed to produce any credible evidence or theory that would 'cast any serious doubt' on the Commission's conclusion that sabotage risk analysis is beyond current probabilistic risk assessment methods and that there is no current basis by which to measure such risk." *Id.* Thus, the court recognized the Intervenor's right to challenge the NRC's policy pronouncement regarding consideration of intentional attacks on a nuclear facility in the specific licensing proceeding in which it had intervened. While the Third Circuit upheld the Commission's ruling that the *Limerick* Intervenor failed to present enough evidence to challenge the factual basis for the policy, that is not the case here. In its contention below, the Attorney General presents a significant body of evidence

IV. FACTUAL AND PROCEDURAL BACKGROUND

A. Pilgrim Nuclear Power Plant

1. Pool Storage of Spent Fuel at Pilgrim

At the Pilgrim nuclear power plant, electricity is generated by fission reactions in radioactive "fuel rods" in the plant's reactor. Fuel rods are grouped together in "assemblies." After a fuel assembly is "spent" in the sense that it no longer can be used to generate power, it is discharged from the reactor. However, at this point in its life the assembly is much more dangerous than when it entered the reactor. It emits heat and intense radiation, and contains a large inventory of radioactive material. Gordon Thompson, Risks and Risk-Reducing Options Associated with Pool Storage of Spent Nuclear Fuel at the Pilgrim and Vermont Yankee Nuclear Power Plants, § 2 (May 25, 2006) ("Thompson Report").[6]

The Pilgrim plant has a fuel storage pool through which fresh fuel assemblies pass during their placement in the reactor, and where spent fuel is stored after it is removed from the reactor core. When Pilgrim and other plants in the present generation of nuclear power plants first began operation in the 1970s, their spent fuel pools were equipped with low-density, open-frame racks. These racks allowed free circulation of water around the fuel assemblies. If water were lost from a pool equipped with open-frame racks, air or steam could circulate freely through the fuel assemblies, cooling the assemblies. As a result, the fuel cladding would ignite, if at all, only in rare conditions. Thompson Report, § 8.

---

showing that the NRC's policy is unfounded.

6 A copy of Dr. Thompson's report is attached to the Declaration of Dr. Gordon Thompson in Support of Massachusetts Attorney General's Contention and Petition for Backfit Order (May 25, 2006, which is included as Exhibit 1 to this pleading.

Over the past three decades, spent fuel inventories have mounted because of the lack of other means of spent fuel management. Plant licensees have responded to this problem by substantially increasing the density at which fuel is stored in the existing spent fuel pools. In order to increase the density of storage, licensees have been obliged to use racks in which each fuel assembly is surrounded by solid, neutron-absorbing panels, which are needed to suppress criticality or a runaway chain reaction. The panels limit the flow of coolant (water, air or steam) to a mode of circulation in which the coolant enters each rack cell from below, rises vertically through the cell, and leaves the cell at its top.

The Pilgrim license has been amended several times to permit storage of an ever-increasing volume of spent fuel in high-density storage racks. Currently, all racks in the Pilgrim pool are high-density. During the requested period of license extension, the Pilgrim pool will contain about 3,200 fuel assemblies with a radioactive inventory of approximately 44 million Curies of cesium-137. Thompson Report, Table 3-4.

If water is lost from a pool equipped with high-density racks, the circulation of coolant over the fuel assemblies will be inhibited, and the fuel will ignite over a wide range of conditions. Thompson Report, § 2. *See also* discussion below in Section V.B.3. A pool fire at Pilgrim could release between four and 40 million curies of radioactive cesium, contaminating a large land area with radioactive cesium-137 for decades, at a cost of many billions of dollars. Thompson Report, § 5; Jan Beyea, Report to the Massachusetets Attorney General on the Potential Consequences of a Spent-fuel Pool

Fire at the Pilgrim or Vermont Yankee Nuclear Plant at 21-24 (May 25, 2006) ("Beyea Report").[7]

2. Availability of dry storage as an alternative to pool storage

Dry storage is an alternative to wet storage that involves placement of the spent fuel in containers (casks or canisters) that are filled with a noncorrosive gas such as helium. Cooling is achieved by convective (*i.e.,* passive) circulation of air over the fuel containers. In comparison with high-density pool storage, dry storage is more expensive because it requires the purchase and installation of new equipment. However, dry storage eliminates the potential for a pool fire and, if properly executed, dramatically reduces the potential for other modes of release of the radioactive material in spent fuel. Thompson Report, § 8. Thus, the expense is well-justified. *Id.,* § 9; Beyea Report, Tables 4 and 5.

To this date, Entergy has not implemented dry storage at the Pilgrim nuclear power plant.

B. Pilgrim license renewal application

Entergy's license for the Pilgrim nuclear power plant is due to expire in 2012. On January 25, 2006, Entergy submitted an application to the NRC for renewal of its operating license for an addition 20-year term, or until 2032. Entergy License Renewal Application, Pilgrim Nuclear Power Station ("License Renewal Application"). As required by 10 C.F.R. § 51.53(c), the license renewal application included an ER, which purported to address the site-specific environmental impacts of the proposed operation during the renewal term and other related issues. Pilgrim License Renewal Application, Appendix E, Applicant's Environmental Report ("Pilgrim ER"). The Pilgrim ER

7 A copy of Dr. Beyea's report is attached to the Declaration of Dr. Jan Beyea in Support of Massachusetts Attorney General's Contention and Petition for Backfit Order (DATE), which is included as Exhibit 2 to this pleading.

addresses the environmental impacts of accidents in Section 4, relying to a significant extent on the License Renewal GEIS for the evaluation of environmental impacts. *See* ER at 4-1, 4-31. In response to its regulatory obligation to identify "new and significant" information regarding the environmental impacts of license renewal, Entergy also states that it is aware of none. ER at 5-2, citing 10 C.F.R. § 51.53(c)(3)(iv).

V. CONTENTION: THE ENVIRONMENTAL REPORT FOR RENEWAL OF THE PILGRIM NUCLEAR POWER PLANT FAILS TO SATISFY NEPA BECAUSE IT DOES NOT ADDRESS THE ENVIRONMENTAL IMPACTS OF SEVERE SPENT FUEL POOL ACCIDENTS.

A. Contention

The Pilgrim ER does not satisfy the requirements of 10 C.F.R. § 51.53(c)(3)(iv) and NEPA, 42 U.S.C. § 4332 *et seq.*, because it fails to address new and significant information regarding the reasonably foreseeable potential for a severe accident involving nuclear fuel stored in high-density storage racks in the Pilgrim fuel pool. Although an NRC-sponsored study conducted as early as 1979 raised the potential for a severe accident in a high-density fuel storage pool if water is partially lost from the pool (NUREG/CR-0649, *Spent Fuel Heatup Following Loss of Water During Storage* (March 1979) ("1979 Sandia Report")), the NRC has failed to take that risk into account in every EIS it has prepared, including the 1979 GEIS on the environmental impacts of fuel storage; the 1990 Waste Confidence rulemaking (Review and Final Revision of Waste Confidence Decision, 55 Fed. Reg. 38,474, 38,481 (September 18, 1990) ("1990 Waste Confidence Rulemaking"); and the 1996 License Renewal GEIS on which the Pilgrim license renewal application relies. Moreover, the environmental impacts of a pool accident were not considered in the 1972 EIS issued in support of the original operating license for the Pilgrim nuclear power plant (Final Environmental Statement Related to

Operation of Pilgrim Nuclear Power Station, Boston Edison Company, Docket No. 50-293 (May 1972) ("1972 Pilgrim EIS")).

Significant new information now firmly establishes that (a) if the water level in a fuel storage pool drops to the point where the tops of the fuel assemblies are uncovered, the fuel will burn, (b) the fuel will burn regardless of its age, (c) the fire will propagate to other assemblies in the pool, and (c) the fire may be catastrophic. *See* Thompson Report and Beyea Report. This new information has also been confirmed by the NRC Staff in NUREG-1738, *Final Technical Study of Spent Fuel Pool Accident Risk and Decommissioning Nuclear Power Plants* (January 2001) ("NUREG-1738"), and by the National Academies of Sciences. *See* NAS Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, *Safety and Security of Commercial Spent Nuclear Fuel Storage* at 53-54 (The National Academies Press: 2006) ("NAS Report").[8]

Moreover, significant new information, including the attacks of September 11, 2001 and the NRC's response to those attacks, shows that the environmental impacts of intentional destructive acts against the Pilgrim fuel pool are reasonably foreseeable. Taken together, the potential for severe pool accidents caused by intentional malicious acts and by equipment failures and natural disasters such as earthquakes is not only reasonably foreseeable, but is likely enough to qualify as a "design-basis accident," *i.e.*, an accident that must be designed against under NRC safety regulations. Thompson Report, §§ 6,7,9.

The ER also fails to satisfy 10 C.F.R. § 51.53(c)(3)(iii) because it does not consider reasonable alternatives for avoiding or reducing the environmental impacts of a

8 Relevant excerpts of NUREG-1738 and the NAS Report are attached as Exhibits 3 and 4, respectively.

severe spent fuel accident, *i.e.*, SAMAs. Alternatives that should be considered include re-racking the fuel pool with low-density fuel storage racks and transferring a portion of the fuel to dry storage.

This contention is supported by the expert declarations and reports of Drs. Gordon Thompson and Jan Beyea regarding the likelihood and consequences of spent fuel pool accidents at the Pilgrim nuclear power plant. *See* Exhibits 1 and 2.

B. Basis for Contention

NEPA requires that new and significant information, not considered in any prior EIS for a proposed action, must be considered in a supplemental EIS if (a) the new information arises before the final action is taken, and (b) the new information shows that the environmental impacts of the proposed action would be significantly different than the impacts presented in the EIS. *Marsh, supra*; 10 C.F.R. § 51.53(c)(3)(iv). Here, significant new information, not previously considered by the NRC in any EIS, shows that the impact of high-density spent fuel pool storage at Pilgrim would be significantly greater than contemplated in prior EISs. Therefore the NRC must consider the environmental impacts of a pool accident in a supplemental EIS for the Pilgrim license renewal decision.

This contention also meets the standard established in *Harris* for pleading an admissible contention seeking consideration of a severe accident in an EIS, because it presents sufficient information to create a "genuine material dispute of fact or law adequate to warrant further inquiry" into the question of whether the likelihood of a pool fire falls within the range of probability considered reasonably foreseeable by the NRC. *Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), LBP-00-19, 52 NRC

85, 97-98 (2000), affirmed on other grounds, CLI-01-11, 53 NRC 370 (2001).[9] In addition, it meets the standard established in *Limerick Ecology Action v. NRC,* that a party may litigate the question of whether NEPA requires consideration of the environmental impacts of intentional and malicious acts against a nuclear facility by presenting sufficient evidence to challenge the factual basis for the policy against such consideration. *See* note 5 above.

1. The potential for a pool fire has not been considered in any previous EIS.

As discussed above in the contention, new information regarding the potential for a pool fire is presented in NUREG-1738, the NAS Report, and the Thompson Report. All of these documents were written after the issuance of the License Renewal GEIS, and therefore they qualify as "new information" for purposes of requiring a supplemental EIS. As the Court recognized in *Hodges v. Abraham,* 300 F.3d 432, 447 (4th Cir. 2002), an agency may review and consider previously issued NEPA documents in determining whether to supplement an EIS. Here, the history of NRC's NEPA consideration of spent fuel storage risks shows that although the NRC has been aware of the risks of high-

---

9 While the ASLB later ruled that the one accident scenario it selected for litigation in the *Harris* case was "remote and speculative" [LBP-01-09, 53 NRC 239, 271], that decision is not dispositive here, by virtue of significant factual differences, including differences in the plants' designs. While Harris is a pressurized water reactor ("PWR"), Pilgrim is a boiling water reactor ("BWR"). As a PWR, Harris has two major design features which render it less vulnerable than Pilgrim to a pool fire: first, the fuel pools are partially below ground, and second, the pools are in a separate building from the reactor building. In contrast, the pool at Pilgrim is above ground, and therefore it is more vulnerable to a breach in the pool wall or floor. NAS Report at 33. Unlike Harris, the Pilgrim pool is also located in the same building as the reactor. Given an early release from the Pilgrim reactor as part of a core-melt accident, hot gases and radioactive material from the reactor would spread throughout the building. The radiation field and the thermal environment would be more extreme than would be the case in the Harris pool building if two of the pools in that building were to suffer fires. Thompson Report, § 6.

density fuel pool fires for many years, it has not publicly disclosed or analyzed that risk in any EIS. Nor has the NRC updated the License Renewal GEIS to address the additional information about the risks of pool fires that has accumulated over the years since publication of the License Renewal GEIS. Thus, the NRC has failed to take the "hard look" required by NEPA. *Marsh,* 490 U.S. at 374.

a. The EIS for the original Pilgrim license and other nuclear power plant licenses did not consider impacts of pool accidents.

Since the early 1980's, the EISs for the licensing of all U.S. nuclear plants have considered the potential for severe accidents. This consideration has been based on the findings of the Reactor Safety Study (WASH-1400) (1975). As later summarized by the NRC, the Reactor Safety Study concluded that the risks of beyond design-basis accidents in the low-density spent fuel storage pools in use at that time were "orders of magnitude" below the risks of reactor core accidents, because of the "simplicity of the spent fuel storage pool design." NUREG-1353, Regulatory Analysis for the Resolution of Generic Issue 82, "Beyond Design-basis Accidents in Spent Fuel Pools" at ES-1 (April 1989) ("NUREG-1353"). The simple features of low-density spent fuel storage were:

> (1) the coolant is at atmospheric pressure, (2) the spent fuel is always subcritical and the heat source is low, (3) there is no piping which can drain the pool and (4) there are no anticipated operational transients that could interrupt cooling or cause criticality.

Id. at ES-1. Thus, the 1972 EIS for the Pilgrim plant, where spent fuel initially was stored in low-density racks, had no reason to address the environmental impacts of pool accidents.

Shortly after WASH-1400 was published, then-President Carter cancelled the national program for reprocessing of spent fuel, and licensees began to use high-density

racks to store an ever-increasing inventory of spent fuel at nuclear power plant sites. This decision to store an increasing volume of spent fuel onsite led to the use of high-density storage racks, which "results in a larger inventory of fission products in the pool, a greater heat load on the pool cooling system, and less distance between adjacent fuel assemblies." NUREG-1353 at ES-1.

b. The 1979 Sandia Report showed risks of high-density pool storage.

In March of 1979, the NRC published a report by one of its contractors, Sandia National Laboratories, showing that in the case of total, instantaneous drainage of water from a pool, densely packed spent fuel, even a year after discharge, would likely heat up to the point where its zircaloy cladding would burst and then catch fire. Analysis in the report also showed that partial drainage would be a more severe condition, causing older fuel to ignite. 1979 Sandia Report. *See* Thompson Report, § 2.

c. The 1979 GEIS did not address pool fire risks.

In August of 1979, several months after publishing the 1979 Sandia Report, the NRC issued the 1979 GEIS, which constitutes the only EIS the NRC ever prepared for the specific purpose of evaluating spent fuel storage impacts. Using the assumption that all pool storage space as originally designed had been expanded by re-racking with medium-density or high-density storage racks (*see* 1979 GEIS at 3-2), the GEIS examined the impacts of fuel storage in pools and found that storage of fuel in pools "has an insignificant impact on the environment." *Id.* at 8-2.

Despite the recent publication of the 1979 Sandia Report, the GEIS made no mention of the potential for a pool fire in high-density fuel storage pools. The GEIS'

only reference to the 1979 Sandia Report was to cite it as a footnote to the following statement:

> Assuming that the spent fuel stored at an independent spent fuel storage installation is at least one year old, calculations have been performed to show that loss of water should not result in fuel failure due to high temperatures *if proper rack design is employed.*[28]
>
> ———
>
> 28. "Spent Fuel Heatup Following Loss of Water During Storage," Report NUREG/CR-0649, March.1979.

1979 GEIS at 4-21 (emphasis added). But the GEIS did not mention the fact that the only rack design that could have been deemed "proper" by the authors of the 1979 Sandia Report was a low-density rack design, because Sandia had found that fuel stored in a high-density rack would burn if water were lost from the pool.

Thus, the 1979 GEIS purported to take account of the 1979 Sandia Study, but actually did not address the known, significant risk implications of the study, thereby failing to satisfy the "hard look" standard for an EIS. *Robertson,* 490 U.S. at 349; *Marsh,* 490 U.S. at 374. *See also Hughes River Watershed Conservancy v. Agriculture Dept.*, 81 F.3d 437, 446 (4th Cir. 1996) (holding that in order for an EIS to serve its functions of informing decision-makers and the public, it is "essential" that the EIS not be based on "misleading" assumptions).

d. The 1990 Waste confidence rulemaking ignored the risk of pool fires.

The NRC next addressed the environmental risks of spent fuel storage in the 1990 revision to the Waste Confidence rulemaking, where the agency examined the environmental impacts of storing spent fuel at reactor sites for an additional 30 years pending the opening of a final repository. 1990 Waste Confidence Rulemaking Notice,

55 Fed. Reg. 38474. In response to comments on the potential for spent fuel pool accidents, the Commission asserted that it had spent "several years" studying "in detail" the "catastrophic loss of reactor spent fuel pool water possibly resulting in a fuel fire in a dry pool." 55 Fed. Reg. at 38,481.[10] The NRC made no mention of the 1979 Sandia Report, however, which had found that partial loss of water from a pool posed a more serious risk than complete and instantaneous drainage.

Moreover, while the NRC cited NUREG-1353 (*id.* at 38,481), it failed to note the observation in NUREG-1353 that: "some laboratory studies have provided evidence of the possibility of fire propagation between assemblies in an air cooled environment." NUREG-1353 at ES-1. Nor did the NRC respond to the recommendation of NUREG-1353 that the NRC undertake a "re-examination" of the risks of spent fuel pool accidents. NUREG-1353 at ES-1.

Finally, the NRC asserted that BWR fuel aged over six months would not burn, although NUREG-1353 considered only low- and medium-density BWR racks, not high-density racks (see pp 4-9 to 4-11 of NUREG-1353).

c. The License Renewal GEIS merely repeated the inadequate analysis in the 1990 Waste Confidence rulemaking.

In the rulemaking notice for the license renewal rule, the Commission claimed to have generically considered the environmental impacts of on-site spent fuel storage in the

---

10 The NRC also cited a set of technical studies, all of which evaluated a total and instantaneous loss of water from the pool rather than partial water loss: NUREG/CR-4982, *Severe Accidents in Spent Fuel Pools in Support of Generic Issue 82* (1987); NUREG/CR-5176, *Seismic Failure and Cask Drop Analysis of the Spent Fuel Pools at Two Representative Nuclear Power Plants* (1989); NUREG/CR-5281, *Value/Impact Analysis of Accident Preventative and Mitigative Options for Spent Fuel Pools;* NUREG-1353, *Regulatory Analysis for the Resolution of Generic Issue 82, Beyond Design-basis Accidents in Spent Fuel Pools* (1989). *See* Thompson Report, § 2.

context of the NRC's GEIS for license renewal. Final Rule, Environmental Review for Renewal of Nuclear Power Plant Operating Licenses, 61 Fed. Reg. 66,537, 66,538, (December 18, 1996). According to the GEIS, the environmental impacts of pool storage of spent fuel are very small. As summarized in an appendix to the NRC's regulations for implementation of NEPA:

> The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on a site with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage area is not available.

Table B-1 of 10 CFR 51, Subpart A, Appendix B to 10 C.F.R. Part 51. *See also* License Renewal GEIS at 6-83.

The License Renewal GEIS also states that "[c]urrent and potential environmental impacts from spent-fuel storage have been studied extensively and are well understood." *Id.* at 6-8 3. But the License Renewal GEIS contains no new analysis of the potential for spent fuel pool accidents, and appears to rely entirely on the 1990 Waste Confidence rulemaking. *Id.* (referring to "generic determination of no significant environmental impact in [NRC] regulations at 10 CFR 51.23," which was promulgated in the Waste Confidence rulemaking.

2. Only the 1979 GEIS has evaluated the environmental impacts of deliberate and malicious acts against spent fuel pools.

The 1979 GEIS contains an appendix which discusses the potential impacts of a deliberate attack on a fuel pool. *Id.*, Appendix J. The GEIS postulated an attack by up to 83 adversaries, and damage to between one and 1,000 fuel assemblies by high-explosive charges. But the analysis was insufficient to address the environmental impacts of a deliberate attack on the fuel because it underestimated the potential for a pool fire if the

explosives succeeded in lowering the pool's water level.

Since the 1979 GEIS was published, the NRC has declined to consider the impacts of deliberate or malicious acts against fuel pools or any other aspect of nuclear facilities in an EIS, including the License Renewal GEIS. *See* License Renewal GEIS at 5-18 and discussion above in Section III.B.3.b.

3. Significant new information shows the reasonably foreseeable potential for a pool fire, and that the consequences are high.

Significant new information, not considered by the NRC in any previous EIS, shows that the potential for a severe fire in Pilgrim's high-density fuel storage pool is significant and that the consequences of such a fire would be extreme.

a. Significant new information shows that fuel of any age will burn if uncovered.

Significant new information, consisting primarily of the attached Thompson Report and two government-sponsored studies -- NUREG-1738 and the NAS Report -- undermines the conclusion of the NRC's previous EISs that (1) only recently discharged fuel will burn, and (2) complete drainage of a fuel pool is a more severe case than partial drainage. *See* 1990 Waste Confidence Rulemaking Notice, 55 Fed. Reg. at 38,481. Total or partial loss of water from a fuel pool containing high-density racks will initiate either an air-zirconium reaction or a steam-zirconium exothermic reaction within hours. Thompson Report, § 2. Once initiated, this reaction could spread to nearby, previously uninvolved, fuel assemblies. A significant fraction of the pool's inventory of radioactive isotopes, notably cesium-137, could be released to the atmosphere and would then travel downwind as a plume, causing extensive environmental contamination. *See* Beyea Report.

In NUREG-1738, the NRC Staff also reached the conclusion that regardless of the age of the fuel in a pool, the fuel will burn shortly after the tops of the fuel assemblies are uncovered. *Id.* at 2-1 – 2-2. As summarized in the report, adiabatic heatup of the fuel, caused by disruption of the passive cooling process, may cause a radioactive release within 24 hours after the fuel assemblies are uncovered, even for fuel aged five years. *Id.* at 2-2.

In a subsequent study which focused on the vulnerability of fuel pools to attack, a committee of the National Academies of Sciences ("NAS"), which included former NRC official Robert Bernerno, reviewed NUREG-1738 and other more recent studies that followed on the work done in NUREG-1738. While a significant portion of the report was classified, the unclassified portion of the report reported the committee's general conclusions that:

> For some scenarios, the fuel could be air cooled within a relatively short time after its removal from the reactor. If a loss-of-coolant event took place before the fuel could be air cooled, however, a zirconium cladding fire could be initiated if no mitigative actions were taken. Such fires could release some of the fuel's radioactive material inventory to the environment in the form of aerosols.
>
> For a partial-loss-of-pool-coolant event, the analysis indicates that the potential for zirconium cladding fires would exist for an even greater time (compared to the complete-loss-of-pool-coolant event) after the spent fuel was discharged from the reactor because air circulation can be blocked by water at the bottom of the pool. Thermal coupling between circulation can be blocked by water at the bottom of the pool. However, this heat transfer model has been modeled simplistically in the MELCOR runs performed by Sandia.
>
> If the water level is above the top of the fuel racks, decay heat in the fuel could cause the pool water to boil. Once water levels fall below a certain level in the fuel assembly, the exposed portion of the fuel cladding might heat up sufficiently to ignite if no mitigative actions were taken. This could result in the release of a substantial fraction of the cesium inventory to the environment in the form of aerosols.

NAS Report at 53-54 (footnote omitted).

Thus, new information shows the existence of a class of severe pool accident scenarios that have not been previously evaluated or that have been evaluated improperly, either generically or for the Pilgrim site.

b. Significant new information shows the credibility of events leading to a fuel pool accident

Significant new information also shows that total or partial loss of water from a fuel pool, either through equipment failure or deliberate malicious acts, is not a remote or speculative event. For a variety of scenarios, including external and internal events and deliberate and malicious acts, a severe pool accident is a credible and reasonably foreseeable event. Indeed, the estimated probability for a number of scenarios is within the range considered by the NRC to constitute a design-basis accident, which must not only be discussed in an ER and EIS, but which must be designed against under NRC safety regulations. *See* Section VII. below.

i. Accidents caused by human error, equipment failure, and natural forces are credible.

As discussed in Section 6 of the attached Thompson report, a number of credible scenarios may lead to a severe accident in the Pilgrim fuel pool. Many reactor core melt scenarios would involve the interruption of cooling to the pool. Moreover, the high-radiation field produced by a reactor core accident could initiate or exacerbate a pool fire by precluding the presence and functioning of operating personnel. Making the reasonable assumption that the conditional probability of a pool fire accompanying an early containment release is 50%, the overall estimated likelihood of a pool fire, excluding acts of malice, is on the order of two per 100,000 years (2×10^{-5}). This level of

probability is well within the range that NRC considers to qualify as a design-basis accident under the *PFS I* standard, and therefore is cognizable under NEPA.

ii. Accidents caused by intentional malicious acts are credible.

The License Renewal GEIS offers two principal bases for the NRC's refusal to consider the environmental impacts of sabotage, terrorist attacks and other intentional malicious acts in its NEPA review for license renewal: their likelihood is not quantifiable, and that in any event this type of accident is "not reasonably expected." License Renewal GEIS at 5-18. The position taken by the Commission in the GEIS is consistent with other pronouncements by the NRC. *See* discussion in Section III.B.3.b above.

Significant new information shows that the Commission's factual basis for refusing to consider the environmental impacts of deliberate and malicious acts in the License Renewal GEIS is no longer viable, and therefore may be challenged in this proceeding under 10 C.F.R. § 51.53(c)(3)(iv). Most significantly, the NRC's assertion that deliberate malicious acts are not "foreseeable" for purposes of preparing an EIS is contradicted by the agency's own response to the events of September 11, which shows not only that the NRC considers terrorist attacks on nuclear facilities to be foreseeable, but that that defending against them is an extremely high priority.

As of September 11, 2001, it is now clear that terrorists are both capable of and intent upon causing major damage to life and property in the United States. As observed by the ASLB in a 2001 decision:

> Regardless of how foreseeable terrorist attacks that could cause a beyond-design-basis accident were prior to the terrorist attacks of September 11, 2001, involving the deliberate crash of hijacked jumbo jets into the twin towers of the World

> Trade Center in New York City and the Pentagon in the Nation's capital, killing thousands of people, it can no longer be argued that terrorist attacks of heretofore unimagined scope and sophistication against previously unimaginable targets are not reasonably foreseeable. Indeed, the very fact that these terrorist attacks occurred demonstrates that massive and destructive terrorist acts can and do occur and closes the door, at least for the immediate future, on qualitative arguments that such terrorist attacks are always remote and speculative and not reasonably foreseeable.

Duke Cogema Stone and Webster (Savannah River Mixed Oxide Fuel Fabrication Facility), LBP-01-35, 54 NRC 403, 446 (2001), *reversed,* CLI-02-24, 56 NRC 335 (2002).[11]

Moreover, as the NRC itself has recognized, the September 11 events were by no means the first sub-national attacks on major strategic targets. Two events in 1993 -- the bombing of the World Trade Center parking garage and the intrusion into the Three Mile Island security area and turbine building by a station wagon – had already prompted the NRC to promulgate a rule protecting nuclear power plants against vehicle bombs. *See* Final Rule, Protection Against Malevolent Use of Vehicles at Nuclear Power Plants, 59 Fed. Reg. 38,889, 38,891 (August 1, 1994).[12]

---

11 In that case, the ASLB admitted a contention seeking NEPA consideration of the environmental impacts of a terrorist attack on a proposed factory for fabrication of plutonium-based nuclear power plant fuel. Although the Commission later reversed the ASLB's decision, the ASLB's comment remains trenchant.

12 Other events of the last two decades include the 1983 bombing of the Marine barracks in Beirut; the 1995 bombing of the Federal Courthouse in Oklahoma City; the 1993 plot to bomb the United Nations Building, FBI offices in New York City, the Lincoln Tunnel, the Holland Tunnel, and the George Washington Bridge; the 1995 release of SARIN nerve gas in the Tokyo subway; the 1998 bombing of the U.S. embassies in Tanzania and Kenya; the 2002 bombing of the U.S.S. Cole; and the 2004 bombing of commuter trains in Madrid, Spain.

Moreover, leaders of adversarial sub-national groups have openly admitted that nuclear power stations are near the top of their lists as targets for attacks on civilians in the United States. On October 30, 2001, for example, the Washington Post reported on an interview with a jailed disciple of Osama bin Laden who said there are "more important

Since September 11, the NRC has only increased its level of vigilance and preparedness against attacks on nuclear facilities. As summarized by the Chairman of the NRC:

> awareness, resources, and vigilance were there [before September 11], but all went to a higher level when 9/11 showed the determination of enemies of the United States to attack our people and our way of life.

Remarks by NRC Chairman Nils J. Diaz to the Joint NRC/DHS State Security Outreach Workshop (June 17, 2003). Thus, in cooperation with the Department of Homeland Security ("DHS"), the NRC established a series of graded threat levels and associated protective measures, whose purpose was to keep the government in a state of readiness to respond to a threat that was now perceived as persistent.[13]

---

places, like atomic plants and reactors" that may have been more appropriate targets than the World Trade Center. William Branigan, *In Afghan Jail, a Terrorist Who Won't Surrender,* Washington Post, October 30, 2001.

13 NRC Regulatory Issue Summary 2002-12A, Power Reactors, NRC Threat Advisory and Protective Measures System (August 19, 2002). Notably, the President also has identified nuclear power plants as "key assets" that are "most critical in terms of national-level public health and safety, governance, economic and national security, and public confidence consequences." National Strategy for the Physical Protection of Critical Infrastructures and Key Assets at vii, xii (February 2003). This report can be found on the internet at http://www.whitehouse.gov/pcipb/physical.html

Other federal agencies have also acknowledged that nuclear power plants are particularly attractive targets because of the widespread health and economic damage they can cause if successfully attacked. As summarized by former FBI Director Robert S. Mueller:

> . . . America is awash in desirable targets – those that are symbolic like the U.S. Capitol and the White House – as well as the many infrastructural targets, lie nuclear power plants, mass transit systems, bridges, and tunnels, shipping and port facilities, financial centers, and airports – that if successfully hit, would cause both mass casualties and a crippling effect on our economy."

Testimony before the Senate Committee on Intelligence of the United States Senate (February 16, 2005).

Thus, after September 11, the NRC began to treat attacks by sub-national adversaries as an inevitable and constant threat requiring perpetual vigilance and preparedness. The NRC's efforts undermine its claim that the potential for such attacks is "remote and speculative." *See PFS II,* 56 NRC at 348-350.

iii. Fuel pools are vulnerable to attack.

A range of means is available to intentionally initiate a pool fire at the Pilgrim plant. Thompson Report, § 7 and Table 7-1. Moreover, both the NRC Staff and the National Academies of Sciences have found that spent fuel storage pools are vulnerable to intentional damage. As the NRC Staff conceded in a 2001 memorandum to the Commissioners:

> Until recently, the staff believed that the DBT [design-basis threat] of radiological sabotage could not cause a zirconium fire. However, NUREG-1738 does not support the assertion of a lesser hazard to the public health and safety, given the possible consequences of sabotage-included uncovery of the fuel in the SFP when a zirconium-fire potential exists.

SECY-01-0100, Memorandum to the Commissioners from William D. Travers, Executive Director for Operations ("EDO") re: Policy Issues Related to Safeguards, Insurance, and Emergency Preparedness Regulations at Decommissioning Nuclear Power Plants Storing Spent Fuel in Spent Fuel Pools (WITS 200000126) (June 4, 2001), attachment at 13.[14] The memorandum went on to say that the NRC is "conducting detailed analyses of the effects of the DBT of radiological sabotage on SFPs," and that it will "use the results of these analyses to determine, on a plant-specific basis, whether

14 A zirconium-induced fire potential exists in virtually any high-density spent fuel pool that is filled with fuel, or even partially filled, as is the case at the Pilgrim nuclear plant. Thompson Report, § 2.

radiological sabotage can result in conditions which could lead to zirconium fires at a decommissioning plant." *Id.* Thus, by embarking on its own investigation into the vulnerability of spent fuel pools to sabotage-included fires, the Staff has effectively conceded that acts of malice against spent fuel are credible and worthy of consideration in the NRC's NEPA decision-making process.

The NAS Report also reports a similar conclusion:

> A terrorist attack that either disrupted the cooling system for the spent fuel pool or damaged or collapsed the pool itself could potentially lead to a loss-of-pool-coolant event. The cooling system could be disrupted by disabling or damaging the system that circulates water from the pool to heat exchangers to remove decay heat. This system would not likely be a primary target of a terrorist attack, but it could be damaged as the result of an attack on the spent fuel pool or other targets at the plant (e.g., the power for the pumps could be interrupted.) The loss of cooling capacity would be of much greater concern were it to occur during or shortly after a reactor offloading operation, because the pool would contain a large amount of decay heat.

NAS Report at 48. The NAS committee also evaluated studies of aircraft crashes and assaults on fuel pools using explosives, and reported that:

> . . . there are some scenarios that could lead to the partial failure of the spent fuel pool wall, thereby resulting in the partial or complete loss of pool coolant. A zirconium cladding fire could result if timely mitigative actions to cool the fuel were not taken.

NAS Report at 49. Notably, the NAS was not able to give any details in support of its conclusion, but referred instead to a classified report for that information. *Id.*

c. **The NRC has adequate qualitative tools to evaluate the potential for intentional malicious acts against the Pilgrim plant.**

In the License Renewal GEIS, the NRC asserts its inability to quantify the likelihood of sabotage as a rationale for refusing to address its impacts in an EIS. GEIS at 5-18. The fact that the risk of sabotage may not be easily quantifiable is not an excuse

for failing to address it in an EIS, however. As provided in the Council on Environmental Quality's regulations implementing NEPA, 40 C.F.R. § 1502.22, the agency must make an attempt to evaluate reasonably foreseeable significant adverse effects if the costs of obtaining the information are not exorbitant. Even if the costs of obtaining the information are exorbitant, the agency must acknowledge that the information exists but is unavailable, make a statement of the relevance of the information to the evaluation of impacts in the EIS, summarize existing relevant and credible scientific evidence, and provide the agency's evaluation of the impacts based on generally accepted theoretical approaches or research methods. *See also* 10 C.F.R. § 51.71 ("To the extent that there are important qualitative considerations or factors that cannot be quantified, these considerations or factors will be discussed in qualitative terms.").

In fact, the Commission has already shown itself capable of qualitatively analyzing the potential for intentional destructive acts against nuclear facilities. By proceeding with the 1994 vehicle bomb rulemaking, which was directly responsive to the World Trade Center bombing and the Three Mile Island vehicle intrusion incident, the Commission abandoned its previous position that the difficulty of quantifying the probability of such events means that they can be ignored. While the Vehicle Bomb rule was promulgated under the AEA rather than NEPA, the rationale for the rule is relevant here because it demonstrates that the NRC has the capacity and information necessary to perform a qualitative analysis of the potential for deliberate and malicious acts. In that instance, the NRC performed a "conditional probabilistic risk analysis" to assess the vulnerability of a nuclear power plant to a vehicle bomb. Vehicle Bomb Rule, 59 Fed.

Reg. at 38,891. In using the findings of this analysis to develop the vehicle-bomb rule, the NRC took a qualitative approach to assessing the probability of a vehicle-bomb event.

In the preamble to the rule, the Commission explicitly recognized that even if the likelihood of malicious or insane acts cannot be quantified, they may not be ignored:

> Over the past several years, a number of National Intelligence Estimates have been produced addressing the likelihood of nuclear terrorism. The analyses and conclusions are not presented in terms of quantified probability but recognize the unpredictable nature of terrorist activity in terms of likelihood. The NRC continues to believe that, although in many cases considerations of probabilities can provide insight into the relative risk of an event, in some cases it is not possible, with current knowledge and methods, to usefully quantify the probability of a specific vulnerability threat.
>
> The NRC notes that, although not quantified, its regulatory analysis recognizes the importance of the perception of the likelihood of an attempt to create radiological sabotage in assessing whether to redefine adequate protection. The NRC's assessment that there is no indication of an actual vehicle threat against the domestic commercial nuclear industry was an important consideration in concluding that neither the Three Mile Island intrusion nor the World Trade Center bombing demonstrated a need to redefine adequate protection.
>
> The NRC does not agree that quantifying the probability of an actual attack is necessary to a judgment of a substantial increase in overall protection of the public health and safety (a less stringent test of the justification of for a rule change). *Inherent in the NRC's current regulations is a policy decision that the threat, although not quantified, is likely in a range that warrants protection against a violent external assault as a matter of prudence.*

59 Fed. Reg. at 38,890-9 (emphasis added). The NRC further elaborated on what it meant by it use of the term "likely," by identifying several factors that make up the "domestic threat environment" and noting the degree to which it had changed in recent years:

> The vehicle bomb attack on the World Trade Center represented a significant change to the domestic threat environment that ... eroded [our prior] basis for concluding that vehicle bombs could be excluded from any consideration of the domestic threat environment. For the first time in the United States, a conspiracy with ties to Middle East extremists clearly demonstrated the capability and motivation to organize, plan and successfully conduct a major vehicle bomb

> attack. Regardless of the motivations or connections of the conspirators, it is significant that the bombing was organized within the United States and implemented with materials obtained on the open market in the United States. Accordingly, the Commission believes that the threat characterized in the final rule is appropriate.

Id., 59 Fed. Reg. at 38891. These same considerations continue to apply in the post-September 11 environment, and indeed are all the more persuasive of a sea change in the "domestic threat environment." Thus, motive, capacity, and the pattern of past incidents are relevant to a qualitative analysis.

Thus the circumstances of this case satisfy the NRC's qualitative standard for determining that deliberate and destructive acts against the Pilgrim spent fuel pool are reasonably foreseeable.

d. Other GEIS grounds for refusing to address impacts of deliberate malicious acts are invalid.

As additional grounds for refusing to consider the environmental impacts of intentional destructive acts, the GEIS asserts that NRC security regulations provide reasonable assurance that the risk from sabotage is small, and that the consequences of an intentionally caused accident would be "no worse than" the consequences of internally initiated events. *Id.* at 5-18. These rationales are invalid.

First, NEPA's procedural requirements are independent of the AEA, and must be satisfied regardless of an applicant's compliance with NRC regulations for implementation of the AEA. *Limerick Ecology Action v. NRC,* 869 F.2d at 730.

Second, the radiological consequences of a pool fire would be quite different from the consequences of a reactor accident, and in some respects worse. The principal radioactive isotopes released in a severe reactor accident are generally short-lived, and thus the most important concern in avoiding or mitigating those impacts is to evacuate

people as quickly as possible from the area. In contrast, the principal radioactive isotope released by a pool fire consists of cesium-137, which has a half-life of 30 years.[15] Immediate evacuation is still an important consideration, but long-term land contamination is an additional factor that must be planned for. The land area affected by a radiological release from a pool fire could be contaminated for decades, requiring permanent relocation of entire communities and their associated businesses, farms and institutions.

Moreover, the area of land contaminated by a release could be much larger for a pool fire than a reactor accident because the inventory of radioactivity that may be released from a pool is so much larger than the inventory of radioactivity that may be released from the core. As demonstrated in Table 3-3 of the Thompson Report, much more radioactive material is held in the pool than in the core.

In any event, even assuming for purposes of argument that the consequences of a reactor accident and a pool accident were the same, the SAMAs appropriate for each type of accident would be different. In considering the environmental impacts of sabotage, it is particularly important to consider SAMAs which could mitigate the impacts of sabotage. Using a combination of low-density wet storage and dry storage would virtually eliminate the vulnerability of the Pilgrim fuel pool to attack. *See* Thompson Report, § 8. Thus, NEPA requires a discussion of the environmental impacts of a pool fire, regardless of whether a pool fire's impacts would be bounded by the impacts of a reactor accident.

e. NRC's policy rationales in *PFS II* and *Diablo Canyon* are not supported.

15 While the reactor core contains cesium-137, the quantity is much smaller than the quantity of cesium-137 contained in the pool. Thompson Report, § 3.

In the *PFS II* and *Diablo Canyon* decisions, the Commission gave a number of policy and fact-based rationales for refusing to consider the environmental impacts of deliberate and malicious acts in its NEPA decisions. Petitioner will respond to them in this section of the contention.

In *Diablo Canyon* and *PFS II,* the Commission argued that the possibility of a terrorist attack is "too far removed from the natural or expected consequences of agency action to require a study under NEPA." *Diablo Canyon,* 57 NRC at 6-7, quoting *PFS II,* 56 NRC at 349. This argument must be rejected because it "runs counter to the evidence before the agency." *Southwest Center v. U.S. Forest Service,* 100 F.3d 1443, 1448 (9th Cir. 1996). In particular, the argument ignores the federal government's own determinations that nuclear facilities are highly attractive targets to terrorists, as well as the NRC's own actions demonstrating how seriously it takes the threat.

The Commission's ruling also is inconsistent with the agency's own long-established policy and practice of addressing the environmental impacts of external events in accident analyses conducted under NEPA. *Sierra Club v. NRC,* 862 F.2d 222, 228 (9th Cir. 1988) (reversing a decision that was "contrary to the NRC's own policy (and one that accords with common sense)"). Under its own NEPA guidance, NRC considers accidents caused or exacerbated by a range of initiating events, including internal events (such as equipment failure) and external events (such as tornados, floods, earthquakes, and explosions at adjacent facilities). NUREG-1555, Environmental Standard Review Plan for Environmental Review for Nuclear Power Plants at 7.2-3 (October 1999). None of these external events would constitute "natural" consequences of operation of the Pilgrim nuclear power plant. If they were to occur while the plant is operating, however,

they could cause an accidental release of radioactivity to the environment, which would not have occurred had the nuclear facility not been licensed.[16]

In *Diablo Canyon* and *PFS II,* the Commission also argued that inquiries into the environmental impacts of terrorist attacks are not "manageable." *Diablo Canyon,* 57 NRC at 6-7, and *PFS II,* 56 NRC at 349 and note 33, quoting *Metropolitan Edison Co. v. People Against Nuclear Energy,* 460 U.S. 766, 776 (1983). According to the NRC, those who seek a NEPA evaluation of the environmental impacts of terrorist attacks effectively seek an open-ended, "worst-case" analysis that has "no stopping point." *PFS II,* 56 NRC at 354.

The Commission's citation to *Metropolitan Edison Co. v. People Against Nuclear Energy* is completely inapposite. In that case, the Supreme Court ruled that psychological effects posed by the risk of an accident at the Three Mile Island nuclear power plant were "too remote from the physical environment" to warrant preparation of an EIS. 460 U.S. at 774. The Supreme Court "emphasize[d]" that it was considering, in that case, "the effects caused by the *risk* of an accident." *Id.* (emphasis added). Here, in contrast, Petitioner is concerned about actual physical environmental effects in the event of a terrorist attack on the Pilgrim fuel pool. As the Court recognized in *Metropolitan*

---

16 In a footnote to *PFS II,* the Commission attempted to distinguish "natural" events from terrorist attacks on the ground that natural events are "closely linked to the natural environment of the area within which a facility will be located, and are reasonably predictable by examining weather patterns and geological data for that region." 56 NRC at 347, note 18. Attacks on nuclear facilities, however, are also "closely linked" to those facilities, in the sense that they are desirable targets. Furthermore, the Commission's argument that natural events are "reasonably predictable" amounts to a reprise of the claim that environmental impacts must be quantifiable in order to be cognizable. *See Limerick Appeal Board Decision,* 22 NRC at 701. As discussed above in Section V.B.3.c, the Commission itself disavowed this position in the Vehicle Bomb Rule. Finally, the Commission's position is inconsistent with 10 C.F.R. § 51.71, which requires a discussion of qualitative factors that cannot be quantified.

Edison, "[t]he situation where an agency is asked to consider effects that will occur if a risk is realized, for example, if an accident occurs at TMI-1, is an entirely different case," where its holding would not apply. *Id.* at 775.

In any event, the Commission's argument is directly contradicted by the agency's own pragmatic approach to evaluating the potential for specific types of terrorist attacks, as outlined in the 1994 Vehicle Bomb Rule. The Vehicle Bomb Rule demonstrates that it is possible to evaluate the potential for and credibility of attack scenarios, and to identify a range of reasonable alternatives for avoiding or mitigating the impacts of such attacks. Here, the Attorney General seeks a hearing on whether just such an analysis is required for the Pilgrim license renewal decision, including a full discussion of the potential consequences of a range of credible events involving destructive intentional acts against the Pilgrim spent fuel pool. The Attorney General also seeks an evaluation of a range of reasonable alternatives to the proposed action, including combined low-density pool storage and dry storage. It is only common sense that the analysis requested by Petitioner is no more open-ended than the analysis the NRC performed in promulgating the Vehicle Bomb Rule.

In the *Diablo Canyon* decision, the Commission also attempted to justify its exclusion of the Petitioners' environmental contentions on the ground that "NEPA's public process is not an appropriate forum for considering sensitive security issues." CLI-03-01, 57 NRC at 7. The Commission cited no legal basis, however, that would excuse it from compliance with NEPA. Without a specific and conflicting statutory basis, the mere sensitivity of information does not provide an excuse for noncompliance with NEPA. Compliance with NEPA is required "unless specifically excluded by statute

or existing law makes compliance impossible." *Limerick Ecology Action v. NRC,* 869 F.2d at 729, citing *Public Service Co. of New Hampshire v. NRC,* 582 F.2d 77, 81 (1st Cir.), *cert. denied,* 439 U.S. 1046 (1978). *See also Flint Ridge Development Corp. v. Scenic Rivers Association of Oklahoma,* 426 U.S. 776, 787-88 (1976).

Moreover, to the extent that the Commission is bound by legal requirements to protect sensitive information, the Commission has failed to demonstrate that those requirements render it "impossible" to consider the environmental impacts of deliberate and malicious against the Pilgrim fuel pool. In fact, the Commission's position is inconsistent with its own practice under another public participation statute, Section 189a of the AEA. 42 U.S.C. § 2239. The NRC has never denied a licensing hearing simply because sensitive, proprietary, or safeguards information may be discussed in the hearing. Instead, it implements procedures that limit access to sensitive information to parties who have signed confidentiality agreements.[17] The NRC can also use these procedures to limit access to sensitive information regarding the vulnerability of the Pilgrim fuel pool to the parties and interested government participants. The Commission also failed to recognize that it can *solicit* public comment, even if it does not disclose all the details of its environmental analysis. State and local governments, which have expertise in and responsibility for implementing back-up security and emergency response measures, also have valuable contributions to make to the decision-making process.

---

17 *See, e.g,* 10 C.F.R. §§ 2.744(e) (procedures for handling safeguards information in NRC hearings), 10 C.F.R. Part 2 Subpart I (procedures for handling classified information in NRC hearings); *Pacific Gas & Electric Company* (Diablo Canyon Nuclear Power Plant), ALAB-410, 5 NRC 1398, 1405 (1977) (granting intervenor's security expert access to confidential security plans during the operating license proceeding for Diablo Canyon).

Finally, the NRC ignores the fact that in numerous instances, other agencies such as the U.S. Department of Energy ("DOE") have prepared EISs containing information that was not accessible to the general public.[18] In none of these instances did the DOE refuse to prepare an EIS because it would involve the discussion of sensitive information. Instead, the publicly available version of the EIS redacted sensitive information. By following appropriate procedures and obtaining appropriate clearances, interested citizens and state and local governments may gain access to the information.

Finally, in *Diablo Canyon,* the Commission asserted that its refusal to prepare an EIS on the environmental impacts of a terrorist attack "comports with the practical realities of spent fuel storage and the congressional policy to encourage utilities to

---

18 For instance, the DOE has restricted circulation of some sensitive information, and withheld other information under the classification of "Official Use Only."For example, Appendix H of the DOE's EIS for the proposed Yucca Mountain high-level radioactive waste repository, which discusses consequences of accidents at the repository, is not in the hard copy of the EIS that was circulated to the public, nor is it on the internet. DOE/EIS-0250F, Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada at H-1 (February 2002). Instead, it was placed in Volume 4 of the Final EIS, which must be specially ordered from the DOE. *Id.*, Readers Guide at 3.

Another EIS prepared by the DOE contains an air transportation accident analysis that is not published in the publicly available version of the EIS, but is contained in an "Official Use Only document." DOE/EIS-236-S2, Draft Supplemental Programmatic Environmental Impact Statement on Stockpile Stewardship and Management for a Modern Pit Facility, Vol. II at C-15 and Tables C.4-1, C.4-2, C.4-3 (May 2003).

The DOE has also prepared EISs containing highly sensitive classified information. *See, e.g.*, DOE/EIS-0161, Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling, Vol. I at 2-1 (October 1995) (evaluating environmental impacts of recycling and production of tritium for nuclear weapons); DOE/EIS-0319, Final Environmental Impact Statement for the Proposed Relocation of Technical Area 18 Capabilities and Materials at the Los Alamos National Laboratory at iii, 5-1 (August 2002) (evaluating environmental impacts of sabotage on a DOE research facility).

provide for spent fuel storage at reactor sites pending construction of a permanent repository." CLI-03-01, 57 NRC at 7. Nothing in the Nuclear Waste Policy Act, however, exempts spent fuel storage from the requirements of NEPA. In fact, the statute specifically requires that the Commission's actions must be consistent with NEPA. 42 U.S.C. § 10152.

4. The consequences of a pool fire are different and potentially more severe than the consequences of a reactor accident.

It is important to consider the environmental impacts of a pool fire, because pool fire impacts are fundamentally different than the impacts of a reactor accident, and therefore have different implications for the consideration of alternatives. *See* discussion above in Section V.B.3.b.iv.

5. The ER and the EIS must discuss reasonable and feasible alternatives for avoiding or mitigating a pool fire.

As discussed above in Sections III.B.1.c and III.B.3.d, NEPA and the NRC's implementing regulations require the consideration of reasonable alternatives to the proposed action, including SAMAs for avoiding or mitigating the consequences of severe accidents. A range of options is available for reducing or avoiding the impacts of a pool fire, including returning the plant to its original design configuration of low-density pool storage of spent fuel and placing excess spent fuel in dry storage. Thompson Report, § 8. This option would allow the pool to survive a loss of water without damage to the fuel, thus avoiding a pool fire. *Id.* The technologies of low-density storage and dry storage are reasonable and feasible, and therefore should be considered. *Idaho Conservation League v. Mumma,* 956 F.2d 1508, 1519-20 (9th Cir. 1992).

VI. PETITION FOR IMPOSITION OF BACKFIT ORDER

As discussed above in Section III.A.1, the AEA, implementing regulations, and NRC precedents require the NRC to ensure that operation of the Pilgrim nuclear power plant does not pose an undue risk to public health and safety during the license renewal term. As the Commission observed in the preamble to the final license renewal rule, the purpose of the rule is to "ensure that operation during the period of extended operation is not inimical to the public health and safety." 56 Fed. Reg. at 64,945. *See also Petition for Emergency and Remedial Action,* 7 NRC at 404, citing *Power Reactor Development Corp.,* 367 U.S. at 402.

One of the NRC's key measures for ensuring adequate protection of the public is to require that its licensed facilities be designed against "design-basis accidents." *See* discussion above in section III.A.2. The NRC requires that reactor core accidents with a "realistic probability" (*i.e.,* a non-conservative probability) of at least one in ten million per year (10^{-7}) must be included in the design-basis. *PFS I,* 54 NRC at 259-60. By the reasoning of *PFS I,* the same threshold of probability should be set for pool accidents, because they also have a large source term (*i.e.,* inventory of radioactive material) that may be released by the driving force of the high heat of a fire.[19] As discussed above in

---

19 In the *PFS I* decision, the Commission chose a "threshold" probability of 10^{-6} for a design-basis accident at an independent spent fuel storage installation, rather than the 10^{-7} factor used for nuclear power plants. As the Commission explained, the difference in threshold probabilities for design-basis accidents for these two types of facilities is based on the significant difference in the potential consequences of an accident:

Section V.B.3.b and as demonstrated in the Thompson Report, §§ 6, 7, and 9, the frequencies for a range of spent fuel pool accident precursors fall well above the estimated probability level considered by the NRC to establish the "threshold" for a design-basis event. *PFS I,* 54 NRC at 259-60.[20]

There was no need to design against pool fire accidents at the time of initial licensing of Pilgrim in 1972, when the former licensee used open low-density racks to store a much smaller quantity of spent fuel. Now that the Pilgrim pool has been re-designed to include high-density storage racks, the design of the Pilgrim plant poses an undue safety risk of a pool fire. Therefore, pursuant to 10 C.F.R. § 50.109(a)(5), the Commission should require the backfitting of the Pilgrim nuclear plant by returning the

---

> The Commission has previously recognized that the 'public health and safety risks posed by ISFSI storage . . . are very different from the risks posed by the safe irradiation of the fuel assemblies in a commercial nuclear reactor, which requires the adequate protection of the public . . . in the conditions of high temperature and pressures under which the reactor operates.' . . . This is because the danger presented by irradiated fuel 'is largely determined by the presence of a driving force behind dispersion,' such as heat and pressure neither of which is present in an ISFSI. . . . Moreover, the radiological source term is lower at an ISFSI than at a reactor both because the spent fuel has decayed over time prior to placement in an ISFSI and because there are fewer fuel assemblies in an individual cask than in reactor. . . .

54 NRC at 265. [footnotes omitted]. As with a reactor accident, the "driving force," of the heat from a pool fire may disperse a very large amount of radioactive material into the environment. *See* Thompson Report, § 2. Thus, a pool accident is comparable to, and may in some cases be more severe than, the consequences of a reactor core melt accident.

20 In fact, the majority of accidents analyzed in NUREG-1150 fall well within the range of probabilities considered by the NRC to qualify as design-basis accidents. *See* Figure 8.6 of NUREG-1150, for example, which shows that both the median and the average core damage frequency for internal and external events at the Peach Bottom nuclear power plant (a BWR like Pilgrim) fall between 10^{-3} and 10^{-5}. This core damage frequency is at least two orders of magnitude above the NRC's threshold probability for a design-basis accident at a nuclear plant.

pool to its original low-density storage configuration and using dry storage for any excess fuel.

While current NRC regulations do not appear to provide for an adjudicatory hearing on the adequacy of any design changes ordered by the NRC, it is a subject on which the NRC should take comment from the interested public because a variety of potential measures for reducing spent fuel pool fire risks are available, with varying degrees of effectiveness. *See* Thompson Report, § 8. Thus, the Attorney General seeks a discretionary hearing on the adequacy of the design modifications proposed by the Commission.[21]

The choice of design measures could also have a significant impact on the quality of the human environment if the NRC chooses a design measure that is not adequate to prevent the risk of a fire. Thus, the Commission must comply with NEPA by publishing its proposed design measures in the draft EIS for renewal of the Pilgrim license. Such design measures are required by the Atomic Energy Act in order to ensure that during the license renewal term operation of the Pilgrim nuclear plant and associated fuel pool poses no undue risk to public health and safety. 42 U. 42 U.S.C. § 2133(d).

VII. CONCLUSION

For these reasons, the Commission should grant Petitioner a hearing regarding the issues raised in his contention. In addition, the Commission should initiate a proceeding for the backfitting of the Pilgrim nuclear power plant to protect against a design-basis accident involving a fire in the fuel pool.

---

21 In contrast, the Attorney General has the statutory right under NEPA to a hearing on the environmental contention raised in Section V of this pleading.

Respectfully submitted,
COMMONWEALTH OF MASSACHUSETTS

By its Attorneys,

THOMAS F. REILLY
ATTORNEY GENERAL

Diane Curran
Harmon Curran, Spielberg & Eisenberg, L.L.P.
1726 M Street N.W., Suite 600
Washington, D.C. 20036
202/328-3500
dcurran@harmoncurran.com

Matthew Brock, Assistant Attorney General
Environmental Protection Division
Office of the Attorney General
One Ashburton Place
Boston, MA 02108
617/727-2200
matthew.brock@ago.state.ma.us

May 26, 2006

CERTIFICATE OF SERVICE

I certify that on May 26, 2005, copies of the foregoing request for hearing, petition to intervene, and petition for a backfit order, were served on the following in the manner described below:

BY HAND:
Office of the Secretary
U.S. Nuclear Regultory Commission
11555 Rockville Pike
Rockville, MD 20852

Office of the General Counsel
U.S. Nuclear Regultory Commission
11555 Rockville Pike
Rockville, MD 20852

BY FEDERAL EXPRESS:
Terence A. Burke, Esq.
Entergy Nuclear
1340 Echolon Parkway
Mail-Stop M-ECH-62
Jackson, MS 39213

Diane Curran

EXHIBIT
1

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE COMMISSION

In the Matter of	)	
	)	
Entergy Nuclear Operations, Inc.	)	Docket No. 50-293
	)	
(Pilgrim Nuclear Power Station)	)	
	)	

DECLARATION OF DR. GORDON THOMPSON IN SUPPORT OF MASSACHUSETTS ATTORNEY GENERAL'S CONTENTION AND PETITION FOR BACKFIT ORDER

I, Gordon Thompson, declare as follows:

1. I am the executive director of the Institute for Resource and Security Studies (IRSS), a nonprofit, tax-exempt corporation based in Massachusetts. Our office is located at 27 Ellsworth Avenue, Cambridge, MA 02139. IRSS was founded in 1984 to conduct technical and policy analysis and public education, with the objective of promoting peace and international security, efficient use of natural resources, and protection of the environment. I am also a research professor at the George Perkins Marsh Institute, Clark University, Worcester, Massachusetts.

2. In support of the Massachusetts Attorney General's request for a hearing, petition to intervene, and backfit petition with respect to the license renewal proceeding for the Pilgrim nuclear power plant, I have prepared a report entitled "Risks and Risk-Reducing Options Associated with Pool Storage of Spent Nuclear Fuel at the Pilgrim and Vermont Yankee Nuclear Power Plants" (25 May 2006). In preparing my report, I reviewed the 25 January 2006 license renewal application filed by Entergy Nuclear Operations, Inc. (Entergy). I have also reviewed various correspondence and technical documents relating to the proposed license amendment and to risks of spent fuel storage, which are identified in the Attorney General's contention and in my Report.

3. The technical factual statements in my report are true and correct to the best of my knowledge, and the technical opinions expressed therein are based on my best professional judgment.

4. I am an expert in the area of technical safety, security and environmental analysis related to nuclear facilities. My Curriculum Vitae is provided here as Attachment A.

5. I received an undergraduate education in science and mechanical engineering at the

University of New South Wales, in Australia. Subsequently, I pursued graduate studies at Oxford University and received from that institution a Doctorate of Philosophy in mathematics in 1973, for analyses of plasmas undergoing thermonuclear fusion. During my graduate studies I was associated with the fusion research program of the UK Atomic Energy Authority. My undergraduate and graduate work provided me with a rigorous education in the methodologies and disciplines of science, mathematics, and engineering.

6. Since 1977, a significant part of my work has consisted of technical analyses of safety, security and environmental issues related to nuclear facilities. These analyses have been sponsored by a variety of nongovernmental organizations and local, state and national governments, predominantly in North America and western Europe. Drawing upon these analyses, I have provided expert testimony in legal and regulatory proceedings, and have served on committees advising US and UK government agencies. To illustrate my expertise, I provide more detailed information on my experience below.

7. I have conducted, directed, and/or participated in a number of studies that evaluated aspects of the design and operation of nuclear power plants with respect to severe accident probabilities and consequences. These include general studies and studies of individual plants. For instance, with respect to general studies, in 1986, I participated in the preparation of a study by the Union of Concerned Scientists of the potential for escape of radioactive material during a reactor core-melt accident (Sholly and Thompson, 1986). In the late 1980s, I was part of a team of four scientists which prepared a comprehensive critique of the state of the art of probabilistic risk assessment (PRA) for Greenpeace International (Hirsch et al, 1989). I published two chapters on the relevance of PRA to emergency planning in a book entitled *Preparing for Nuclear Power Plant Accidents* (Golding, et al., 1995). All of these studies required me to be highly familiar with the design and operation of nuclear power plants, as well as the characteristics of probabilistic risk assessment.

8. I have also done considerable work on the risks posed by individual nuclear facilities. In addition to performing the studies described elsewhere in this Declaration, I have studied the risks posed by the Seabrook and Harris plants (U.S.), the La Hague facility (France), and the Darlington and Pickering Stations (Canada). All of these studies required me to become familiar with the relevant details of the design and operation of the facilities involved.

9. To a significant degree, my work has been accepted or adopted by the governmental agencies involved. During the period 1978-1979, for example, I served on an international review group commissioned by the government of Lower Saxony (a state in Germany) to evaluate a proposal for a nuclear fuel cycle center at Gorleben. I led the subgroup that examined accident and security risks and alternative options with lower risk. One of the risk issues that I identified and analyzed was the potential for an exothermic reaction of fuel cladding in a high-density fuel pool if water is lost. I identified partial loss of water as a more severe condition than total loss of water. I identified and described alternative fuel storage options with lower risk. The Lower Saxony government accepted my findings and ruled that high-density pool storage was not an acceptable option at

Gorleben. As a direct result, policy throughout Germany has been to use dry storage, rather than high-density pool storage, for away-from-reactor storage of spent fuel.

10. My work has also influenced decision making by safety officials in the U.S. Department of Energy (DOE). During the period 1986-1991, I was commissioned by environmental groups to assess the safety of the military production reactors at the Savannah River Site, and to identify and assess alternative options for the production of tritium for the US nuclear arsenal. Initially, much of the relevant information was classified or otherwise inaccessible to the public. Nevertheless, I addressed safety issues through analyses that were recognized as accurate by nuclear safety officials at DOE. I eventually concluded that the Savannah River reactors could not meet the safety objectives set for them by DOE. DOE subsequently reached the same conclusion. The current national policy for tritium production is to employ commercial reactors, an option that I had concluded was technically attractive but problematic from the perspective of nuclear weapons proliferation.

11. In 1977, and again during the period 1996-2000, I examined the safety of nuclear fuel reprocessing and liquid high-level waste management facilities at the Sellafield site in the UK. My investigation in the latter period was supported by a consortium of local governments in Ireland and the UK, and my findings were presented at briefings in the UK and Irish parliaments. I identified safety issues that were not addressed in any publicly available literature about the Sellafield site. As a direct result of my investigation, the UK Nuclear Installations Inspectorate (NII) required the operator of the Sellafield site to conduct extensive safety analyses. These analyses confirmed the significance of the safety issues that I identified, and the NII imposed a schedule for run-down of the Sellafield inventory of liquid high-level waste.

11. In 2000, the NRC Staff accepted my view that older fuel in a spent-fuel pool is more vulnerable to ignition in a state of partial drainage than in a state of total drainage, because convective heat transfer is suppressed by the presence of residual water at the base of the fuel assemblies. Although the NRC Staff previously ignored or disparaged my opinion, the Staff eventually confirmed the validity of my expert opinion on the matter.

12. I am prepared to testify as an expert witness on behalf of the Massachusetts Attorney General with respect to the facts and opinions set forth in my Report.

****

I declare, under penalty of perjury, that the foregoing facts provided in my Declaration are true and correct to the best of my knowledge and belief, and that the opinions expressed herein are based on my best professional judgment.

Executed on 25 May 2006.

G.R. Thompson

Gordon Thompson

Curriculum Vitae for Gordon R. Thompson
November 2005

Professional expertise

• Technical and policy analyst in the fields of energy, environment, sustainable development, and international security.

Current appointments

• Executive director, Institute for Resource & Security Studies (IRSS), Cambridge, Massachusetts (since 1984).
• Research Professor, George Perkins Marsh Institute, Clark University, Worcester, Massachusetts (since 2002).

Education

• D.Phil., applied mathematics, Oxford University (Balliol College), 1973.
• B.E., mechanical engineering, University of New South Wales, Sydney, Australia, 1967.
• B.Sc., mathematics & physics, University of New South Wales, 1966.

Project sponsors and tasks (selected)

• California Energy Commission, 2005: conducted technical analysis and participated in expert workshop regarding safety and security of commercial nuclear facilities.
• Committee on Radioactive Waste Management (a committee appointed by the UK government), 2005: provided expert advice on safety and security of radioactive waste management.
• Legal Resources Centre, Cape Town, South Africa, 2004-2005: conducted technical analysis regarding the proposed South African pebble bed modular reactor.
• STAR Foundation, New York, 2002-2004: reviewed planning and actions for decommissioning of research reactors at Brookhaven National Laboratory.
• Attorney General of Utah, 2003: conducted technical analysis and prepared expert testimony regarding a proposed national storage facility for spent nuclear fuel.
• Mothers for Peace, California, 2002-2004: analyzed risk issues and prepared expert testimony associated with the Diablo Canyon nuclear power plant.
• Citizens Awareness Network, Massachusetts, 2002-2003: conducted analysis on robust storage of spent nuclear fuel.
• Tides Center, California, 2002-2004: conducted analysis for the Santa Susana Field Laboratory (SSFL) Advisory Panel regarding the history of releases of radioactive material from the SSFL.

• Orange County, North Carolina, 1999-2002: assessed risk issues associated with the Harris nuclear power plant, identified risk-reduction options, and prepared expert testimony.
• William and Flora Hewlett Foundation and other sponsors, 1999-2005: performed research and project development for conflict-management projects, through IRSS's International Conflict Management Program.
• STAR Foundation, New York, 2000-2001: assessed risk issues associated with the Millstone nuclear power plant, identified risk-reduction options, and prepared expert testimony.
• Massachusetts Water Resources Authority, 2000: evaluated risks associated with water supply and wastewater systems that serve greater Boston.
• Canadian Senate, Energy & Environment Committee, 2000: reviewed risk issues associated with the Pickering Nuclear Generating Station.
• Greenpeace International, Amsterdam, 2000: reviewed impacts associated with the La Hague nuclear complex in France.
• Government of Ireland, 1998-2001: developed framework for assessment of impacts and alternative options associated with the Sellafield nuclear complex in the UK.
• Clark University, Worcester, Massachusetts, 1998-1999: participated in confidential review of outcomes of a major foundation's grants related to climate change.
• UN High Commissioner for Refugees, 1998: developed a strategy for conflict management in the CIS region.
• General Council of County Councils (Ireland), W. Alton Jones Foundation (USA), and Nuclear Free Local Authorities (UK), 1996-2000: assessed safety and economic issues of nuclear fuel reprocessing in the UK; assessed alternative options.
• Environmental School, Clark University, Worcester, Massachusetts, 1996: session leader at the Summer Institute, "Local Perspectives on a Global Environment".
• Greenpeace Germany, Hamburg, 1995-1996: a study on war, terrorism and nuclear power plants.
• HKH Foundation, New York, and Winston Foundation for World Peace, Washington, DC, 1994-1996: studies and workshops on preventive action and its role in US national security planning.
• Carnegie Corporation of New York, Winston Foundation for World Peace, Washington, DC, and others, 1995: collaboration with the Organization for Security and Cooperation in Europe to facilitate improved coordination of activities and exchange of knowledge in the field of conflict management.
• World Bank, 1993-1994: a study on management of data describing the performance of projects funded by the Global Environment Facility (joint project of IRSS and Clark University).
• International Physicians for the Prevention of Nuclear War, 1993-1994: a study on the international control of weapons-usable fissile material.
• Government of Lower Saxony, Hannover, Germany, 1993: analysis of standards for radioactive waste disposal.
• University of Vienna (using funds supplied by the Austrian government), 1992: review of radioactive waste management at the Dukovany nuclear power plant, Czech Republic.

• Sandia National Laboratories, 1992-1993: advice to the US Department of Energy's Office of Foreign Intelligence.
• US Department of Energy and Battelle Pacific Northwest Laboratories, 1991-1992: advice for the Intergovernmental Panel on Climate Change regarding the design of an information system on technologies that can limit greenhouse gas emissions (joint project of IRSS, Clark University and the Center for Strategic and International Studies).
• Winston Foundation for World Peace, Boston, Massachusetts, and other funding sources, 1992-1993: development and publication of recommendations for strengthening the International Atomic Energy Agency.
• MacArthur Foundation, Chicago, Illinois, W. Alton Jones Foundation, Charlottesville, Virginia, and other funding sources, 1984-1993: policy analysis and public education on a "global approach" to arms control and disarmament.
• Energy Research Foundation, Columbia, South Carolina, and Peace Development Fund, Amherst, Massachusetts, 1988-1992: review of the US government's tritium production (for nuclear weapons) and its implications.
• Coalition of Environmental Groups, Toronto, Ontario (using funds supplied by Ontario Hydro under the direction of the Ontario government), 1990-1993: coordination and conduct of analysis and preparation of testimony on accident risk of nuclear power plants.
• Greenpeace International, Amsterdam, Netherlands, 1988-1990: review of probabilistic risk assessment for nuclear power plants.
• Bellerive Foundation, Geneva, Switzerland, 1989-1990: planning for a June 1990 colloquium on disarmament and editing of proceedings.
• Iler Research Institute, Harrow, Ontario, 1989-1990: analysis of regulatory response to boiling-water reactor accident potential.
• Winston Foundation for World Peace, Boston, Massachusetts, and other funding sources, 1988-1989: analysis of future options for NATO (joint project of IRSS and the Institute for Peace and International Security).
• Nevada Nuclear Waste Project Office, Carson City, Nevada (via Clark University), 1989-1990: analyses of risk aspects of radioactive waste management and disposal.
• Ontario Nuclear Safety Review (conducted by the Ontario government), Toronto, Ontario, 1987: review of safety aspects of CANDU reactors.
• Washington Department of Ecology, Olympia, Washington, 1987: analyses of risk aspects of a proposed radioactive waste repository at Hanford.
• Natural Resources Defense Council, Washington, DC, 1986-1987: preparation of expert testimony on hazards of the Savannah River Plant, South Carolina.
• Lakes Environmental Association, Bridgton, Maine, 1986: analysis of federal regulations for disposal of radioactive waste.
• Greenpeace Germany, Hamburg, 1986: participation in an international study on the hazards of nuclear power plants.
• Three Mile Island Public Health Fund, Philadelphia, Pennsylvania, 1983-1989: studies related to the Three Mile Island nuclear power plant and emergency response planning.
• Attorney General, Commonwealth of Massachusetts, 1984-1989: analyses of the safety of the Seabrook nuclear power plant, preparation of expert testimony.
• Union of Concerned Scientists, Cambridge, Massachusetts, 1980-1985: studies on energy demand and supply, nuclear arms control, and the safety of nuclear installations.

• Conservation Law Foundation of New England, Boston, Massachusetts, 1985: preparation of expert testimony on cogeneration potential at a Maine paper mill.
• Town & Country Planning Association, London, UK, 1982-1984: coordination and conduct of a study on safety and radioactive waste implications of the proposed Sizewell nuclear power plant, testimony to the Sizewell Public Inquiry.
• US Environmental Protection Agency, Washington, DC, 1980-1981: assessment of the cleanup of Three Mile Island Unit 2 nuclear power plant.
• Center for Energy & Environmental Studies, Princeton University, Princeton, New Jersey, and Solar Energy Research Institute, Golden, Colorado, 1979-1980: studies on the potentials of renewable energy sources.
• Government of Lower Saxony, Hannover, Federal Republic of Germany, 1978-1979: coordination and conduct of studies on safety and security aspects of the proposed Gorleben nuclear fuel cycle center.

Other experience (selected)

• Principal investigator, project on "Exploring the Role of 'Sustainable Cities' in Preventing Climate Disruption", involving IRSS and three other organizations, 1990-1991.
• Visiting fellow, Peace Research Centre, Australian National University, 1989.
• Principal investigator, Three Mile Island emergency planning study, involving IRSS, Clark University and other partners, 1987-1989.
• Co-leadership (with Paul Walker) of a study group on nuclear weapons proliferation, Institute of Politics, Harvard University, 1981.
• Foundation (with others) of an ecological political movement in Oxford, UK, which contested the 1979 Parliamentary election.
• Conduct of cross-examination and presentation of expert testimony, on behalf of the Political Ecology Research Group, at the 1977 Public Inquiry into proposed expansion of reprocessing capacity at Windscale, UK.
• Conduct of research on plasma theory (while a D.Phil candidate), as an associate staff member, Culham Laboratory, UK Atomic Energy Authority, 1969-1973.
• Service as a design engineer on coal-fired power plants, New South Wales Electricity Commission, Sydney, Australia, 1968.

Publications (selected)

• *Reasonably Foreseeable Security Events: Potential threats to options for long-term management of UK radioactive waste*, a report for the UK Committee on Radioactive Waste Management, 2 November 2005.
• "Plasma, policy and progress", *The Australian Mathematical Society Gazette*, Volume 32, Number 3, 2005, pp 162-168.
• "A Psychosocial-Healing Approach to Post-Conflict Reconstruction" (with Paula Gutlove), *Mind & Human Interaction*, Volume 14, Number 1, 2005, pp 35-63.
• "Designing Infrastructure for New Goals and Constraints", Proceedings of the conference, *Working Together: R&D Partnerships in Homeland Security*, Boston,

Massachusetts, 27-28 April 2005, sponsored by the US Department of Homeland Security. (A version of this paper has also been published as CRS Discussion Paper 2005-02, Center for Risk and Security, George Perkins Marsh Institute, Clark University, Worcester, Massachusetts.)

• "Potential Radioactive Releases from Commercial Reactors and Spent Fuel", Proceedings of the conference, *Working Together: R&D Partnerships in Homeland Security*, Boston, Massachusetts, 27-28 April 2005, sponsored by the US Department of Homeland Security. (A version of this paper has also been published as CRS Discussion Paper 2005-03, Center for Risk and Security, George Perkins Marsh Institute, Clark University, Worcester, Massachusetts.)

• *Safety of the Proposed South African Pebble Bed Modular Reactor*, a report for the Legal Resources Centre, Cape Town, South Africa, 12 January 2005.

• *Decommissioning of Research Reactors at Brookhaven National Laboratory: Status, Future Options and Hazards*, a report for STAR Foundation, East Hampton, New York, April 2004.

• "Psychosocial Healing and Post-Conflict Social reconstruction in the Former Yugoslavia" (with Paula Gutlove), *Medicine, Conflict and Survival*, Volume 20, Number 2, April-June 2004, pp 136-150.

• "Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States" (with Robert Alvarez, Jan Beyea, Klaus Janberg, Jungmin Kang, Ed Lyman, Allison Macfarlane and Frank N. von Hippel), *Science and Global Security*, Volume 11, 2003, pp 1-51.

• "Health, Human Security, and Social Reconstruction in Afghanistan" (with Paula Gutlove and Jacob Hale Russell), in John D. Montgomery and Dennis A. Rondinelli (eds), *Beyond Reconstruction in Afghanistan*, Palgrave Macmillan, 2004.

• *Psychosocial Healing: A Guide for Practitioners, based on programs of the Medical Network for Social Reconstruction in the Former Yugoslavia* (with Paula Gutlove), IRSS, Cambridge, Massachusetts and OMEGA Health Care Center, Graz, Austria, May 2003.

• *A Call for Action to Protect the Nation Against Enemy Attack on Nuclear Power Plants and Spent Fuel*, and a Supporting Document, Mothers for Peace, San Luis Obispo, California, April 2003 and May 2003.

• "Human Security: Expanding the Scope of Public Health" (with Paula Gutlove), *Medicine, Conflict and Survival*, Volume 19, 2003, pp 17-34.

• *Social Reconstruction in Afghanistan through the Lens of Health and Human Security* (with Paula Gutlove and Jacob Hale Russell), IRSS, Cambridge, Massachusetts, May 2003.

• *Robust Storage of Spent Nuclear Fuel: A Neglected Issue of Homeland Security*, a report commissioned by Citizens Awareness Network, Shelburne Falls, Massachusetts, January 2003.

• *Medical Network for Social Reconstruction in the Former Yugoslavia: A Survey of Participants' Views on the Network's Goals and Achievements*, IRSS, Cambridge, Massachusetts, September 2001.

• *The Potential for a Large, Atmospheric Release of Radioactive Material from Spent Fuel Pools at the Harris Nuclear Power Plant: The Case of a Pool Release Initiated by a*

Severe Reactor Accident, a report for Orange County, North Carolina, 20 November 2000.
• *A Review of the Accident Risk Posed by the Pickering 'A' Nuclear Generating Station,* a report for the Standing Committee on Energy, Environment and Natural Resources, Canadian Senate, August 2000.
• *High-Level Radioactive Liquid Waste at Sellafield: An Updated Review*, a report for the UK Nuclear Free Local Authorities, June 2000.
• *Hazard Potential of the La Hague Site: An Initial Review*, a report for Greenpeace International, May 2000.
• *A Strategy for Conflict Management: Integrated Action in Theory and Practice* (with Paula Gutlove), IRSS, Cambridge, Massachusetts, March 1999.
• *Risks and Alternative Options Associated with Spent Fuel Storage at the Shearon Harris Nuclear Power Plant*, a report for Orange County, North Carolina, February 1999.
• *High Level Radioactive Liquid Waste at Sellafield: Risks, Alternative Options and Lessons for Policy*, IRSS, Cambridge, Massachusetts, June 1998.
• "Science, democracy and safety: why public accountability matters", in F. Barker (ed), *Management of Radioactive Wastes: Issues for local authorities*, Thomas Telford, London, 1998.
• "Conflict Management and the OSCE" (with Paula Gutlove), *OSCE/ODIHR Bulletin*, Volume 5, Number 3, Fall 1997.
• *Safety of the Storage of Liquid High-Level Waste at Sellafield* (with Peter Taylor), Nuclear Free Local Authorities, UK, November 1996.
• *Assembling Evidence on the Effectiveness of Preventive Actions, their Benefits, and their Costs: A Guide for Preparation of Evidence*, IRSS, Cambridge, Massachusetts, August 1996.
• *War, Terrorism and Nuclear Power Plants,* Peace Research Centre, Australian National University, Canberra, October 1996.
• "The Potential for Cooperation by the OSCE and Non-Governmental Actors on Conflict Management" (with Paula Gutlove), *Helsinki Monitor*, Volume 6 (1995), Number 3.
• "Potential Characteristics of Severe Reactor Accidents at Nuclear Plants", "Monitoring and Modelling Atmospheric Dispersion of Radioactivity Following a Reactor Accident" (with Richard Sclove, Ulrike Fink and Peter Taylor), "Safety Status of Nuclear Reactors and Classification of Emergency Action Levels", and "The Use of Probabilistic Risk Assessment in Emergency Response Planning for Nuclear Power Plant Accidents" (with Robert Goble), in D. Golding, J. X. Kasperson and R. E. Kasperson (eds), *Preparing for Nuclear Power Plant Accidents*, Westview Press, Boulder, Colorado, 1995.
• *A Data Manager for the Global Environment Facility* (with Robert Goble), Environment Department, The World Bank, June 1994.
• *Preventive Diplomacy and National Security* (with Paula Gutlove), Winston Foundation for World Peace, Washington, DC, May 1994.
• *Opportunities for International Control of Weapons-Usable Fissile Material,* International Physicians for the Prevention of Nuclear War, Cambridge, Massachusetts, January 1994.
• "Article III and IAEA Safeguards", in F. Barnaby and P. Ingram (eds), *Strengthening the Non-Proliferation Regime*, Oxford Research Group, Oxford, UK, December 1993.

• *Risk Implications of Potential New Nuclear Plants in Ontario* (prepared with the help of eight consultants), a report for the Coalition of Environmental Groups, Toronto, submitted to the Ontario Environmental Assessment Board, November 1992 (3 volumes).
• *Strengthening the International Atomic Energy Agency*, IRSS, Cambridge, Massachusetts, September 1992.
• *Design of an Information System on Technologies that can Limit Greenhouse Gas Emissions* (with Robert Goble and F. Scott Bush), Center for Strategic and International Studies, Washington, DC, May 1992.
• *Managing Nuclear Accidents: A Model Emergency Response Plan for Power Plants and Communities* (with six other authors), Westview Press, Boulder, CO, 1992.
• "Let's X-out the K" (with Steven C. Sholly), *Bulletin of the Atomic Scientists*, March 1992, pp 14-15.
• "A Worldwide Programme for Controlling Fissile Material", and "A Global Strategy for Nuclear Arms Control", in F. Barnaby (ed), *Plutonium and Security*, Macmillan Press, UK, 1992.
• *No Restart for K Reactor* (with Steven C. Sholly), IRSS, Cambridge, Massachusetts, October 1991.
• *Regulatory Response to the Potential for Reactor Accidents: The Example of Boiling-Water Reactors,* IRSS, Cambridge, Massachusetts, February 1991.
• *Peace by Piece: New Options for International Arms Control and Disarmament*, IRSS, Cambridge, Massachusetts, January 1991.
• *Developing Practical Measures to Prevent Climate Disruption* (with Robert Goble), CENTED Research Report No. 6, Clark University, Worcester, Massachusetts, August 1990.
• "Treaty a Useful Relic", *Bulletin of the Atomic Scientists*, July/August 1990, pp 32-33.
• "Practical Steps for the 1990s", in Sadruddin Aga Khan (ed), *Non-Proliferation in a Disarming World*, Proceedings of the Groupe de Bellerive's 6th International Colloquium, Bellerive Foundation, Geneva, Switzerland, 1990.
• *A Global Approach to Controlling Nuclear Weapons*, IRSS, Cambridge, Massachusetts, October 1989.
• *IAEA Safety Targets and Probabilistic Risk Assessment* (with three other authors), Greenpeace International, Amsterdam, August 1989.
• *New Directions for NATO* (with Paul Walker and Pam Solo), published jointly by IRSS and the Institute for Peace and International Security (both of Cambridge, Massachusetts), December 1988.
• "Verifying a Halt to the Nuclear Arms Race", in F. Barnaby (ed), *A Handbook of Verification Procedures*, Macmillan Press, UK, 1990.
• "Verification of a Cutoff in the Production of Fissile Material", in F.Barnaby (ed), *A Handbook of Verification Procedures*, Macmillan Press, UK, 1990.
• "Severe Accident Potential of CANDU Reactors," Consultant's Report in *The Safety of Ontario's Nuclear Power Reactors*, Ontario Nuclear Safety Review, Toronto, February 1988.
• *Nuclear-Free Zones* (edited with David Pitt), Croom Helm Ltd, Beckenham, UK, 1987.
• *Risk Assessment Review For the Socioeconomic Impact Assessment of the Proposed High-Level Nuclear Waste Repository at Hanford Site, Washington* (edited; written with

five other authors), prepared for the Washington Department of Ecology, December 1987.
• *The Nuclear Freeze Revisited* (with Andrew Haines), Nuclear Freeze and Arms Control Research Project, Bristol, UK, November 1986. Variants of the same paper have appeared as Working Paper No. 18, Peace Research Centre, Australian National University, Canberra, February 1987, and in *ADIU Report*, University of Sussex, Brighton, UK, Jan/Feb 1987, pp 6-9.
• *International Nuclear Reactor Hazard Study* (with fifteen other authors), Greenpeace, Hamburg, Federal Republic of Germany (2 volumes), September 1986.
• "What happened at Reactor Four" (the Chernobyl reactor accident), *Bulletin of the Atomic Scientists*, August/September 1986, pp 26-31.
• *The Source Term Debate: A Report by the Union of Concerned Scientists* (with Steven C. Sholly), Union of Concerned Scientists, Cambridge, Massachusetts, January 1986.
• "Checks on the spread" (a review of three books on nuclear proliferation), *Nature*, 14 November 1985, pp 127-128.
• Editing of *Perspectives on Proliferation*, August 1985, published by the Proliferation Reform Project, IRSS.
• "A Turning Point for the NPT ?", *ADIU Report*, University of Sussex, Brighton, UK, Nov/Dec 1984, pp 1-4.
• "Energy Economics", in J. Dennis (ed), *The Nuclear Almanac*, Addison-Wesley, Reading, Massachusetts, 1984.
• "The Genesis of Nuclear Power", in J. Tirman (ed), *The Militarization of High Technology*, Ballinger, Cambridge, Massachusetts, 1984.
• *A Second Chance: New Hampshire's Electricity Future as a Model for the Nation* (with Linzee Weld), Union of Concerned Scientists, Cambridge, Massachusetts, 1983.
• *Safety and Waste Management Implications of the Sizewell PWR* (prepared with the help of six consultants), a report to the Town & Country Planning Association, London, UK, 1983.
• *Utility-Scale Electrical Storage in the USA: The Prospects of Pumped Hydro, Compressed Air, and Batteries*, Princeton University report PU/CEES #120, 1981.
• *The Prospects for Wind and Wave Power in North America*, Princeton University report PU/CEES # 117, 1981.
• *Hydroelectric Power in the USA: Evolving to Meet New Needs*, Princeton University report PU/CEES # 115, 1981.
• Editing and part authorship of "Potential Accidents & Their Effects", Chapter III of *Report of the Gorleben International Review*, published in German by the Government of Lower Saxony, FRG, 1979; Chapter III published in English by the Political Ecology Research Group, Oxford, UK.
• *A Study of the Consequences to the Public of a Severe Accident at a Commercial FBR located at Kalkar, West Germany*, Political Ecology Research Group, 1978.

Expert presentations and testimony (selected)

• Presentation, "Are Nuclear Installations Terrorist Targets?", at the conference, *Nuclear Energy: Does it Have a Future?*, Drogheda, County Louth, Ireland, 10-11 March 2005.

• Presentation at the session, "UN Security Council Resolution 1244 and Final Status for Kosovo", at the conference, *Lessons Learned from the Balkan Conflicts*, Boston College, Chestnut Hill, Massachusetts, 16-17 October 2004.
• California Public Utilities Commission, 2004: testimony regarding the nature and cost of potential measures for enhanced defense of the Diablo Canyon nuclear power plant.
• European Parliament, 2003: invited presentation to EP members regarding safety and security issues at the Sellafield nuclear site in the UK, and broader implications.
• US Congress, 2002 and 2003: invited presentations at member-sponsored staff briefings on vulnerabilities of nuclear-power facilities to attack and options for improved defenses.
• Numerous public forums in the USA, 2001-2005: invited presentations to public officials and general audiences regarding vulnerabilities of nuclear-power facilities to attack and options for improved defenses.
• UK Consensus Conference on Radioactive Waste Management, 1999: invited testimony on information and decision-making.
• Joint Committee on Public Enterprise and Transport, Irish Parliament, 1999: invited testimony on nuclear fuel reprocessing and international security.
• UK and Irish Parliaments, 1998: invited presentations to members on risks and alternative options associated with nuclear fuel reprocessing in the UK.
• Center for Russian Environmental Policy, Moscow, 1996: invited presentation at a forum in parallel with the G-7 Nuclear Safety Summit.
• Lacey Township Zoning Board, New Jersey, 1995: testimony regarding radioactive waste management.
• Ontario Court of Justice, Toronto, Ontario, 1993: testimony regarding Canada's Nuclear Liability Act.
• Oxford Research Group, seminar on "The Plutonium Legacy", Rhodes House, Oxford, UK, 1993: invited presentation on nuclear safeguards.
• Defense Nuclear Facilities Safety Board, Washington, DC, 1991: testimony regarding the proposed restart of K-reactor, Savannah River Site.
• Conference to consider amending the Partial Test Ban Treaty, United Nations, New York, 1991: presentation on a global approach to arms control and disarmament.
• US Department of Energy, hearing on draft EIS for new production reactor capacity, Columbia, South Carolina, 1991: testimony on tritium need and implications of tritium production options.
• Society for Risk Analysis, 1990 annual meeting, New Orleans, special session on nuclear emergency planning: presentation on real-time techniques for anticipating emergencies.
• Parliamentarians' Global Action, 11th Annual Parliamentary Forum, United Nations, Geneva, 1990: invited presentation on the potential for multilateral nuclear arms control.
• Advisory Committee on Nuclear Facility Safety, Washington, DC, 1989: testimony on public access to information and on government accountability.
• Peace Research Centre, Australian National University, seminar on "Australia and the Fourth NPT Review Conference", Canberra, 1989: invited presentation regarding a universal nuclear weapons non-proliferation regime.

• Carnegie Endowment for International Peace, Conference on "Nuclear Non-Proliferation and the Role of Private Organizations", Washington, DC, 1989: invited presentation on options for reform of the non-proliferation regime.
• US Department of Energy, EIS scoping hearing, Columbia, South Carolina, 1988: testimony on appropriate scope of an EIS for new production reactor capacity.
• International Physicians for the Prevention of Nuclear War, 6th and 7th Annual Congresses, Koln, FRG, 1986 and Moscow, USSR, 1987: invited presentations on relationships between nuclear power and the threat of nuclear war.
• County Council, Richland County, South Carolina, 1987: testimony on implications of severe reactor accidents at the Savannah River Plant.
• Maine Land Use Regulation Commission, 1985: testimony on cogeneration potential at facilities of Great Northern Paper Company.
• Interfaith Hearings on Nuclear Issues, Toronto, Ontario, 1984: invited presentations on options for Canada's nuclear trade and Canada's involvement in nuclear arms control.
• Sizewell Public Inquiry, UK, 1984: testimony on safety and radioactive waste implications of the proposed Sizewell nuclear power plant.
• New Hampshire Public Utilities Commission, 1983: testimony on electricity demand and supply options for New Hampshire.
• Atomic Safety & Licensing Board, US Nuclear Regulatory Commission, 1983: testimony on use of filtered venting at the Indian Point nuclear power plant.
• US National Advisory Committee on Oceans and Atmosphere, 1982: testimony on implications of ocean disposal of radioactive waste.
• Environmental & Energy Study Conference, US Congress, 1982: invited presentation on implications of radioactive waste management.

Miscellaneous

• Married, two children.
• Extensive experience in public speaking and interviews by mass media.
• Author of numerous essays and letters in newspapers and magazines.

Contact information

Institute for Resource and Security Studies
27 Ellsworth Avenue, Cambridge, Massachusetts 02139, USA
Phone: 617-491-5177 Fax: 617-491-6904 E-mail: gthompson@irss-usa.org

INSTITUTE FOR RESOURCE AND SECURITY STUDIES
27 Ellsworth Avenue, Cambridge, Massachusetts 02139, USA
Phone: 617-491-5177 Fax: 617-491-6904
Email: info@irss-usa.org

Risks and Risk-Reducing Options Associated with Pool Storage of Spent Nuclear Fuel at the Pilgrim and Vermont Yankee Nuclear Power Plants

by
Gordon R. Thompson

25 May 2006

A report for
Office of the Attorney General
Commonwealth of Massachusetts

Abstract

This report addresses some of the risks associated with the future operation of the Pilgrim and Vermont Yankee nuclear power plants. The risks that are addressed here arise from the storage of spent nuclear fuel in a water-filled pool adjacent to the reactor at each plant. Both pools are now equipped with high-density, closed-form storage racks. Options are available to reduce spent-fuel-pool risks. The option that would achieve the largest risk reduction at each plant, during operation within a license extension period, would be to re-equip the pool with low-density, open-frame storage racks. That option would return the plant to its original design configuration. This report describes risks and risk-reducing options, and relevant analysis that is required from the licensee and the Nuclear Regulatory Commission in the context of license extension applications for the Pilgrim and Vermont Yankee plants.

About the Institute for Resource and Security Studies

The Institute for Resource and Security Studies (IRSS) is an independent, nonprofit, Massachusetts corporation, founded in 1984. Its objective is to promote sustainable use of natural resources and global human security. In pursuit of this mission, IRSS conducts technical and policy analysis, public education, and field programs. IRSS projects always reflect a concern for practical solutions to resource and security problems.

About the Author

Gordon R. Thompson is the executive director of IRSS and a research professor at Clark University, Worcester, Massachusetts. He studied and practiced engineering in Australia, and received a doctorate in applied mathematics from Oxford University in 1973, for analyses of plasma undergoing thermonuclear fusion. Dr. Thompson has been based in the USA since 1979. His professional interests encompass a range of technical and policy issues related to international security and protection of natural resources. He has conducted numerous studies on the environmental and security impacts of nuclear facilities and options for reducing these impacts.

Dr. Thompson independently identified the potential for a spent-fuel-pool fire, and articulated alternative options for lower-risk storage of spent fuel, during his work for the German state government of Lower Saxony in 1978-1979. His findings were accepted by that government after a public hearing. Since that time, Thompson has conducted several other studies on spent-fuel-storage risk, alone and with colleagues. Findings of these studies have been confirmed by a 2005 report by the National Academy of Sciences, prepared at the request of the US Congress.

Acknowledgements

This report was prepared by IRSS for the Office of the Attorney General, Commonwealth of Massachusetts. Gordon R. Thompson is solely responsible for the content of the report.

Contents

(See next page)

List of Tables
(Tables are located at the end of the report.)

1. Introduction

Applications have been submitted for 20-year extensions of the operating licenses of the Pilgrim and Vermont Yankee nuclear power plants. These plants began operating in 1972, and their current operating licenses expire in 2012. The designs of the two plants are broadly similar, and both are operated by Entergy Nuclear Operations Inc. (Entergy). Each plant features a boiling-water reactor (BWR) with a Mark 1 containment. The US Nuclear Regulatory Commission (NRC) has announced that interested persons can petition to intervene in the license extension proceedings for these plants. In that context, the Office of the Attorney General, Commonwealth of Massachusetts, has requested the preparation of this report.

This report addresses a particular set of risks associated with the future operation of the Pilgrim and Vermont Yankee plants. These risks arise from the storage of spent nuclear fuel in water-filled pools. Each plant's nuclear reactor periodically discharges fuel that is "spent" in the sense that the fuel is no longer suitable for power generation. The spent fuel contains a large amount of radioactive material, and is stored in a water-filled pool adjacent to the reactor. In this report, the word "risk" applies to the potential for a release of radioactive material from nuclear fuel to the atmosphere. Other risks arise from the operation of nuclear power plants, but are not addressed here. The concept of risk encompasses both the consequences and probability of an event. However, risk is not simply the arithmetic product of consequence and probability numbers, as is sometimes assumed.

Although this report focuses on the risks arising from pool storage of spent fuel, the report necessarily considers some aspects of the risks arising from operation of the reactor at each plant. Such consideration is necessary because the pool and the reactor are in close physical proximity within the same building, and some of their essential support systems are shared. Thus, an incident involving a release of radioactive material from the pool could be initiated or exacerbated by an incident at the reactor, or vice versa, or parallel incidents at the pool and the reactor could have a common cause.

Scope of this analysis

This report does not purport to provide a comprehensive assessment of the risks arising from pool storage of spent fuel at the Pilgrim and Vermont Yankee plants. As discussed in Section 10, below, preparation of such an assessment is a duty of Entergy and the NRC. Neither party has performed this duty. In the absence of a comprehensive assessment, this report provides illustrative analysis of selected issues. Assumptions of the analysis are stated, and the author would be pleased to engage in open technical debate regarding his analysis. A companion report, prepared independently by Dr. Jan Beyea, examines the offsite consequences of releases of radioactive material. Findings in that report are consistent with scientific knowledge and experience in the field of

radiological consequence assessment. Questions about the analysis in that report should be directed to Dr. Beyea.

Five major purposes are pursued in this report. The focus throughout is on the Pilgrim and Vermont Yankee plants and their license extension applications, but much of the report's discussion has wider application. First, the potential for a release of radioactive material from a spent-fuel pool is described. Second, options for reducing the probability and/or consequences of such a release are described. These descriptions provide a general picture of the risks and risk-reducing options associated with pool storage of spent fuel. Third, an integrated view of these risks and risk-reducing options is provided. Fourth, the state of knowledge about these risks and risk-reducing options is reviewed. Fifth, the technical analysis required from Entergy and the NRC to improve this state of knowledge is described.

Two classes of event could lead to a release of radioactive material from a spent-fuel pool. One class of events, typically described as "accidents", includes human error, equipment failure and/or natural forces such as earthquakes. A second class encompasses deliberate, malicious acts. Some events, which involve harmful acts by insane but cognitively functioning persons, fall into both classes. This report considers the full range of initiating events, including human error, equipment failure, natural forces, malice, and/or insanity.

Protection of sensitive information

Any responsible analyst who discusses potential acts of malice at nuclear power plants is careful about making statements in public settings. The author of this report exercises such care. The author has no access to classified information, and this report contains no such information. However, a higher standard of discretion is necessary. An analyst should not publish detailed information that will assist potential attackers, even if this information is publicly available from other sources. On the other hand, if a plant's design and operation leave the plant vulnerable to attack, and the vulnerability is not being addressed appropriately, then a responsible analyst is obliged to publicly describe the vulnerability in general terms.

This report exemplifies the balance of responsibility described in the preceding paragraph. Vulnerabilities of the Pilgrim and Vermont Yankee plants are described here in general terms. Detailed information relating to those vulnerabilities is withheld here, although that information has been published elsewhere or could be re-created by many persons with technical education and/or military experience. For example, this report does not provide cross-section drawings of the Pilgrim and Vermont Yankee plants, although such drawings have been published for many years and are archived around the world. NRC license proceedings provide potential forums at which sensitive information can be discussed without concern about disclosure to potential attackers. Rules and practices are available so that the parties to a license proceeding can discuss sensitive information in a protected setting.

Structure of this report

The remainder of this report has eleven sections. Section 2 outlines the hazard posed by storage of spent fuel in a high-density configuration in pools at nuclear power plants, and describes the history of attention to this issue. The hazard arises from the potential for a self-ignited fire in a spent-fuel pool if water is lost from the pool. Technical aspects of this hazard are discussed in greater detail in subsequent sections of the report. Characteristics of the Pilgrim and Vermont Yankee plants and their spent fuel are described in Section 3. National trends in the management of spent nuclear fuel are described in Section 4, providing evidence that spent fuel is likely to remain at the Pilgrim and Vermont Yankee sites for at least several decades, and potentially for more than a century. The risks of spent-fuel storage will continue to accumulate over that period.

Section 5 reviews the state of technical knowledge about potential spent-fuel-pool fires. Scenarios for such a fire at the Pilgrim or Vermont Yankee plants are discussed in the two following sections. Section 6 discusses scenarios initiated by accidents not involving malice, while Section 7 discusses scenarios initiated by malicious action. Options to reduce the risks of spent-fuel-pool fires at the Pilgrim and Vermont Yankee plants are described in Section 8. An integrated view of risks and risk-reducing options at these plants is set forth in Section 9.

In Section 5 and elsewhere, this report discusses the state of technical knowledge about risks and risk-reducing options associated with spent-fuel pools. There are substantial deficiencies in present knowledge. Section 10 describes the technical analysis required from Entergy and the NRC to correct these deficiencies in the context of license extension applications for Pilgrim and Vermont Yankee. Conclusions are set forth in Section 11, and a bibliography is provided in Section 12. All documents cited in the text of this report are listed in the bibliography.

2. Recognition of the Spent-Fuel Hazard

From the earliest years of the nuclear-technology era, analysis and experience have shown that a nuclear reactor can undergo an accident in which the reactor's fuel is damaged. This damage can lead to a release of radioactive material within the reactor and, potentially, from the reactor to the external environment. An early illustration of this accident potential occurred in the UK in 1957, when an air-cooled reactor at Windscale caught fire and released radioactive material to the atmosphere. At that time, spent fuel was not perceived as a significant hazard.

When the Pilgrim and Vermont Yankee plants began operating in 1972, there was limited technical understanding of the potential for severe accidents at commercial reactors. In this context, "severe" means that the reactor core is severely damaged, which typically involves melting of some fraction of the core materials. The environmental impact

statements (EISs) related to the operation of Pilgrim and Vermont Yankee did not consider severe reactor accidents.[1] Knowledge about the potential for such accidents was improved by completion of the Reactor Safety Study (WASH-1400) in 1975.[2] More knowledge has accumulated from analysis and experience since that time.[3]

Until 1979 it was widely assumed that stored spent fuel did not pose risks comparable to those associated with reactors. This assumption arose because a spent fuel assembly does not contain short-lived radioactivity, and therefore produces less radioactive decay heat than does a similar fuel assembly in an operating reactor. However, that factor was counteracted by the introduction of high-density, closed-form storage racks into spent-fuel pools, beginning in the 1970s. Initially, pools were designed so that each held only a small inventory of spent fuel, with the expectation that spent fuel would be stored briefly and then taken away for reprocessing. Low-density, open-frame storage racks were used. Cooling fluid can circulate freely through such a rack. When reprocessing was abandoned in the United States, spent fuel began to accumulate in the pools. Excess spent fuel could have been offloaded to other storage facilities, allowing continued use of low-density racks. Instead, as a cost-saving measure, high-density racks were introduced, allowing much larger amounts of spent fuel to be stored in the pools.

The potential for a pool fire

Unfortunately, the closed-form configuration of the high-density racks would create a major problem if water were lost from a spent-fuel pool. The flow of air through the racks would be highly constrained, and would be almost completely cut off if residual water or debris were present in the base of the pool. As a result, removal of radioactive decay heat would be ineffective. Over a broad range of water-loss scenarios, the temperature of the zirconium fuel cladding would rise to the point (approximately 1,000 degrees C) where a self-sustaining, exothermic reaction of zirconium with air or steam would begin. Fuel discharged from the reactor for 1 month could ignite in less than 2 hours, and fuel discharged for 3 months could ignite in about 3 hours.[4] Once initiated, the fire would spread to adjacent fuel assemblies, and could ultimately involve all fuel in the pool. A large, atmospheric release of radioactive material would occur. For simplicity, this potential disaster can be described as a "pool fire".

Water could be lost from a spent-fuel pool through leakage, boiling, siphoning, pumping, displacement by objects falling into the pool, or overturning of the pool. These modes of water loss could arise from events, alone or in combination, that include: (i) acts of malice by persons within or outside the plant boundary; (ii) an accidental aircraft impact; (iii) an earthquake; (iv) dropping of a fuel cask; (v) accidental fires or explosions; and (vi) a severe accident at an adjacent reactor that, through the spread of radioactive

[1] AEC, 1972a; AEC, 1972b.
[2] NRC, 1975.
[3] Relevant experience includes the Three Mile Island reactor accident of 1979 and the Chernobyl reactor accident of 1986.
[4] This sentence assumes adiabatic conditions.

material and other influences, precludes the ongoing provision of cooling and/or water makeup to the pool.

These events have differing probabilities of occurrence. None of them is an everyday event. Nevertheless, they are similar to events that are now routinely considered in planning and policy decisions related to commercial nuclear reactors. To date, however, such events have not been given the same attention in the context of spent-fuel pools.

Some people have found it counter-intuitive that spent fuel, given its comparatively low decay heat and its storage under water, could pose a fire hazard. This perception has slowed recognition of the hazard. In this context, a simple analogy may be helpful. We all understand that a wooden house can stand safely for many years but be turned into an inferno by a match applied in an appropriate location. A spent-fuel pool equipped with high-density racks is roughly analogous, but in this case ignition would be accomplished by draining water from the pool. In both cases, a triggering event would unleash a large amount of latent chemical energy.

The sequence of studies related to pool fires

Two studies completed in March 1979 independently identified the potential for a fire in a drained spent-fuel pool equipped with high-density racks. One study was by members of a scientific panel assembled by the German state government of Lower Saxony to review a proposal for a nuclear fuel cycle center at Gorleben.[5] After a public hearing, the Lower Saxony government ruled in May 1979, as part of a broader decision, that high-density pool storage of spent fuel would not be acceptable at Gorleben. The second study was done by Sandia Laboratories for the NRC.[6] In light of knowledge that has accumulated since 1979, the Sandia report generally stands up well, provided that one reads the report in its entirety. However, the report's introduction contains an erroneous statement that complete drainage of the pool is the most severe situation. The body of the report clearly shows that partial drainage can be a more severe case, as was recognized in the Gorleben context. Unfortunately, the NRC continued, until October 2000, to employ the erroneous assumption that complete drainage is the most severe case.

The NRC has published various documents that discuss aspects of the potential for a spent-fuel-pool fire. Several of these documents are discussed in Section 5, below. Only three of the various documents are products of processes that provided an opportunity for formally structured public comment and, potentially, for in-depth analysis of risks and alternatives. One such document is the August 1979 Generic Environmental Impact Statement (GEIS) on handling and storage of spent fuel (NUREG-0575).[7] The second document is the May 1996 GEIS on license renewal (NUREG-1437).[8] These two documents purported to provide systematic analysis of the risks and relative costs and

[5] Thompson et al, 1979.
[6] Benjamin et al, 1979.
[7] NRC, 1979.
[8] NRC, 1996.

benefits of alternative options. The third document is the NRC's September 1990 review (55 FR 38474) of its Waste Confidence Decision.[9] That document did not purport to provide an analysis of risks and alternatives.

NUREG-0575 addresses the potential for a spent-fuel-pool fire in a single sentence that cites the 1979 Sandia report. The sentence reads:[10]

> Assuming that the spent fuel stored at an independent spent fuel storage installation is at least one year old, calculations have been performed to show that loss of water should not result in fuel failure due to high temperatures if proper rack design is employed.

Although this sentence refers to pool storage of spent fuel at an independent spent fuel storage installation, NUREG-0575 regards at-reactor pool storage as having the same properties. This sentence misrepresents the findings of the Sandia report. The sentence does not define "proper rack design". It does not disclose Sandia's findings that high-density racks promote overheating of exposed fuel, and that overheating can cause fuel to self-ignite and burn. The NRC has never corrected this deficiency in NUREG-0575.

NUREG-1437 also addresses the potential for a spent-fuel-pool fire in a single sentence, which in this instance states:[11]

> NRC has also found that, even, under the worst probable cause of a loss of spent-fuel pool coolant (a severe seismic-generated accident causing a catastrophic failure of the pool), the likelihood of a fuel-cladding fire is highly remote (55 FR 38474).

The parenthetic citation is to the NRC's September 1990 review of its Waste Confidence Decision. Thus, NUREG-1437's examination of pool fires is totally dependent on the September 1990 review. In turn, that review bases its opinion about pool fires on the following four NRC documents:[12] (i) NUREG/CR-4982;[13] (ii) NUREG/CR-5176;[14] (iii) NUREG-1353;[15] and (iv) NUREG/CR-5281.[16] These documents are discussed in Section 5, below. That discussion reveals substantial deficiencies in the documents' analysis of the potential for a pool fire.

Thus, neither of the two GEISs (NUREG-0575 and NUREG-1437), nor the September 1990 review of the Waste Confidence Decision, provides a technically defensible

---

[9] NRC, 1990a.
[10] NRC, 1979, page 4-21.
[11] NRC, 1996, pp 6-72 to 6-75.
[12] NRC, 1990a, page 38481.
[13] Sailor et al, 1987.
[14] Prassinos et al, 1989.
[15] Throm, 1989.
[16] Jo et al, 1989.

examination of spent-fuel-pool fires and the associated risks and alternatives. The statements in each document regarding pool fires are inconsistent with the findings of subsequent, more credible studies discussed below.

The most recent published NRC technical study on the potential for a pool fire is an NRC Staff study, originally released in October 2000 but formally published in February 2001, that addresses the risk of a pool fire at a nuclear power plant undergoing decommissioning.[17] This author submitted comments on the study to the NRC Commissioners in February 2001.[18] The study was in several respects an improvement on previous NRC documents that addressed pool fires. It reversed the NRC's longstanding, erroneous position that total, instantaneous drainage of a pool is the most severe case of drainage. However, it did not consider acts of malice. Nor did it add significantly to the weak base of technical knowledge regarding the propagation of a fire from one fuel assembly to another. Its focus was on a plant undergoing decommissioning. Therefore, it did not address potential interactions between pools and operating reactors, such as the interactions discussed in Section 6, below.

In 2003, eight authors, including the present author, published a paper on the risks of spent-fuel-pool fires and the options for reducing these risks.[19] That paper aroused vigorous comment, and its findings were disputed by NRC officials and others. Critical comment was also directed to a related report by this author.[20] In an effort to resolve this controversy, the US Congress requested the National Academy of Sciences (NAS) to conduct a study on the safety and security of spent-fuel storage. The NAS submitted a classified report to Congress in July 2004, and released an unclassified version in April 2005.[21] Press reports described considerable tension between the NAS and the NRC regarding the inclusion of material in the unclassified NAS report.[22]

Since September 2001, the NRC has not published any document that contains technical analysis related to the potential for a pool fire. The NRC claims that it is conducting further analysis in a classified setting. The scope of information treated as secret by the NRC is questionable. Much of the relevant analysis would address issues such as heat transfer and fire propagation. Calculations and experiments on such subjects should be performed and reviewed in the public domain. Classification is appropriate for other information, such as specific points of vulnerability of a spent-fuel pool to attack.

3. Characteristics of the Pilgrim and Vermont Yankee Plants and their Spent Fuel

Basic data about the Pilgrim and Vermont Yankee plants are set forth in Table 3-1. Data and estimates about storage of spent fuel at these plants are set forth in Tables 3-2

[17] Collins and Hubbard, 2001
[18] Thompson, 2001a.
[19] Alvarez et al, 2003.
[20] Thompson, 2003.
[21] NAS, 2006.
[22] Wald, 2005.

through 3-5. In regard to the latter tables, publicly available information is incomplete and inconsistent. Therefore, assumptions are made at various points in the tables, as is readily evident. In addition, the estimates set forth in Tables 3-3 through 3-5 involve a number of simplifying assumptions, which are also evident from the tables.

The scope and accuracy of Tables 3-1 through 3-5 could be improved using information that is held by Entergy and the NRC. Given this information, a more sophisticated analysis could be conducted to estimate the inventories and other characteristics of the Pilgrim and Vermont Yankee spent-fuel pools during the requested period of license extension. These improvements would not alter the basic findings of this report.

At the Pilgrim plant, the present configuration of the storage racks in the spent-fuel pool reflects a license amendment approved by the NRC in 1994. A report submitted by the licensee in support of that license amendment states that the existing racks in the pool and the proposed new racks had a center-to-center distance of about 6.3 inches in both directions. The new racks would, when fully installed, fill the pool tightly, wall-to-wall.[23] Equivalent detail is not available regarding the present configuration of racks in the Vermont Yankee pool. However, from the data provided in Table 3-2 regarding the capacities, inventories and dimensions of both pools, it is evident that the Vermont Yankee pool configuration is similar to that at Pilgrim.[24]

Entergy has announced its intention to establish an independent spent fuel storage installation (ISFSI) at the Vermont Yankee site, and for this purpose has requested a Certificate of Public Good from the Vermont Public Service Board. The ISFSI would store fuel in dry-storage modules. Entergy has described its planned schedule for transferring spent fuel from the pool to the ISFSI.[25] From this schedule, it is evident that Entergy plans to use the spent-fuel pool at nearly its full capacity, storing the overflow from that capacity in the ISFSI.

Extension of the Pilgrim operating license would imply the establishment of an ISFSI at the Pilgrim site. Entergy has not yet announced a plan to establish such an ISFSI. Given the continuing accumulation of spent fuel in the Pilgrim pool, and the time required to establish an ISFSI, it can reasonably be presumed that Entergy plans to use the Pilgrim spent-fuel pool at nearly its full capacity, storing the overflow from that capacity in a future ISFSI.

Inventories of cesium-137

The radioactive isotope cesium-137 provides a useful indicator of the hazard potential of the Pilgrim and Vermont Yankee spent-fuel pools. This isotope, which has a half-life of

[23] Holtec, 1993.
[24] Hoffman, 2005, states that the present Vermont Yankee racks have a center-to-center distance of 6.2 inches.
[25] Hoffman, 2005.

30 years, is a volatile element that would be liberally released during a pool fire.[26] Table 3-4 shows the estimated inventory of cesium-137 in the Pilgrim and Vermont Yankee spent-fuel pools during the period of license extension. This table shows that the pools will hold about 1.6 million TBq (Pilgrim) and 1.4 million TBq (Vermont Yankee) of cesium-137. For comparison, Tables 3-3 and 3-5 provide licensee estimates showing that the Pilgrim and Vermont Yankee reactor cores will hold 190,000 TBq and 179,000 TBq, respectively, of cesium-137. Thus, each pool will hold about 8 times as much cesium-137 as will be present in the adjacent reactor.

4. Trends in Management of Spent Fuel

Risks arising from storage of spent fuel will accumulate over time. Thus, it is important to estimate the time period during which spent fuel will be stored at the Pilgrim or Vermont Yankee site, whether in a pool or an onsite ISFSI. In testimony before the Vermont Public Service Board, an Entergy witness has stated that the US Department of Energy (DOE) could begin accepting spent fuel from Vermont Yankee as early as 2015, for emplacement in the proposed repository in Yucca Mountain, Nevada.[27]

Some decision makers have advocated a revival of spent-fuel reprocessing as an alternative to placing intact spent fuel in a repository. Reprocessing was the national strategy for spent-fuel management when the Pilgrim and Vermont Yankee plants were built, but was abandoned in the 1970s. If reprocessing were to resume, it would provide an option for removal of spent fuel from reactor sites.

This author has testified before the Vermont Public Service Board regarding the prospects for the Yucca Mountain repository, reprocessing, and other options for removal of spent fuel from the Vermont Yankee site. He concluded that spent fuel is likely to remain at the site for at least several decades, and potentially for more than a century.[28] The same arguments apply to the Pilgrim site. Here, selected arguments are summarized, to illustrate the factors that will hinder removal of spent fuel from each site.

Current national policy for long-term management of spent fuel is to establish a repository inside Yucca Mountain. Progress with this project has been slow, and many observers believe that it will be cancelled. Even if the repository does open, there will be a delay before fuel can be shipped to Yucca Mountain and emplaced in the repository. Table 4-1 shows a schedule projection by DOE, indicating that the emplacement process could occupy five decades.

---

[26] A study by the US Department of Energy (DOE, 1987) shows that cesium-137 accounts for most of the offsite radiation exposure that is attributable to the 1986 Chernobyl reactor accident, and for about half of the radiation exposure that is attributable to fallout from nuclear weapons tests in the atmosphere. Note that the particular mechanisms of the Chernobyl accident could not occur in the Pilgrim or Vermont Yankee pool.
[27] Hoffman, 2005.
[28] Thompson, 2006.

The US fleet of commercial reactors will probably produce more than 80,000 MgU of spent fuel if each reactor operates to the end of its initial 40-year license period. If each reactor received a 20-year license extension, the fleet could eventually produce a total of about 120,000 MgU of spent fuel. Yet, the capacity of Yucca Mountain is limited by federal statute to 63,000 MgU of spent fuel. DOE has investigated the option of placing 105,000 MgU of spent fuel in Yucca Mountain, which assumes a statute amendment. However, Table 4-2 shows that emplacement of 105,000 MgU of fuel could require an emplacement area of up to 3,800 acres if a lower-temperature operating mode is selected. Licensing considerations are likely to favor the selection of a lower-temperature operating mode, and there may not be enough space in the mountain to allow a total emplacement area of 3,800 acres. Thus, the physical capacity of Yucca Mountain could be less than 105,000 MgU of fuel.

As Table 4-3 shows, operation of the Yucca Mountain repository would involve a large number of spent-fuel shipments. This potential traffic poses a security concern, because there is evidence that shipping casks are more vulnerable to attack by sub-national groups than DOE has previously assumed.[29] Spent-fuel shipments could be comparatively attractive targets because they cannot be protected to the same extent as nuclear power plants.

A further impediment to shipping spent fuel to Yucca Mountain is that DOE has announced that it will receive fuel in standard canisters that are inserted, unopened, into waste packages prior to emplacement in the repository. Yet, as Table 4-4 shows, the concept of a standard canister is incompatible with the present configurations of dry-storage canisters and the proposed configurations of Yucca Mountain disposal packages. There is no clear path to resolution of this problem.

5. Technical Understanding of Spent-Fuel-Pool Fires

Section 2, above, introduces the concept of a pool fire and describes the history of analysis of pool-fire risks. There is a body of technical literature on these risks, containing documents of varying degrees of completeness and accuracy. Current opinions about the risks vary widely, but the differences of opinion may be more about the probabilities of pool-fire scenarios than about the physical characteristics of these scenarios. In turn, differing opinions about probabilities lead to differing support for risk-reducing options. This situation is captured in a comment by Allan Benjamin on a paper (Alvarez et al, 2003) by this author and seven colleagues.[30] Benjamin's comment is quoted in the unclassified NAS report as follows:[31]

---

[29] The term "sub-national group" is used in security analysis to describe a human group that is larger and more capable than an isolated individual, but is not an arm of a national government. This distinction has strategic significance because deterrence, a potentially effective means of influencing a national government, may not influence a sub-national group.
[30] Allan Benjamin was one of the authors of: Benjamin et al, 1979.
[31] NAS, 2006, page 45.

> In a nutshell, [Alvarez et al] correctly identify a problem that needs to be addressed, but they do not adequately demonstrate that the proposed solution is cost-effective or that it is optimal.

The "proposed solution" to which Benjamin refers is the re-equipment of spent-fuel pools with low-density, open-frame racks, transferring excess spent fuel to onsite dry storage. In fact, however, the [Alvarez et al] authors had not claimed to complete the level of analysis, especially site-specific analysis, that risk-reducing options should receive in an Environmental Report or EIS. These authors stated:[32]

> Finally, all of our proposals require further detailed analysis and some would involve risk tradeoffs that also would have to be further analyzed. Ideally, these analyses could be embedded in an open process in which both analysts and policy makers can be held accountable.

The paper by Alvarez et al is consistent with current knowledge of pool-fire phenomena, including the findings set forth in the unclassified NAS report. The same cannot be said for all of the NRC documents that were cited in the NRC's September 1990 review of its Waste Confidence Decision. As discussed in Section 2, above, four NRC documents were cited to support that review's finding regarding the risks of pool fires.[33] In turn, the May 1996 GEIS on license renewal (NUREG-1437) relied on the September 1990 review for its position on the risks of pool fires. The four NRC documents are discussed in the following paragraphs.

NUREG/CR-4982 was prepared at Brookhaven National Laboratory to provide "an assessment of the likelihood and consequences of a severe accident in a spent fuel storage pool".[34] The postulated accident involved complete, instantaneous loss of water from the pool, thereby excluding important phenomena from consideration. The Brookhaven authors employed a simplistic model to examine propagation of a fire from one fuel assembly to another. That model neglected important phenomena including slumping and burn-through of racks, slumping of fuel assemblies, and the accumulation of a debris bed at the base of the pool. Each of these neglected phenomena would promote fire propagation. The study ignored the potential for interactions between a pool fire and a reactor accident. It did not consider acts of malice. Overall, this study did not approach the completeness and quality needed to support consideration of a pool fire in an EIS.

NUREG/CR-5176 was prepared at Lawrence Livermore National Laboratory.[35] It examined the potential for earthquake-induced failure of the spent-fuel pool and the pool's support systems at the Vermont Yankee and Robinson Unit 2 plants. It also considered the effect of dropping a spent-fuel shipping cask on a pool wall. Overall, this study appears to have been a competent exercise within its stated assumptions. With

---

[32] Alvarez et al, 2003, page 35.
[33] NRC, 1990a, page 38481.
[34] Sailor et al, 1987.
[35] Prassinos et al, 1989.

appropriate updating, NUREG/CR-5176 could contribute to the larger body of analysis that would be needed to support consideration of a pool fire in an EIS.

NUREG-1353 was prepared by a member of the NRC Staff to support resolution of NRC Generic Issue 82.[36] It postulated a pool accident involving complete, instantaneous loss of water from the pool, thereby excluding important phenomena from consideration. It relied on the fire-propagation analysis of NUREG/CR-4982. As discussed above, that analysis is inadequate. In considering heat transfer from BWR fuel after water loss, NUREG-1353 assumed that a high-density rack configuration would involve a 5-inch open space between each row of fuel assemblies. That assumption is inappropriate and non-conservative. Modern, high-density BWR racks have a center-to-center distance of about 6 inches in both directions. Thus, NUREG-1353 under-estimated the potential for ignition of BWR fuel. Overall, NUREG-1353 did not approach the completeness and quality needed to support consideration of a pool fire in an EIS.

NUREG/CR-5281 was prepared at Brookhaven National Laboratory to evaluate options for reducing the risks of pool fires.[37] It took NUREG/CR-4982 as its starting point, and therefore shared the deficiencies of that study.

Clearly, these four NRC documents do not provide an adequate technical basis for an EIS that addresses the risks of pool fires. The knowledge that they do provide could be supplemented from other documents, including the unclassified NAS report, the paper by Alvarez et al, and the NRC Staff study (NUREG-1738) on pool-fire risk at a plant undergoing decommissioning.[38] However, this combined body of information would be inadequate to support the preparation of an EIS. For that purpose, a comprehensive, integrated study would be required, involving analysis and experiment. The depth of investigation would be similar to that involved in preparing the NRC's December 1990 study on the risks of reactor accidents (NUREG-1150).[39]

A pool-fire "source term"

The incompleteness of the present knowledge base is evident when one needs a "source term" to estimate the radiological consequences of a pool fire. The concept of a source term encompasses the magnitude, timing and other characteristics of a release of radioactive material. Present knowledge does not allow theoretical or empirically-based prediction of the source term for a postulated pool-fire scenario. Instead, informed judgment must be used.

Table 5-1 provides two versions of a source term for a pool fire at Pilgrim or Vermont Yankee. Each version assumes that a high-density pool would be almost full of spent

[36] Throm, 1989.
[37] Jo et al, 1989.
[38] Collins and Hubbard, 2001.
[39] NRC, 1990b.

fuel, which is the expected mode of operation of each plant during the period of license extension.

One version of the source term involves a release of 100 percent of the cesium-137 in a pool. That is an upper limit. In practice, the cesium-137 release fraction would be less than 100 percent, but there is no way to determine if the largest achievable release fraction would be 90 percent or 95 percent or some other number. In any event, this large source term implies that all or most of the zirconium in the pool would oxidize. Table 5-1 assumes that the oxidation occurs over a period of 5 hours. The second version of the source term involves a release of 10 percent of the cesium-137 in the pool, with oxidation of 10 percent of the zirconium over a period of 0.5 hours.

Given present knowledge, the approximately 100-percent release and the 10-percent release are equally probable for a typical pool fire. A prudent decision maker could, therefore, reasonably use the 100-percent release to assess risks and risk-reducing options.

6. Initiation of a Pool Fire by an Accident Not Involving Malice

Section 2, above, provides a general description of the potential for a spent-fuel-pool fire. Such a fire could be caused by a variety of events. Here, accidental events not involving malice are considered, with a focus on the Pilgrim and Vermont Yankee plants. Section 7, below, considers events that involve malicious action.

At Pilgrim or Vermont Yankee, non-malicious events at the plant that could lead to a pool fire include: (i) an accidental aircraft impact, with or without an accompanying fuel-air explosion or fire; (ii) an earthquake; (iii) dropping of a fuel transfer cask or shipping cask; (iv) a fire inside or outside the plant building; and (v) a severe accident at the adjacent reactor.

Given the major consequences of a pool fire, analysis should have been performed to examine pool-fire scenarios across a full range of initiating events. The NRC has devoted substantial attention and resources to the examination of reactor-core-melt scenarios, through studies such as NUREG-1150.[40] Neither the NRC nor the nuclear industry has conducted a comparable study of pool fires. In the absence of such a study, this report provides illustrative analysis.

[40] NRC, 1990b.

A pool fire accompanied by a reactor accident

As mentioned in Section 1, above, at Pilgrim and Vermont Yankee the pool and the reactor are in close physical proximity within the same building, and some of their essential support systems are shared. These plants are, therefore, comparatively likely to experience a pool fire that is accompanied by a reactor accident.

This combination of accidents is the focus of discussion here. The pool fire and the reactor accident might have a common cause. For example, a severe earthquake could cause leakage of water from the pool, while also damaging the reactor and its supporting systems to such an extent that a core-melt accident occurs. In some scenarios, the high radiation field produced by a pool fire could initiate or exacerbate an accident at the reactor by precluding the presence and functioning of operating personnel. In other scenarios, the high radiation field produced by a core-melt accident could initiate or exacerbate a pool-fire scenario, again by precluding the presence and functioning of operating personnel. Many core-melt scenarios would involve the interruption of cooling to the pool.

By focusing on a pool fire accompanied by a reactor accident, this report does not imply that other pool-fire scenarios make a smaller contribution to pool-fire risks at Pilgrim and Vermont Yankee. Such a conclusion could come only from a comprehensive assessment of pool-fire risks, and no such assessment has ever been performed.

Tables 6-1 and 6-2 provide licensee estimates of core-damage frequency (probability) and radioactive-release frequency for the Pilgrim and Vermont Yankee reactors.[41] Some of these estimates are from the Independent Plant Examination (IPE) and the Independent Plant Examination for External Events (IPEEE) that have been performed for each plant.[42] The remaining estimates are from the Environmental Report (Appendix E of the license renewal application) for each plant. In this report, the IPE and IPEEE estimates are used instead of the ER estimates, because the studies underlying the latter are not available for review.[43]

Estimates shown in Tables 6-1 and 6-2 that are of particular relevance to this report are the estimates of the probability (frequency) of an early release of radioactive material from the reactor. Table 6-3 provides a definition of "early" and other terms that are used to categorize potential radioactive releases. "High" and "medium" release scenarios, as defined in Table 6-3, are often "early" and vice versa.

---

[41] For present purposes, core damage is equivalent to core melt.
[42] Boston Edison, 1992; Boston Edison, 1994; VYNPS, 1993; VYNPS, 1998.
[43] NRC Public Document Room staff informed Diane Curran that the recent reactor-accident studies referenced in the Environmental Reports for Pilgrim and Vermont Yankee could not be located within the NRC.

Lessons from a license-amendment proceeding for the Harris plant

This report assumes that the conditional probability of a spent-fuel-pool fire, given an early release from the adjacent reactor, is 50 percent. That assumption is reasonable – and not necessarily conservative – for the Pilgrim or Vermont Yankee plant because the pool and the reactor are in close physical proximity within the same building, and some of their essential support systems are shared. Support for this assumption is provided by technical studies and opinions submitted to the Atomic Safety and Licensing Board (ASLB) in a license-amendment proceeding in regard to the expansion of spent-fuel-pool capacity at the Harris nuclear power plant. All three parties to the proceeding – the NRC Staff, Carolina Power and Light (CP&L), and Orange County – reached the same conclusion on an issue that is relevant to the above-stated conditional probability of 50 percent.

The Harris plant has one reactor and four pools. The reactor – a PWR – is in a cylindrical, domed containment building. The four pools are in a separate, adjacent building that was originally intended to serve four reactors. Only one reactor was built. Two pools were in use at high density prior to the proceeding, and the proceeding addressed the activation of the two remaining pools, also at high density.

During the proceeding, the ASLB determined that the potential for a pool fire should be considered, and ordered the three parties to analyze a single scenario for such a fire.[44] In the postulated scenario, a severe accident at the Harris reactor would contaminate the Harris site with radioactive material to an extent that would preclude actions needed to supply cooling and makeup to the Harris pools. Thereafter, the pools would boil and dry out, and fuel within the pools would burn. Following the ALSB's order, Orange County submitted a report by this author.[45] The NRC Staff submitted an affidavit by members of the Staff.[46] CP&L – the licensee – submitted a document prepared by ERIN Engineering.[47]

Orange County's analysis found that the minimum value for the best estimate of a pool fire, for the ASLB's postulated scenario, is 1.6 per 100 thousand reactor-years. This estimate did not account for acts of malice, degraded standards of plant operation, or gross errors in design, construction or operation. The NRC Staff estimated, for the same scenario, that the probability of a pool fire is on the order of 2 per 10 million reactor-years. The ASLB accepted the Staff's estimate, thereby concluding that, for the particular configuration of the Harris plant, the postulated scenario is "remote and speculative"; the

[44] ASLB, 2000.
[45] Thompson, 2000.
[46] Parry et al, 2000.
[47] ERIN, 2000.

ASLB then terminated the proceeding without conducting an evidentiary hearing.[48] Elsewhere, the author has described deficiencies in the ASLB's ruling.[49]

A major reason for the difference in the probability estimates proffered by Orange County and the NRC Staff was their differing assessments of the spread of radioactive material from the reactor containment building to the separate, adjacent pool building. However, the Staff agreed with Orange County on some other matters. For example, the Staff reversed its previous position that comparatively long-discharged fuel will not ignite in the event of water loss from a high-density pool. Staff members stated that loss of water from pools containing fuel aged less than 5 years "would almost certainly result in an exothermic reaction", and also stated: "Precisely how old the fuel has to be to prevent a fire is still not resolved."[50] Moreover, the Staff assumed that a fire would be inevitable if the water level fell to the top of the racks.

Most importantly for present purposes, the technical submissions of all three parties agreed that the onset of a pool fire in two of the pools in the Harris pool building would preclude the provision of cooling and water makeup to the other two pools. This effect would arise from the spread of hot gases and radioactive material throughout the pool building, which would preclude access by operating personnel. Thus, the pools not involved in the initial fire would boil and dry out, and their fuel would burn.

The Pilgrim and Vermont Yankee plants have a different configuration than the Harris plant, because at Pilgrim and Vermont Yankee the reactor and the pool are within the same building whereas at Harris they are in different buildings. Thus, the Pilgrim and Vermont Yankee plants are analogous to the Harris pool building. Given an early release from the Pilgrim or Vermont Yankee reactor as part of a core-melt accident, hot gases and radioactive material from the reactor would spread throughout the building that encloses both. Provision of cooling and water makeup to the pool would be precluded, the radiation field and the thermal environment being even more extreme than in the Harris situation. The pool would boil and dry out, and its fuel would burn.

Thus, the three parties' agreement in the Harris proceeding implies their agreement that a pool fire would inevitably follow an early release as part of a core-melt accident at Pilgrim or Vermont Yankee. Against that background, this report's assumption of a conditional probability of 50 percent for a pool fire, given an early release, is reasonable.

7. Initiation of a Pool Fire by Malicious Action

The NRC's August 1979 Generic Environmental Impact Statement on handling and storage of spent fuel (NUREG-0575) considered potential sabotage events at a spent-fuel pool.[51] Table 7-1 describes the postulated events, which encompassed the detonation of

[48] ASLB, 2001.
[49] Thompson, 2001b.
[50] Parry et al, 2000, paragraph 29.
[51] NRC, 1979, Section 5 and Appendix J.

explosive charges in the pool, breaching of the walls of the pool building and the pool floor by explosive charges or other means, and takeover of the central control room for one half-hour. Involvement of up to 80 adversaries was implied.

NUREG-0575 did not, however, recognize the potential for an attack with these attributes to cause a fire in the pool.[52] Technically-informed attackers operating within this envelope of attributes could cause a fire in a pool at Pilgrim, Vermont Yankee or other plants. Informed attackers could use explosives, and their command of the control room for one half-hour, to drain water from the pool and release radioactive material from the reactor.[53] The radiation field from the reactor release would preclude personnel access, thus precluding recovery actions if command of the plant were returned to the operators after one half-hour.

The potential for a maliciously-induced pool fire at Pilgrim or Vermont Yankee is influenced by several factors. Here, the following factors are considered: (i) the present level of protection of nuclear power plants and spent fuel; (ii) options for providing greater protection; (iii) available means of attack; and (iv) motives for attack. In the context of an EIS, the first, third and fourth of these factors relate to the probability of a successful attack, and the second factor relates to alternatives.

The present level of protection of nuclear power plants and spent fuel

Site-security measures mandated by the NRC have made access to a nuclear power plant more difficult for attackers approaching on foot or by land vehicle than was the case in 1979.[54] Nevertheless, as discussed below, a successful attack could be mounted today using resources of the scale assumed in NUREG-0575 or employed to attack the United States on 11 September 2001. In light of information now available, the NRC could prepare a supplement to NUREG-0575 that updates its sabotage analysis. This supplement could employ a classified appendix to prevent public disclosure of sensitive information.

The consideration of sabotage events in NUREG-0575 is an exception. As a general rule, the NRC does not consider malicious acts in the context of license proceedings or environmental impact statements. The NRC's policy on this matter is illustrated by a September 1982 ruling by the Atomic Safety and Licensing Board in the operating-license proceeding for the Harris nuclear power plant. An intervenor, Wells Eddleman, had proffered a contention alleging, in part, that the plant's safety analysis was deficient because it did not consider the "consequences of terrorists commandeering a very large airplane.....and diving it into the containment." In rejecting this contention the ASLB stated:[55]

---

[52] The sabotage events postulated in NUREG-0575 yielded comparatively small radioactive releases.
[53] In some areas of the Pilgrim or Vermont Yankee reactor building, one explosive charge could potentially breach the pool wall, the reactor containment, and the reactor vessel.
[54] NRC, 2004; Thompson, 2004.
[55] ASLB, 1982.

> This part of the contention is barred by 10 CFR 50.13. This rule must be read *in pari materia* with 10 CFR 73.1(a)(1), which describes the "design basis threat" against which commercial power reactors *are* required to be protected. Under that provision, a plant's security plan must be designed to cope with a violent external assault by "several persons," equipped with light, portable weapons, such as hand-held automatic weapons, explosives, incapacitating agents, and the like. Read in the light of section 73.1, the principal thrust of section 50.13 is that military style attacks with heavier weapons are not a part of the design basis threat for commercial reactors. Reactors could not be effectively protected against such attacks without turning them into virtually impregnable fortresses at much higher cost. Thus Applicants are not required to design against such things as artillery bombardments, missiles with nuclear warheads, or kamikaze dives by large airplanes, despite the fact that such attacks would damage and may well destroy a commercial reactor.

As indicated by the ASLB, the NRC's basic policy on protecting nuclear facilities from attack is laid down in the regulation 10 CFR 50.13. This regulation was promulgated in September 1967 by the US Atomic Energy Commission (AEC) – which preceded the NRC – and was upheld by the US Court of Appeals in August 1968. It states:[56]

> An applicant for a license to construct and operate a production or utilization facility, or for an amendment to such license, is not required to provide for design features or other measures for the specific purpose of protection against the effects of (a) attacks and destructive acts, including sabotage, directed against the facility by an enemy of the United States, whether a foreign government or other person, or (b) use or deployment of weapons incident to US defense activities.

Pursuant to 10 CFR 50.13, licensees are not required to design or operate nuclear facilities to resist enemy attack. However, events have obliged the NRC to progressively modify this position, so as to require greater protection against malicious or insane acts by sub-national groups. A series of events, including the 1993 bombing of the World Trade Center in New York, persuaded the NRC to introduce, in 1994, regulations requiring licensees to defend nuclear power plants against vehicle bombs. The attacks of 11 September 2001 led the NRC to require additional measures.

The NRC requires its licensees to defend against a design basis threat (DBT), a postulated attack that has become more severe over time. The present DBT was promulgated in April 2003. Prior to February 2002 the DBT was published, but not thereafter. The NRC has described the present DBT for nuclear power plants as follows:[57]

---

[56] Federal Register, Vol. 32, 26 September 1967, page 13445.
[57] NRC Press Release No. 03-053, 29 April 2003.

> The Order that imposes revisions to the Design Basis Threat requires power plants to implement additional protective actions to protect against sabotage by terrorists and other adversaries. The details of the design basis threat are safeguards information pursuant to Section 147 of the Atomic Energy Act and will not be released to the public. This Order builds on the changes made by the Commission's February 25, 2002 Order. The Commission believes that this DBT represents the largest reasonable threat against which a regulated private security force should be expected to defend under existing law. It was arrived at after extensive deliberation and interaction with cleared stakeholders from other Federal agencies, State governments and industry.

From this statement, and from other published information, it is evident that the NRC requires a comparatively light defense for nuclear power plants and their spent fuel. The scope of the defense does not reflect a full spectrum of threats. Instead, it reflects a consensus about the level of threat that licensees can "reasonably" be expected to resist.[58]

A rationale for the present level of protection of nuclear facilities was articulated by the NRC chair, Richard Meserve, in 2002:[59]

> If we allow terrorist threats to determine what we build and what we operate, we will retreat into the past – back to an era without suspension bridges, harbor tunnels, stadiums, or hydroelectric dams, let alone skyscrapers, liquid-natural-gas terminals, chemical factories, or nuclear power plants. We cannot eliminate the terrorists' targets, but instead we must eliminate the terrorists themselves. A strategy of risk avoidance – the elimination of the threat by the elimination of potential targets – does not reflect a sound response.

Options for providing greater protection

Chairman Meserve's statement does not consider another approach – designing new infrastructure elements or modifying existing elements so that they are more robust against attack. It has been known for decades that nuclear power plants could be designed to be more robust against attack. For example, in the early 1980s the reactor vendor ASEA-Atom developed a preliminary design for an "intrinsically safe" commercial reactor known as the PIUS reactor. Passive-safety design principles were used. The design basis for the PIUS reactor included events such as equipment failures, operator errors and earthquakes, but also included: (i) takeover of the plant for one operating shift by knowledgeable saboteurs equipped with large amounts of explosives; (ii) aerial bombardment with 1,000-pound bombs; and (iii) abandonment of the plant by the operators for one week.[60]

---

[58] Fertel, 2006; Wells, 2006; Brian, 2006.
[59] Meserve, 2002, page 22.
[60] Hannerz, 1983.

As explained in Section 8, below, the spent-fuel pools at the Pilgrim and Vermont Yankee plants would be more robust against attack if they were re-equipped with low-density, open-frame storage racks. This step would restore the pools to their original design configuration.

Available means of attack

In considering the potential for a future attack on the Pilgrim or Vermont Yankee spent-fuel pool, it is necessary to consider both means and motives. Table 7-2 provides some general information about means. This table shows that nuclear power plants are vulnerable to attack by means available to sub-national groups. For example, one of the potential instruments of attack shown in Table 7-2 is an explosive-laden smaller aircraft. In this connection, note that the US General Accounting Office (GAO) expressed concern, in September 2003 testimony to Congress, about the potential for malicious use of general-aviation aircraft. The testimony stated:[61]

> Since September 2001, TSA [the Transportation Security Administration] has taken limited action to improve general aviation security, leaving it far more open and potentially vulnerable than commercial aviation. General aviation is vulnerable because general aviation pilots are not screened before takeoff and the contents of general aviation planes are not screened at any point. General aviation includes more than 200,000 privately owned airplanes, which are located in every state at more than 19,000 airports. Over 550 of these airports also provide commercial service. In the last 5 years, about 70 aircraft have been stolen from general aviation airports, indicating a potential weakness that could be exploited by terrorists.

Sub-national groups could obtain explosive devices that would be effective instruments of attack on a nuclear power plant.[62] Assistance from a government or access to classified information would not be required. Designs for sophisticated explosive devices capable of exploiting the vulnerabilities of the Pilgrim or Vermont Yankee spent-fuel pools are publicly available from sources including the web. Means for delivery of such devices to the target are also readily available.[63]

Motives for attack

Understanding the factors that could motivate a sub-national group to attack a civilian nuclear facility in the USA is a difficult task. Multiple, competing factors will be in play, and will affect different groups in different ways. An attacking group might be foreign, as was the case in New York and Washington in September 2001, or domestic, as was the case in Oklahoma City in April 1995 and London in July 2005. As we try to understand

[61] Dillingham, 2003, page 14.
[62] Walters, 2003.
[63] For example: Raytheon, 2004; the website www.aircraftdealer.com, accessed 6 November 2004.

the complex issue of motives, one requirement is clear. We must set aside our own perspectives, and attempt to understand the perspectives of those who might attack us. That understanding will help us to assess risks and prepare countermeasures.

One insight from experience is that an attack by a sub-national group could be part of an action-reaction cycle.[64] Former CIA Director Stansfield Turner has recounted how the October 1983 truck bombing of a US Marine barracks in Beirut was part of such a cycle.[65] A high-level task force convened by the Council on Foreign Relations recognized the potential for an action-reaction effect in the context of US military operations with counterterrorism objectives. They recommended that this effect be offset by greater protection of domestic targets. An October 2002 report of the task force stated:[66]

> *Homeland security measures have deterrence value*:
> US counterterrorism initiatives abroad can be reinforced by making the US homeland a less tempting target. We can transform the calculations of would-be terrorists by elevating the risk that (1) an attack on the United States will fail, and (2) the disruptive consequences of a successful attack will be minimal. It is especially critical that we bolster this deterrent now since an inevitable consequence of the US government's stepped-up military and diplomatic exertions will be to elevate the incentive to strike back before these efforts have their desired effect.

Probability of attack

For policy and planning purposes, it would be useful to have an estimate of the probability of an attack-induced spent-fuel-pool fire. The record of experience does not allow a statistically valid estimate of this probability. A decision maker or risk analyst must, therefore, rely on prudent judgment.[67] In the case of an attack-induced spent-fuel-pool fire in the USA, prudent judgment indicates that a probability of at least one per century is a reasonable assumption for policy purposes.

8. Options to Reduce the Risks of Pool Fires

Various options are available to reduce the probability and/or magnitude of an atmospheric release from a spent-fuel-pool fire at Pilgrim or Vermont Yankee. A useful option must achieve one or more of the following five effects: (i) reduce the probability of a loss of water; (ii) reduce the potential for ignition of fuel following a loss of water; (iii) reduce the potential for fire propagation following ignition of one or more fuel

[64] Davis, 2006.
[65] Turner, 1991.
[66] Hart et al, 2002, pp 14-15.
[67] The NRC has used qualitative judgment about the probability of attack as a basis for the 1994 vehicle-bomb rule and the present design basis threat.

assemblies; (iv) reduce the inventory of spent fuel in the pool; or (v) suppress a fire in the pool.

The fifth effect – fire suppression – would be extremely difficult to achieve. Spraying water on a fire could feed a zirconium-steam reaction. In principle, an air-zirconium reaction in the pool could be smothered, perhaps by spreading large amounts of a non-reactive powder. In practice, the high radiation field surrounding the pool would preclude the approach of firefighters. Here, the focus is on the first four effects.

Table 8-1 describes selected risk-reducing options that could, to some degree, achieve one or more of the first four effects. This table does not purport to identify a comprehensive set of risk-reducing options, or to provide a complete assessment of the listed options. Instead, this table illustrates the range of options and their properties.

The option that would achieve the largest risk reduction, during plant operation within a license extension period, would be to re-equip the pool with low-density, open-frame storage racks. Implementation of this option would return the plant to its original design configuration. Excess spent fuel would be placed in dry storage at the plant site. This option would not reduce the probability of a loss of water. Instead, it would allow the pool to survive a loss of water without damage to the fuel. It would prevent ignition of fuel in almost all scenarios of water loss. For the few, unlikely scenarios that would remain, it would inhibit fire propagation across the pool. By reducing the inventory of radioactive material in the pool, this option would limit the magnitude of the greatest possible release.

Re-equipping a spent-fuel pool with low-density, open-frame racks would be an entirely passive measure of risk reduction. Successful functioning of this option would not require electricity, a water supply, the presence of personnel, or any other active function. Passive risk-reduction measures of this type represent good practice in nuclear engineering design. Reactor vendors are seeking to use passive-safety principles in the design of new commercial reactors.

Nuclear power plants are important elements of the nation's critical infrastructure. Other elements of that infrastructure also offer opportunities to use passive measures of risk reduction. Passive measures can be highly reliable and predictable in their effectiveness. They can substitute for other measures to protect critical infrastructure, as shown in Table 8-2, yielding monetary and non-monetary benefits.

Table 8-3 provides an estimated cost for offloading spent fuel from the Pilgrim or Vermont Yankee pool, to allow the pool to be re-equipped with low-density, open-frame racks. There would be an additional, smaller cost for replacing the racks, which is neglected here. Note that Table 8-3 does not purport to provide a definitive specification for re-equipment of the pools, or a final estimate of the cost of this option. The analysis presented in Table 8-3 is illustrative. A more sophisticated analysis would not alter the basic findings of this report.

From Table 8-3 one sees that the estimated cost of a transition to low-density, open-frame racks would be $54-109 million at Pilgrim and $43-87 million at Vermont Yankee. Approximately the same cost would otherwise be incurred during decommissioning of the plant, when spent fuel would be offloaded from the pool to dry storage. The net additional cost of the option would reflect the comparative present values of approximately equal expenditures now or two decades in the future.

9. An Integrated View of Risks and Risk-Reducing Options

Preceding sections of this report have discussed particular aspects of the risks and risk-reducing options associated with pool storage of spent nuclear fuel. To produce useful policy findings, these separate discussions must be integrated.

Section 6 of this report provides, in Tables 6-1 and 6-2, licensee estimates of the probability of an early release as part of a severe reactor accident – of non-malicious origin – at Pilgrim or Vermont Yankee. Also, Section 6 develops the reasonable assumption that the conditional probability of a spent-fuel-pool fire, given an early release from the reactor, is 50 percent. Section 7 sets forth a judgment that the probability of a successful, attack-induced spent-fuel-pool fire in the USA can be assumed, for policy purposes, to be at least one per century. Section 8 provides an estimate that the cost of a transition to low-density, open-frame racks in a spent-fuel pool would be $54-109 million at Pilgrim and $43-87 million at Vermont Yankee.

Table 9-1 combines the findings of Sections 6 and 7, yielding an estimate that the total probability of a pool fire at Pilgrim or Vermont Yankee is 1.2 per 10,000 years at each plant. A number of simplifying assumptions are employed in Table 9-1, as is evident from the table. A more sophisticated analysis would not alter the general findings of this report.

Entergy's Environmental Reports for Pilgrim and Vermont Yankee present a cost-versus-benefit analysis as a means of evaluating Severe Accident Mitigation Alternatives. Table 9-2 illustrates this type of analysis. The table shows that an investment of $110-200 million (depending on discount rate) is justified to prevent a radioactive release with a probability of one per 10,000 years and a consequence cost of $100 billion.

A companion report by Dr. Jan Beyea shows that the consequence cost attributable to a spent-fuel-pool fire at Pilgrim or Vermont Yankee would exceed $100 billion across a range of release scenarios.[68] This report estimates that the probability of a pool fire at Pilgrim or Vermont Yankee is more than one per 10,000 years at each plant. Re-equipping the Pilgrim or Vermont Yankee pool with low-density, open-frame racks would substantially reduce the probability of a pool fire and the magnitude of its

[68] The findings in Dr. Beyea's companion report are consistent with previous analysis provided in: Beyea et al, 2004.

consequences. To a first-order approximation, re-equipping a pool in this manner would eliminate the risk of a pool fire. The cost of re-equipping a pool would be less than $110 million. Thus, a SAMA-type analysis shows that re-equipping both pools with low-density, open-frame racks is justified.

The analysis underlying this conclusion does not purport to be comprehensive. This analysis is, however, sufficient to show that Entergy and the NRC are obliged to perform new studies, as described in Section 10, below.

Probabilistic analysis, of the type that is used in Table 9-1 and in Entergy's Environmental Reports, should not be the only means of evaluating Severe Accident Mitigation Alternatives. People who are unfamiliar with probabilistic risk assessment may place unwarranted faith in the numerical values that it generates. A closer look at probabilistic risk assessment for nuclear power plants shows that its findings are plagued by incompleteness and uncertainty.[69] These findings cannot substitute for prudent, informed judgment. In exercising that judgment, decision makers should be aware of strategic considerations, such as those addressed in Table 8-2. ,

10. Analysis Required From Entergy and the Nuclear Regulatory Commission

Entergy's Environmental Reports for the Pilgrim and Vermont Yankee plants do not examine the potential for a radioactive release from a fire in a spent-fuel pool. Nor do they consider SAMA-type options that could reduce the probability and/or magnitude of such a release. Similarly, the NRC does not consider such options in its GEIS for re-licensing of nuclear power plants.

Yet, the NRC has determined that the potential for a reactor core-melt accident must be considered in a re-licensing EIS. Moreover, a spent-fuel-pool fire at Pilgrim or Vermont Yankee has, according to this report, a probability comparable to the probability of a reactor core-melt accident. Finally, the offsite radiological impact of the pool fire could be substantially greater than the impact of the core-melt accident, because the pool has a larger inventory of cesium-137. Therefore, the potential for a pool fire should be considered in an Environmental Report or EIS for re-licensing. Such studies should use at least the depth of analysis that is employed to consider the potential for a core-melt accident.

Entergy should withdraw, revise and re-submit its Environmental Reports. In addressing the potential for pool fires, each revised ER should consider the full range of potential initiating events, including acts of malice. Options for reducing the risks of pool fires should be considered to at least the depth of analysis that is employed for SAMAs in the context of reactor accidents.

---

[69] Hirsch et al, 1989.

The NRC should prepare generic supplements to its August 1979 Generic Environmental Impact Statement on handling and storage of spent fuel (NUREG-0575), and its May 1996 GEIS on license renewal (NUREG-1437). These supplements should address the risks of spent-fuel-pool fires to at least the depth of analysis and experiment that was conducted to prepare the NRC's December 1990 study on the risks of reactor accidents (NUREG-1150).[70] In addition, the supplements should identify a range of options to reduce the risks of pool fires, and should comprehensively assess the benefits and costs of these options. An EIS prepared for re-licensing of Pilgrim or Vermont Yankee should incorporate the findings of the new, generic supplements to NUREG-0575 and NUREG-1437.

11. Conclusions

Discussions in preceding sections of this report lead to the following major conclusions:

C1. At the Pilgrim and Vermont Yankee plants, large amounts of spent nuclear fuel are stored in water-filled pools equipped with high-density, closed-form storage racks. Entergy plans to continue this practice during the period of license extension, operating the pools at near to full capacity.

C2. The radioactive isotope cesium-137 provides a useful indicator of the hazard potential of the Pilgrim and Vermont Yankee spent-fuel pools. During the period of license extension, it is likely that these pools will hold about 1.6 million TBq (Pilgrim) and 1.4 million TBq (Vermont Yankee) of cesium-137. Each pool will hold about 8 times as much cesium-137 as will be present in the adjacent reactor.

C3. Various studies by the NRC and other bodies have shown that loss of water from a spent-fuel pool equipped with high-density, closed-form storage racks would, over a range of scenarios, lead to self-ignition of some of the fuel assemblies in the pool, leading to a fire that could propagate across the pool. Burning of fuel assemblies would lead to a large atmospheric release of cesium-137 and other radioactive isotopes. These findings have been confirmed by a 2005 report prepared by the National Academy of Sciences at the request of the US Congress.

C4. Entergy has submitted an Environmental Report (ER) as part of each license extension application. Each ER examines potential reactor accidents involving damage to the reactor core and release of radioactive material to the atmosphere. That examination supports the ER's evaluation of Severe Accident Mitigation Alternatives (SAMAs) – options that could reduce the probability and/or magnitude of a radioactive release from the reactor. Neither ER examines the potential for a radioactive release from a fire in a spent-fuel pool, or considers SAMA-type options that could reduce the probability and/or magnitude of such a release.

---

[70] NRC, 1990b.

C5. The NRC has published various documents that discuss aspects of the potential for a spent-fuel-pool fire. Only three of these documents are products of processes that provided an opportunity for formally structured public comment and, potentially, for in-depth analysis of risks and alternatives. One document is the August 1979 Generic Environmental Impact Statement (GEIS) on handling and storage of spent fuel (NUREG-0575). The second document is the May 1996 GEIS on license renewal (NUREG-1437). These two documents purported to provide systematic analysis of the risks and relative costs and benefits of alternative options. The third document is a September 1990 review (55 FR 38474) of the NRC's Waste Confidence Decision. That document did not purport to provide an analysis of risks and alternatives. None of the three documents provides a technically defensible examination of spent-fuel-pool fires and the associated risks and alternatives. The findings in each document are inconsistent with the more recent and more credible findings of the National Academy of Sciences, set forth in its 2005 report, and the findings of other studies conducted since 1996.

C6. The August 1979 GEIS (NUREG-0575) considered potential sabotage events at a spent-fuel pool. The GEIS did not recognize the potential for an attack with the postulated attributes to cause a fire in the pool. Technically-informed attackers operating within this envelope of attributes could, with high confidence, cause an unstoppable fire in a pool.

C7. Site-security measures mandated by the NRC have made access to a nuclear power plant more difficult for attackers approaching on foot or by land vehicle than was the case in 1979. Nevertheless, a successful attack could be mounted using resources of the scale assumed in NUREG-0575 or employed to attack the United States on 11 September 2001. The NRC has not prepared any environmental impact statement or comparable study that updates the sabotage analysis set forth in NUREG-0575.

C8. The record of experience does not allow a statistically valid estimate of the probability of an attack-induced spent-fuel-pool fire in the USA. Prudent judgment indicates that a probability of at least one per century is a reasonable assumption for policy purposes. This translates to a probability of one per 10,000 years at Pilgrim or Vermont Yankee, which is comparable to the estimated probability of a reactor core-melt accident according to probabilistic risk studies done for these plants.

C9. Probabilistic risk studies done by licensees for the Pilgrim and Vermont Yankee plants can support an estimate of the probability of a spent-fuel-pool fire that is caused by or accompanies a core-melt accident at the adjacent reactor. The connection between these events is particularly strong at these plants because the pool and the reactor are in close physical proximity within the same building, and some of their essential support systems are shared. A provisional estimate of the probability of a spent-fuel-pool fire associated with a core-melt accident, not involving malice, is about two per 100,000 years at each plant.

C10. Options are available to reduce the probability and/or magnitude of an atmospheric release from a spent-fuel-pool fire at Pilgrim or Vermont Yankee. The option that would achieve the largest risk reduction, during plant operation within a license extension period, would be to re-equip the pool with low-density, open-frame racks. This step would return the plant to its original design configuration. Excess spent fuel would be placed in dry storage at the plant site. The estimated cost of this option would be $54-109 million at Pilgrim and $43-87 million at Vermont Yankee. Approximately the same cost would otherwise be incurred during decommissioning of the plant, when spent fuel would be offloaded from the pool to dry storage. The net additional cost of the option would reflect the comparative present values of approximately equal expenditures now or two decades in the future.

C11. Re-equipping a spent-fuel pool with low-density, open-frame racks would be a passive measure that would eliminate most scenarios for a pool fire and greatly reduce the atmospheric release for the few, unlikely scenarios that would remain. Passive risk-reduction measures of this type represent good practice in nuclear engineering design. Substantial benefits, both monetary and non-monetary, could arise from the deployment of passive risk-reduction measures at nuclear power plants and other elements of critical infrastructure.

C12. Entergy's Environmental Reports present a cost-versus-benefit analysis as a means of evaluating Severe Accident Mitigation Alternatives. This type of analysis should not be the only basis for evaluating SAMAs, but can provide useful information. The analysis shows that an investment of $110-200 million (depending on discount rate) is justified to prevent a radioactive release with a probability of one per 10,000 years and a consequence cost of $100 billion. A companion report by Dr. Jan Beyea shows that the consequence cost attributable to a spent-fuel-pool fire at Pilgrim or Vermont Yankee would exceed $100 billion across a range of release scenarios. Given the pool-fire probability found in this report (at least one per 10,000 years), and the estimated cost of re-equipping the Pilgrim or Vermont Yankee pool with low-density, open-frame racks (less than $110 million), re-equipment of both pools in this manner is justified.

C13. The NRC has determined that the potential for a reactor core-melt accident must be considered in an environmental impact statement for the re-licensing of a nuclear power plant. Thus, the NRC has determined that such an accident is neither remote nor speculative. A spent-fuel-pool fire at Pilgrim or Vermont Yankee has, by estimation in this report, a probability comparable to the probability of a reactor core-melt accident. The offsite radiological impact of the pool fire could be substantially greater than the impact of the core-melt accident. Therefore, the potential for a pool fire should be considered in a re-licensing EIS to at least the depth accorded the consideration of a core-melt accident.

C14. Entergy should withdraw, revise and re-submit its Environmental Reports for Pilgrim and Vermont Yankee. The revised ERs should address the potential for pool fires to at least the depth of analysis that is employed for reactor accidents. The pool-fire

analysis should consider the full range of potential initiating events, including acts of malice. Options for reducing the risks of pool fires should be considered to at least the depth of analysis that is employed for SAMAs in the context of reactor accidents.

C15. The NRC should prepare supplements to its August 1979 Generic Environmental Impact Statement on handling and storage of spent fuel (NUREG-0575), and its May 1996 GEIS on license renewal (NUREG-1437). These supplements should address the risks of spent-fuel-pool fires to at least the depth of analysis and experiment that was conducted to prepare the NRC's December 1990 study on the risks of reactor accidents (NUREG-1150). Acts of malice should be considered. In addition, the supplements should identify a range of options to reduce the risks of pool fires, and should comprehensively assess the benefits and costs of these options.

12. Bibliography

(AEC, 1972a)
US Atomic Energy Commission, *Final Environmental Statement Related to Operation of Pilgrim Nuclear Power Station* (Washington, DC: AEC, May 1972).

(AEC, 1972b)
US Atomic Energy Commission, *Final Environmental Statement Related to Operation of Vermont Yankee Nuclear Power Station* (Washington, DC: AEC, July 1972).

(Alvarez et al, 2003)
Robert Alvarez, Jan Beyea, Klaus Janberg, Jungmin Kang, Ed Lyman, Allison Macfarlane, Gordon Thompson and Frank N. von Hippel, "Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States", *Science and Global Security*, Volume 11, 2003, pp 1-51.

(ASLB, 2001)
ASLBP No. 99-762-02-LA, "Memorandum and Order (Denying Request for Evidentiary Hearing and Terminating Proceeding)", 1 March 2001.

(ASLB, 2000)
ASLBP No. 99-762-02-LA, "Memorandum and Order (Ruling on Late-Filed Environmental Contention)", 7 August 2000.

(ASLB, 1982)
Carolina Power and Light Co. (Shearon Harris Nuclear Power Plant, Units 1 and 2), LBP-82-119A, 16 NRC 2069, 2098 (1982).

(Benjamin et al, 1979)
Allan S. Benjamin and 3 other authors, *Spent Fuel Heatup Following Loss of Water During Storage, NUREG/CR-0649* (Washington, DC: US Nuclear Regulatory Commission, March 1979).

(Beyea et al, 2004)
Jan Beyea, Ed Lyman and Frank von Hippel, "Damages from a Major Release of Cs-137 into the Atmosphere of the United States", *Science and Global Security*, Volume 12, 2004, pp 125-136.

(Boston Edison, 1994)
Boston Edison Co., *Pilgrim Nuclear Power Station Individual Plant Examination for External Events*, July 1994.

(Boston Edison, 1992)
Boston Edison Co., *Pilgrim Nuclear Power Station Individual Plant Examination*, September 1992.

(Brian, 2006)
Danielle Brian, Project on Government Oversight, letter to NRC chair Nils J. Diaz, 22 February 2006.

(Collins and Hubbard, 2001)
T. E. Collins and G. Hubbard, *Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants, NUREG-1738* (Washington, DC: US Nuclear Regulatory Commission, February 2001). (This document was first released in October 2000.)

(Davis, 2006)
Mike Davis, "The Poor Man's Air Force: A History of the Car Bomb (Part 1)", TomDispatch.com, 12 April 2006.

(Dillingham, 2003)
Gerald L. Dillingham, US General Accounting Office, testimony before the Committee on Commerce, Science and Transportation, US Senate, "Aviation Security: Progress Since September 11, 2001, and the Challenges Ahead", 9 September 2003.

(DOE, 1987)
US Department of Energy, *Health and Environmental Consequences of the Chernobyl Nuclear Power Plant Accident, DOE/ER-0332* (Washington, DC: DOE. June 1987).

(ERIN, 2000)
ERIN Engineering and Research Inc., "Technical Input for Use in the Matter of Shearon Harris Spent Fuel Pool Before the Atomic Safety and Licensing Board (Docket No. 50-400-LA)", November 2000.

(Fertel, 2006)
Marvin Fertel, Nuclear Energy Institute, testimony before the Subcommittee on National Security, Emerging Threats and International Relations, US House Committee on Government Reform, 4 April 2006.

(Hannerz, 1983)
K. Hannerz, *Towards Intrinsically Safe Light Water Reactors* (Oak Ridge, Tennessee: Institute for Energy Analysis, February 1983).

(Hart et al, 2002)
Gary Hart and Warren B. Rudman (Co-chairs), Stephen E. Flynn (project director) and Task Force members, *America Still Unprepared – America Still in Danger: Report of an*

Independent Task Force Sponsored by the Council on Foreign Relations (New York, NY: Council on Foreign Relations, 25 October 2002).

(Hirsch et al, 1989)
H. Hirsch and 3 other authors, *IAEA Safety Targets and Probabilistic Risk Assessment* (Hannover, Germany: Gesellschaft fur Okologische Forschung und Beratung, August 1989).

(Hoffman, 2005)
John Hoffman, pre-filed testimony to Vermont Public Service Board on behalf of Entergy Nuclear Vermont Yankee, LLC, 16 June 2005.

(Holtec, 1993)
Holtec International, *Pilgrim Nuclear Power Station Spent Fuel Storage Capacity Expansion* (Cherry Hill, New Jersey: Holtec, 5 January 1993).

(Jo et al, 1989)
J. H. Jo and 5 other authors, *Value/Impact Analyses of Accident Preventive and Mitigative Options for Spent Fuel Pools, NUREG/CR-5281* (Washington, DC: US Nuclear Regulatory Commission, March 1989).

(Meserve, 2002)
Richard A. Meserve, "Nuclear Security in a New World", *The Industrial Physicist*, October/November 2002, pp 20-23.

(NAS, 2006)
Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, Board on Radioactive Waste Management, National Research Council, *Safety and Security of Commercial Spent Nuclear Fuel Storage: Public Report* (Washington, DC: National Academies Press, 2006). (This document was first released in April 2005.)

(NRC, 2004)
US Nuclear Regulatory Commission, *Protecting Our Nation Since 9-11-01, NUREG/BR-0314* (Washington, DC: Nuclear Regulatory Commission, September 2004).

(NRC, 1996)
US Nuclear Regulatory Commission, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, NUREG-1437* (Washington, DC: Nuclear Regulatory Commission, May 1996).

(NRC, 1990a)
US Nuclear Regulatory Commission, "10 CFR Part 51: Waste Confidence Decision Review", Federal Register, Vol. 55, 18 September 1990, page 38474.

(NRC, 1990b)
US Nuclear Regulatory Commission, *Severe Accident Risks: An Assessment for Five US Nuclear Power Plants, NUREG-1150* (Washington, DC: Nuclear Regulatory Commission, December 1990).

(NRC, 1979)
US Nuclear Regulatory Commission, *Generic Environmental Impact Statement on Handling and Storage of Spent Light Water Power Reactor Fuel, NUREG-0575* (Washington, DC: Nuclear Regulatory Commission, August 1979).

(NRC, 1975)
US Nuclear Regulatory Commission, *Reactor Safety Study, WASH-1400 (NUREG-75/014)* (Washington, DC: Nuclear Regulatory Commission, October 1975).

(Parry et al, 2000)
ASLBP No. 99-762-02-LA, "Affidavit of Gareth W. Parry, Stephen F. LaVie, Robert L. Palla and Christopher Gratton in Support of NRC Staff Brief and Summary of Relevant Facts, Data and Arguments upon which the Staff Proposes to Rely at Oral Argument on Environmental Contention EC-6", 20 November 2000.

(Prassinos et al, 1989)
P. G. Prassinos and 8 other authors, *Seismic Failure and Cask Drop Analyses of the Spent Fuel Pools at Two Representative Nuclear Power Plants, NUREG/CR-5176* (Washington, DC: US Nuclear Regulatory Commission, January 1989).

(Raytheon, 2004)
Raytheon Aircraft Company, "Technical Data, Beechcraft King Air C90B", 16 June 2004.

(Sailor et al, 1987)
V. L. Sailor and 3 other authors, *Severe Accidents in Spent Fuel Pools in Support of Generic Safety Issue 82, NUREG/CR-4982* (Washington, DC: US Nuclear Regulatory Commission, July 1987).

(Thompson, 2006)
Gordon R. Thompson, pre-filed testimony before the Public Service Board, State of Vermont, 17 January 2006.

(Thompson, 2004)
Gordon Thompson, Institute for Resource and Security Studies, Cambridge, Massachusetts, testimony before the Public Utilities Commission of the State of California regarding Application No. 04-02-026, 13 December 2004. (This testimony, prepared for California Earth Corps, addressed the provision of an enhanced defense of Units 2 and 3 of the San Onofre Nuclear Generating Station.)

(Thompson, 2003)
Gordon Thompson, *Robust Storage of Spent Nuclear Fuel: A Neglected Issue of Homeland Security* (Cambridge, Massachusetts: Institute for Resource and Security Studies, January 2003).

(Thompson, 2001a)
Gordon Thompson, *Comments on the NRC Staff's Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants* (Cambridge, Massachusetts: Institute for Resource and Security Studies, 19 February 2001).

(Thompson, 2001b)
US Court of Appeals for the District of Columbia Circuit, No. 01-1246, "Declaration of 31 May 2001 by Dr Gordon Thompson in Support of Orange County's Stay Motion".

(Thompson, 2000)
Gordon Thompson, *The Potential for a Large, Atmospheric Release of Radioactive Material from Spent Fuel Pools at the Harris Nuclear Power Plant: The Case of a Pool Release Initiated by a Severe Reactor Accident* (Cambridge, Massachusetts: Institute for Resource and Security Studies, 20 November 2000).

(Thompson et al, 1979)
Gordon Thompson (subgroup chair), Jan Beyea, Yves Lenoir and Gene Rochlin, "Potential Accidents and their Effects", Chapter 3 of the Report of the Gorleben International Review, submitted (in German) to the government of Lower Saxony, March 1979.

(Throm, 1989)
E. D. Throm, *Regulatory Analysis for the Resolution of Generic Issue 82, "Beyond Design Basis Accidents in Spent Fuel Pools", NUREG-1353* (Washington, DC: US Nuclear Regulatory Commission, April 1989).

(Turner, 1991)
Stansfield Turner, *Terrorism and Democracy* (Boston: Houghton Mifflin Co., 1991).

(VYNPS, 1998)
Vermont Yankee Nuclear Power Station, *Vermont Yankee Individual Plant Examination, External Events – IPEEE* (Vernon, Vermont: VYNPS, June 1998).

(VYNPS, 1993)
Vermont Yankee Nuclear Power Station, *Vermont Yankee Individual Plant Examination – IPE* (Vernon, Vermont: VYNPS, December 1993).

(Wald, 2005)
Matthew L. Wald, "Agencies Fight Over Report on Sensitive Atomic Wastes", *The New York Times*, 30 March 2005.

(Walters, 2003)
William Walters, "An Overview of the Shaped Charge Concept", paper presented at the 11th Annual ARL/USMA Technical Symposium, 5 and 7 November 2003. (This symposium was sponsored by the Mathematical Sciences Center of Excellence at the US Military Academy (USMA) and hosted by the US Army Research Laboratory (ARL) and USMA.)

(Wells, 2006)
Jim Wells, US Government Accountability Office, testimony before the Subcommittee on National Security, Emerging Threats and International Relations, US House Committee on Government Reform, "Nuclear Power Plants Have Upgraded Security, but the Nuclear Regulatory Commission Needs to Improve Its Process for Revising the Design Basis Threat", 4 April 2006.

Table 3-1
Selected Characteristics of the Pilgrim and Vermont Yankee Plants

Characteristic	Pilgrim	Vermont Yankee
Reactor type	BWR Mark 3	BWR Mark 4
Containment type	Mark 1: Drywell and free-standing torus	Mark 1: Drywell and free-standing torus
Rated power	2,028 MWt	1,593 MWt; application pending for 20% uprate to 1,912 MWt
Number of fuel assemblies in reactor core	580	368
Date of first commercial operation	December 1972	November 1972
Date of expiration of present operating license	June 2012	March 2012
Heat sink	Ocean	Connecticut River and/or cooling towers
Inventory of cesium-137 in reactor core	1.90E+17 Bq (Assumed power: 2,028 MWt)	1.79E+17 Bq (Assumed power: 1,912 MWt)

Sources:
(a) Jay R. Larson, *System Analysis Handbook, NUREG/CR-4041*, USNRC, November 1985.
(b) License renewal application, Appendix E (for each plant).

Table 3-2
Selected Characteristics of the Spent-Fuel Pools at the Pilgrim and Vermont Yankee Plants

Characteristic	Pilgrim	Vermont Yankee
Licensed capacity	3,859 fuel assemblies	• In 1988: 2,870 fuel assemblies; unused floor space could hold racks with potential additional capacity of about 360 assemblies • At present: 3,355 fuel assemblies, incl. temporary, 266-cell rack in cask position
Inventory at end of 2002	2,274 fuel assemblies	2,671 fuel assemblies
Capacity needed for full-core discharge	580 fuel assemblies	368 fuel assemblies
Floor dimensions	40 ft 4 in by 30 ft 6 in; 5 ft 8 in thick	40 ft 0 in by 26 ft 0 in; 5 ft 0 in thick including 11 in of grout
Depth	38 ft 9 in	38 ft 9 in
Wall thicknesses	Reactor shield wall forms one face; thicknesses of other walls range from 4 ft 1 in to 6 ft 1 in.	Reactor shield wall forms one face; thicknesses of other walls range from 4 ft 6 in to 6 ft 0 in.
Typical spent fuel assembly	General Electric 8x8; 210 kgU per assembly	General Electric 8x8; 210 kgU per assembly

Sources:
(a) USNRC documentation of Amendment No. 155, Pilgrim operating license.
(b) USNRC documentation of Amendment No. 104, Vermont Yankee operating license.
(c) P. G. Prassinos et al, *Seismic Failure and Cask Drop Analyses of the Spent Fuel Pools at Two Representative Nuclear Power Plants, NUREG/CR-5176*, USNRC, January 1989.
(d) Vermont Yankee Nuclear Power Corporation, *Vermont Yankee Spent Fuel Storage Rack Replacement Report*, April 1986.
(e) Holtec International, *Pilgrim Nuclear Power Station Spent Fuel Storage Capacity Expansion*, 5 January 1993.
(f) USNRC, *Generic EIS on Handling and Storage of Spent Light Water Power Reactor Fuel, NUREG-0575*, August 1979.
(g) Anthony Andrews, *Spent Nuclear Fuel Storage Locations and Inventory, CRS Report for Congress*, 21 December 2004.
(h) John Hoffman, pre-filed testimony to Vermont Public Service Board on behalf of Entergy Nuclear Vermont Yankee, LLC, 16 June 2005.

Table 3-3
Estimation of Cesium-137 Inventory in a Spent-Fuel Assembly and the Reactor Core, for the Pilgrim and Vermont Yankee Plants

Estimation Step	Pilgrim	Vermont Yankee
Fuel burnup at discharge	B MWt-days per kgU	B MWt-days per kgU
Discharge burnup assuming each fuel assembly has a mass of 210 kgU	210xB MWt-days per assembly	210xB MWt-days per assembly
Reactor characteristics	• Rated power: 2,028 MWt • 580 fuel assemblies	• Rated power: 1,912 MWt • 368 fuel assemblies
Av. rated power per assembly	2,028/580 = 3.50 MWt	1,912/368 = 5.20 MWt
Av. full-power days per assembly	210xB/3.50 = 60.0xB days	210xB/5.20 = 40.4xB days
Av. full-power days per assembly, assuming B = 30	1,800 days = 4.93 yr	1,212 days = 3.32 yr
Av. actual days of exposure per assembly, assuming plant capacity factor = 0.90	2,000 days = 5.48 yr	1,347 days = 3.69 yr
Cesium-137 inventory in av. fuel assembly at completion of exposure	7.24E+14 Bq	7.39E+14 Bq
Approx. core inventory of cesium-137	((7.24E+14)/2)x580 = 2.10E+17 Bq	((7.39E+14)/2)x368 = 1.36E+17 Bq
Core inventory of cesium-137 as reported in Appendix E of license renewal application	1.90E+17 Bq	1.79E+17 Bq

Notes:
Here, calculation of the cesium-137 inventory in an average fuel assembly assumes steady-state fission of uranium-235 with an energy yield of 200 MeV per fission and a cesium-137 fission yield of 6.2 percent, over the actual days of exposure with a constant power level of 0.90 times the rated power level.

Table 3-4
Estimated Future Inventory and Selected Characteristics of Spent Fuel in Pools at the Pilgrim and Vermont Yankee Plants

Estimation Step	Pilgrim	Vermont Yankee
Licensed capacity	3,859 fuel assemblies	3,089 fuel assemblies (Not including temporary, 266-cell rack in cask position)
Capacity needed for full-core discharge	580 fuel assemblies	368 fuel assemblies
Assumed periodic offload of older fuel assemblies to onsite dry-storage modules	Offload to fill 3 modules, each of 68-assembly capacity: 204 assemblies	Offload to fill 3 modules, each of 68-assembly capacity: 204 assemblies
Average inventory of spent fuel, assuming pool used at near-full capacity	3,859 – 580 – 204/2 = 3,177 fuel assemblies	3,089 – 368 – 204/2 = 2,619 fuel assemblies
Av. period of exposure of assembly in core, assuming burnup of 30 MWt-days per kgU and plant capacity factor of 0.90	5.48 yr	3.69 yr
Av. age of fuel assemblies after discharge to pool	(3,177/(580/5.48))/2 = 15.0 yr	(2,619/(368/3.69))/2 = 13.1 yr
Cesium-137 in av. fuel assembly at discharge	7.24E+14 Bq	7.39E+14 Bq
Cesium-137 in pool, assuming all assemblies at average age	1.63E+18 Bq (44.1 MCi)	1.43E+18 Bq (38.6 MCi)
Mass of zirconium in pool, assuming 60 kg per fuel assembly	191,000 kg	157,000 kg

Notes:
Data on a General Electric 8x8 fuel assembly are provided in Table G.4 of: USNRC, *Generic EIS on Handling and Storage of Spent Light Water Power Reactor Fuel, NUREG-0575*, August 1979. The total mass of an assembly is 275 kg and the mass of uranium is 210 kg. If all non-U mass were Zr, then the mass ratio of Zr to U would be 0.31. For comparison, masses of U and Zr in the core of the Peach Bottom BWR are provided in Table 4.7 of: M. Silberberg et al, *Reassessment of the Technical Bases for Estimating Source Terms, NUREG-0956*, USNRC, July 1986. The U mass is 138 Mg and the Zr mass is 64.1 Mg. Thus, the mass ratio of Zr to U in the core is 0.46. In the table above, it is assumed that each fuel assembly contains 60 kg of Zr, representing a Zr-to-U mass ratio of 0.29.

Table 3-5
Illustrative Inventories of Cesium-137

Case	Inventory of Cesium-137 (TBq)
Produced during detonation of a 10-kilotonne fission weapon	67
Released to atmosphere during Chernobyl reactor accident of 1986	89,000
Released to atmosphere during nuclear-weapon tests, primarily in the 1950s and 1960s (Fallout was non-uniformly distributed across the planet, mostly in the Northern hemisphere.)	740,000
In Pilgrim spent-fuel pool during period of license extension	1,630,000
In Vermont Yankee spent-fuel pool during period of license extension	1,430,000
In Pilgrim reactor core	190,000
In Vermont Yankee reactor core	179,000

Notes:
(a) 1 Tbq = 1.0E+12 Bq = 27.0 Ci
(b) Inventories in the first three rows are from Table 3-2 of: Gordon Thompson, *Reasonably Foreseeable Security Events: Potential threats to options for long-term management of UK radioactive waste*, A report for the UK government's Committee on Radioactive Waste Management, IRSS, 2 November 2005.
(c) Inventories in the fourth and fifth rows are author's estimates set forth in this report.
(d) Inventories in the sixth and seventh rows are from Appendix E of the license renewal application for each plant.

Table 4-1
Estimated Duration of Phases of Implementation of the Yucca Mountain Repository

Phase of Repository Implementation		Duration of Phase (years)	
		If Yucca Mountain Total Inventory of Commercial Spent Fuel = 63,000 MgU	If Yucca Mountain Total Inventory of Commercial Spent Fuel = 105,000 MgU
Construction phase		5	5
Operation and monitoring phases	Development	22	36
	Emplacement	24-50	38-51
	Monitoring	76-300	62-300
Closure phase		10-17	12-23

Notes:
(a) These estimates are from the Final EIS for Yucca Mountain, DOE/EIS-0250F, Volume I, February 2002, pages 8-8 and 2-18.
(b) The Development and Emplacement phases would begin on the same date. Other phases would be sequential.
(c) The Construction phase would begin with issuance of construction authorization, and end with issuance of a license to receive and dispose of radioactive waste.

Table 4-2
Potential Emplacement Area of the Yucca Mountain Repository for Differing Spent-Fuel Inventories and Operating Modes

Total Inventory of Commercial Spent Fuel in Repository (MgU)	Emplacement Area (acres)	
	Higher-Temperature Operating Mode	Lower-Temperature Operating Modes
63,000	1,150	1,600 to 2,570
105,000	1,790	2,480 to 3,810

Source: Final EIS for Yucca Mountain, DOE/EIS-0250F, Volume I, February 2002, page 8-9.

Table 4-3
Estimated Number of Radioactive-Waste Shipments to the Yucca Mountain Site

Category of Radioactive Waste	Total Number of Shipments			
	If Yucca Mountain Total Inventory of Commercial Spent Fuel = 63,000 MgU		If Yucca Mountain Total Inventory of Commercial Spent Fuel = 105,000 MgU	
	By Truck	By Rail	By Truck	By Rail
*** If shipment mostly by truck ***				
Commercial spent fuel	41,000	0	80,000	0
All wastes	53,000	300	109,000 to 110,000	300 to 360
*** If shipment mostly by rail ***				
Commercial spent fuel	1,100	7,200	3,100	13,000
All wastes	1,100	9,700	3,100	18,000 to 19,000

Source: Final EIS for Yucca Mountain, DOE/EIS-0250F, Volume I, February 2002, page 8-8.

Table 4-4
Characteristics of BWR-Spent-Fuel Storage Canisters or Disposal Packages Proposed for Use at the Monticello or Skull Valley ISFSIs, or at Yucca Mountain

Category	Characteristics of Storage Canister or Disposal Package		
	NUHOMS 61BT Storage Canister (proposed for Monticello ISFSI)	HI-STORM 100 MPC-68 Storage Canister (proposed for Skull Valley)	Proposed Disposal Package for Emplacement in Yucca Mountain
Vendor	Transnuclear West	Holtec	Unknown
Capacity (number of BWR fuel assemblies)	61	68	24 or 44
Wall thickness	0.5 in. (stainless steel)	0.5 in. (stainless steel)	2.0 in. (stainless steel) plus 0.8 in. outer layer (Alloy 22)
Length	196.0 in.	190.3 in.	201.0 in. (for 24 assemblies) or 203.3 in. (for 44 assemblies)
Diameter	67.2 in.	68.4 in.	51.9 in. (for 24 assemblies) or 65.9 in. (for 44 assemblies)
Neutron absorber material	Boral	Boral	Borated stainless steel
Fill gas	Helium	Helium	Helium
Presence of aluminum thermal shunts to transfer interior heat to wall of vessel ?	No	No	No for 24 assemblies, Yes for 44 assemblies

Notes:
(a) NUHOMS data are from: Xcel Energy's Application to the Minnesota PUC for a Certificate of Need to Establish an ISFSI at the Monticello Generating Plant, 18 January 2005, Section 3.7; and Transnuclear West's FSAR for the Standardized NUHOMS system, Revision 6, non-proprietary version, October 2001.
(b) HI-STORM data are from Holtec's FSAR for the HI-STORM 100 system, Holtec Report HI-2002444, Revision 1.
(c) Characteristics of the Yucca Mountain package are from the Yucca Mountain Science and Engineering Report, DOE/RW-0539, May 2001, Section 3.

Table 5-1
Estimated Source Term for Atmospheric Release from Spent-Fuel-Pool Fire at the Pilgrim or Vermont Yankee Plant

Indicator	Pilgrim	Vermont Yankee
** *Large Release* **		
Release to atmosphere of 100% of cesium-137 in pool	1.63E+18 Bq	1.43E+18 Bq
Thermal power of fire, assuming oxidation of 100% of Zr over 5 hrs	191,000x12.1/(5x60x60) = 128 MW	157,000x12.1/(5x60x60) = 106 MW
** *Smaller Release* **		
Release to atmosphere of 10% of cesium-137 in pool	1.63E+17 Bq	1.43E+17 Bq
Thermal power of fire, assuming oxidation of 10% of Zr over 0.5 hrs	19,100x12.1/(0.5x60x60) = 128 MW	15,700x12.1/(0.5x60x60) = 106 MW

Notes:
(a) Pool inventories of cesium-137 and zirconium are from Table 3-4.
(b) The heat of reaction of Zr with oxygen or water is provided in Table 3-1 of: Louis Baker Jr. and Robert C. Liimatainen, "Chemical Reactions", Chapter 17 in T. J. Thompson and J. G. Beckerley (editors), *The Technology of Nuclear Reactor Safety*, MIT Press, 1973. The heat of reaction with oxygen is 12.1 MJ/kg, and the heat of reaction with water (steam) is 6.53 MJ/kg. In the table above, it is assumed that Zr reacts with air (oxygen).

Table 6-1
Licensee Estimates of Core Damage Frequency and Radioactive Release Frequency, Pilgrim Plant

Indicator	Source of Estimate	Estimated Frequency	Est. Frequency Adjusted (by factor of 6) to Account for External Events & Uncertainty
Core damage freq. (internal events)	License renewal application, App. E	6.4E-06 per yr	3.8E-05 per yr
Core damage frequency (fires)	License renewal application, App. E	1.9E-05 per yr	Not relevant
Core damage freq. (earthquakes)	License renewal application, App. E	3.2E-05 per yr	Not relevant
Large, early release frequency (internal events)	License renewal application, App. E	1.1E-07 per yr	6.8E-07 per yr
Medium, early release frequency (internal events)	License renewal application, App. E	6.5E-08 per yr	3.9E-07 per yr
Core damage frequency (internal events)	IPE, September 1992	5.8E-05 per yr	This adjustment not used in this source
Core damage frequency (fires)	IPEEE, July 1994	2.2E-05 per yr	Not relevant
Core damage frequency (earthquakes)	IPEEE, July 1994	5.8E-05 per yr (EPRI) 9.4E-05 per yr (LLNL)	Not relevant
Early release frequency (internal events)	IPE, September 1992	1.3E-05 per yr	This adjustment not used in this source
Early release frequency (earthquakes)	IPEEE, July 1994	1.6E-05 per yr (EPRI) 3.2E-05 per yr (LLNL)	Not relevant

Table 6-2
Licensee Estimates of Core Damage Frequency and Radioactive Release Frequency, Vermont Yankee Plant

Indicator	Source of Estimate	Estimated Frequency	Est. Frequency Adjusted (by factor of 10) to Account for External Events & Uncertainty
Core damage frequency (internal events)	License renewal application, App. E	5.0E-06 per yr	5.0E-05 per yr
Core damage frequency (fires)	License renewal application, App. E	5.6E-05 per yr	Not relevant
Core damage frequency (earthquakes)	License renewal application, App. E	Not estimated in this source or in IPEEE of June 1998	Not relevant
Large, early release frequency (internal events)	License renewal application, App. E	1.6E-06 per yr	1.6E-05 per yr
Medium, early release frequency (internal events)	License renewal application, App. E	2.1E-06 per yr	2.1E-05 per yr
Core damage frequency (internal events except intl. floods)	IPE, December 1993	4.3E-06 per yr	This adjustment not used in this source
Core damage frequency (internal floods)	IPEEE, June 1998	9.0E-06 per yr	Not relevant
Core damage frequency (fires)	IPEEE, June 1998	3.8E-05 per yr	Not relevant
Large, early release frequency (internal events except intl. floods)	IPE, December 1993	9.4E-07 per yr	This adjustment not used in this source
Medium, early release frequency (internal events except intl. floods)	IPE, December 1993	8.0E-07 per yr	This adjustment not used in this source

Table 6-3
Categories of Release to Atmosphere by Core-Damage Accidents at Pilgrim and Vermont Yankee Nuclear Plants

Release Magnitude		Release Timing	
Category	**Release of Cesium from Reactor Core to Atmosphere**	**Category**	**Timing of Release Initiation After Accident Begins**
High	Greater than 10%	Early	Less than 6 hrs
Medium	1% to 10%		
Low	0.1% to 1%	Intermediate	6 hrs to 24 hrs
Low-Low	0.001% to 0.1%		
Negligible	Less than 0.001%	Late	Greater than 24 hrs

Notes:
These release categories are set forth in Appendix E of the license renewal application for Vermont Yankee. In the license renewal application for Pilgrim, the same categories are used except that: (i) the Early and Intermediate categories shown in the table above are combined into one category designated as 'Early'; and (ii) the Low and Low-Low categories are combined into one category designated as 'Low'.

Table 7-1
Potential Sabotage Events at a Spent-Fuel-Storage Pool, as Postulated in the NRC's August 1979 GEIS on Handling and Storage of Spent LWR Fuel

Event Designator	General Description of Event	Additional Details
Mode 1	• Between 1 and 1,000 fuel assemblies undergo extensive damage by high-explosive charges detonated under water • Adversaries commandeer the central control room and hold it for approx. 0.5 hr to prevent the ventilation fans from being turned off	• One adversary can carry 3 charges, each of which can damage 4 fuel assemblies • Damage to 1,000 assemblies (i.e., by 83 adversaries) is a "worst-case bounding estimate"
Mode 2	• Identical to Mode 1 except that, in addition, an adversary enters the ventilation building and removes or ruptures the HEPA filters	
Mode 3	• Identical to Mode 1 within the pool building except that, in addition, adversaries breach two opposite walls of the building by explosives or other means	• Adversaries enter the central control room or ventilation building and turn off or disable the ventilation fans
Mode 4	• Identical to Mode 1 except that, in addition, adversaries use an additional explosive charge or other means to breach the pool liner and 5-ft-thick concrete floor of the pool	

Notes:
(a) Information in this table is from Appendix J of: USNRC, *Generic EIS on Handling and Storage of Spent Light Water Power Reactor Fuel, NUREG-0575*, August 1979.
(b) The postulated fuel damage ruptures the cladding of each rod in an affected fuel assembly, releasing "contained gases" (gap activity) to the pool water, whereupon the released gases bubble to the water surface and enter the air volume above that surface.

Table 7-2
Potential Modes and Instruments of Attack on a Nuclear Power Plant

Mode of Attack	Characteristics	Present Defense
Commando-style attack	• Could involve heavy weapons and sophisticated tactics • Successful attack would require substantial planning and resources	Alarms, fences and lightly-armed guards, with offsite backup
Land-vehicle bomb	• Readily obtainable • Highly destructive if detonated at target	Vehicle barriers at entry points to Protected Area
Anti-tank missile	• Readily obtainable • Highly destructive at point of impact	None if missile launched from offsite
Commercial aircraft	• More difficult to obtain than pre-9/11 • Can destroy larger, softer targets	None
Explosive-laden smaller aircraft	• Readily obtainable • Can destroy smaller, harder targets	None
10-kilotonne nuclear weapon	• Difficult to obtain • Assured destruction if detonated at target	None

Notes:
This table is adapted from a table, supported by analysis and citations, in: Gordon Thompson, *Robust Storage of Spent Nuclear Fuel: A Neglected Issue of Homeland Security*, IRSS, January 2003. Later sources confirming this table include:
(a) Gordon Thompson, testimony before the California Public Utilities Commission regarding Application No. 04-02-026, 13 December 2004.
(b) Jim Wells, US Government Accountability Office, testimony before the Subcommittee on National Security, Emerging Threats and International Relations, US House Committee on Government Reform, 4 April 2006.
(c) Marvin Fertel, Nuclear Energy Institute, testimony before the Subcommittee on National Security, Emerging Threats and International Relations, US House Committee on Government Reform, 4 April 2006.
(d) Danielle Brian, Project on Government Oversight, letter to NRC chair Nils J. Diaz, 22 February 2006.
(e) National Research Council, *Safety and Security of Commercial Spent Nuclear Fuel Storage: Public Report*, National Academies Press, 2006.

Table 8-1
Selected Options to Reduce Risks of Spent-Fuel-Pool Fires at the Pilgrim and Vermont Yankee Plants

Option	Passive or Active?	Does Option Address Fire Scenarios Arising From:		Comments
		Malice?	Other Events?	
Re-equip pool with low-density, open-frame racks	Passive	Yes	Yes	• Will substantially reduce pool inventory of radioactive material • Will prevent auto-ignition of fuel in almost all cases
Install emergency water sprays above pool	Active	Yes	Yes	• Spray system must be highly robust • Spraying water on overheated fuel can feed Zr-steam reaction
Mix hotter (younger) and colder (older) fuel in pool	Passive	Yes	Yes	• Can delay or prevent auto-ignition in some cases • Will be ineffective if debris or residual water block air flow • Can promote fire propagation to older fuel
Minimize movement of spent-fuel cask over pool	Active	No (Most cases)	Yes	• Can conflict with adoption of low-density, open-frame racks
Deploy air-defense system (e.g., Sentinel and Phalanx) at plant	Active	Yes	No	• Implementation requires presence of US military at plant
Develop enhanced onsite capability for damage control	Active	Yes	Yes	• Requires new equipment, staff and training • Personnel must function in extreme environments

Table 8-2
Selected Approaches to Protecting US Critical Infrastructure From Attack by Sub-National Groups, and Some of the Strengths and Weaknesses of these Approaches

Approach	Strengths	Weaknesses
Offensive military operations internationally	• Can deter or prevent governments from supporting sub-national groups hostile to the USA	• Can promote growth of sub-national groups hostile to the USA, and build sympathy for these groups in foreign populations • Can be costly in terms of lives, money and national reputation
International police cooperation within a legal framework	• Can identify and intercept potential attackers	• Implementation can be slow and/or incomplete • Requires ongoing international cooperation
Surveillance and control of the domestic population	• Can identify and intercept potential attackers	• Can destroy civil liberties, leading to political, social and economic decline of the nation
Active defense of infrastructure elements	• Can stop attackers before they reach the target	• Can involve higher operating costs • Requires ongoing vigilance
Passive defense of infrastructure elements	• Can allow target to survive attack without damage • Can substitute for other approaches, avoiding their costs	• Can involve higher capital costs

Table 8-3
Estimation of Cost to Offload Spent Fuel from Pools at the Pilgrim and Vermont Yankee Plants After 5 Years of Decay

Estimation Step	Pilgrim	Vermont Yankee
Present licensed capacity of pool	3,859 fuel assemblies	3,089 fuel assemblies
Pool capacity needed for full-core discharge	580 fuel assemblies	368 fuel assemblies
Anticipated av. pool inventory of spent fuel during period of license extension	3,177 fuel assemblies	2,619 fuel assemblies
Av. period of exposure of fuel assembly in core	5.48 yr	3.69 yr
Av. annual discharge of fuel from reactor	580/5.48 = 106 fuel assemblies	368/3.69 = 100 fuel assemblies
Pool capacity needed to store fuel for 5-yr decay, incl. 10% buffer	106x5x1.1 = 583 fuel assemblies	100x5x1.1 = 550 fuel assemblies
Total pool capacity needed for full-core discharge and 5-yr decay	580 + 583 = 1,163 fuel assemblies	368 + 550 = 918 fuel assemblies
Fuel requiring offload if pool storage is limited to fuel undergoing 5-yr decay	3,177 – 583 = 2,594 fuel assemblies	2,619 – 550 = 2,069 fuel assemblies
Capital cost to offload fuel, assuming 210 kgU per assembly and capital cost of $100-200 per kgU for dry storage	$54-109 million	$43-87 million

Notes:
A capital cost of $100-200 per kgU for dry storage of spent fuel is used by Robert Alvarez et al in their paper in *Science and Global Security*, Volume 11, 2003, pp 1-51.

Table 9-1
Provisional Estimate of the Probability of a Spent-Fuel-Pool Fire at the Pilgrim or Vermont Yankee Plant

Estimation Step	Pilgrim	Vermont Yankee
CDF (internal events)	2.8E-05 per yr	4.3E-06 + 9.0E-06 = 1.3E-05 per yr
CDF (fires + earthquakes)	2.2E-05 + (5.8E-05 + 9.4E-05)/2 = 9.8E-05 per yr	3.8E-05 + (5.8E-05 + 9.4E-05)/2 = 1.1E-04 per yr
CDF (internal events + fires + earthquakes)	1.3E-04 per yr	1.2E-04 per yr
Early release frequency (internal events + fires + earthquakes)	1.3E-05 + (1.3/5.8)x2.2E-05 + (1.6E-05 + 3.2E-05)/2 = 4.2E-05 per yr	1.7E-06 + (1.7/4.3)x(9.0E-06 + 3.8E-05) + (1.6E-05 + 3.2E-05)/2 = 4.4E-05 per yr
Conditional probability of a pool fire, given an early release from the reactor (internal events + fires + earthquakes)	0.5 (Author's assumption)	0.5 (Author's assumption)
Probability of a pool fire initiated by events not including malice	(4.2E-05)x0.5 = 2.1E-05 per yr	(4.4E-05)x0.5 = 2.2E-05 per yr
Probability of a maliciously-induced pool fire in the USA (99 pools)	1 per 100 yr (Author's assumption)	1 per 100 yr (Author's assumption)
Probability of a maliciously-induced pool fire at this plant	1.0E-04 per yr	1.0E-04 per yr
Total probability of a pool fire at this plant	2.1E-05 + 1.0E-04 = 1.2E-04 per yr	2.2E-05 + 1.0E-04 = 1.2E-04 per yr

Notes:
(a) CDF = core damage frequency
(b) Estimates in the first four rows are drawn from the IPEs and IPEEEs for each plant, except that the Pilgrim internal-events CDF is drawn from: Willard Thomas et al, *Pilgrim Technical Evaluation Report on the Individual Plant Examination Front End Analysis*, Science and Engineering Associates, prepared for the USNRC, 9 April 1996. Earthquake findings shown for Pilgrim are the average of the EPRI and LLNL values, and are used for both plants. The conditional probability of an early release, given core damage, is assumed to be the same for events initiated by fires and by internal events including internal flooding.
(c) The probability of a maliciously-induced pool fire in the USA is assumed to be uniformly distributed across all pools.

Table 9-2
Present Value of Cumulative (20-year) Economic Risk of a Potential Release of Radioactive Material

Selected Characteristics of the Potential Release		Present (Initial) Value of Cumulative (20-year) Economic Risk, for various Discount Rates (D)		
Economic Cost of the Release	**Probability of the Release**	**D = 7% per yr**	**D = 3% per yr**	**D = 0% per yr**
$100 billion	1.0E-03 per yr	$1.1 billion	$1.5 billion	$2 billion
	1.0E-04 per yr	$110 million	$150 million	$200 million
	1.0E-05 per yr	$11 million	$15 million	$20 million
	1.0E-06 per yr	$1.1 million	$1.5 million	$2 million

Notes:
(a) The discounted cumulative-value function is: (1-exp(-DT))/D, where T = 20.
(b) The present values shown in the table can be scaled linearly for alternative values of the economic cost or probability of the potential release.

EXHIBIT
2

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE COMMISSION

In the Matter of	)	
	)	
Entergy Nuclear Operations, Inc.	)	Docket No. 50-293
	)	
(Pilgrim Nuclear Power Station)	)	
	)	

DECLARATION OF DR. JAN BEYEA
IN SUPPORT OF MASSACHUSETTS ATTORNEY GENERAL'S
CONTENTION AND PETITION FOR BACKFIT ORDER

I, Jan, Beyea, declare as follows:

1. I am senior scientist at Consulting in the Public Interest, providing scientific assistance to not-for-profits, universities, government, and injured plaintiffs.

2. In support of the Massachusetts Attorney General's request for hearing, petition to intervene and backfit petition respect to the license renewal proceeding for the Pilgrim nuclear power plant, I have prepared a report entitled "report to the Massachusetts Attorney General on the Potential Consequences of a Spent-Fuel Pool Fire at the Pilgrim or Vermont Yankee Nuclear Plant (May 25, 2006). In preparing my report, I reviewed the environmental report, the 1972 EIS, the FSAR, and the NRC's 1996 generic relicensing EIS. In addition, I reviewed technical documents relating to risks of spent fuel storage at this facility, which are identified in my Report. One of those documents was the report of Gordon Thompson, Ph.D.

3. The technical factual statements in my report are true and correct to the best of my knowledge, and the technical opinions expressed therein are based on my best professional judgment.

4. I am an expert regarding the consequences of both real and hypothetical nuclear accidents, as well as strategies for mitigation. I also have expertise in technical safety and environmental analysis related to nuclear facilities. My Curriculum Vitae is provided here as Attachment A.

5. I am a regular member of panels and boards of the National Research Council of the National Academy of Sciences and an advisor to the Division of Engineering and Physical Sciences.

6. After receiving my Ph.D. in nuclear physics from Columbia University, I taught environmental studies at Holy Cross College. Next, I did research at Princeton's Center For Energy and Environmental Studies modeling the consequences of nuclear accidents. I then spent 15 years at the National Audubon Society as Senior Policy Scientist, and ultimately as Chief Scientist and Vice President.

7. I am the author of over 100 articles and reports that span a diverse range of topics. I am a regular peer reviewer of articles for scientific journals. One of my specialties is geographic exposure modeling of toxic releases. My reconstruction of exposures following the TMI accident has been used in radiation epidemiologic studies. My reconstructions of historical exposures to traffic pollution are being used in two ongoing epidemiologic studies of breast cancer. I am a co-author of studies on risks and consequences of spent-fuel-pool fires. I presented a briefing on this work to a committee of the National Research Council that was studying risks of spent fuel.

8. I am prepared to testify as an expert witness on behalf of the Massachusetts Attorney General with respect to the facts and opinions set forth in my Report.

****

I declare, under penalty of perjury, that the foregoing facts provided in my Declaration are true and correct to the best of my knowledge and belief, and that the opinions expressed herein are based on my best professional judgment.

Executed on 25 May 2006.

Jan Beyea

Jan Beyea

(609-397-2370), jbeyea@cipi.com

EDUCATION:

Ph.D., Columbia University, 1970 (Nuclear Physics).
B.A., Amherst College, 1962.

PROFESSIONAL EXPERIENCE:

1968 to 1970	Research Associate, Columbia University Physics Department.
1970 to 1976	Assistant Professor of Physics, Holy Cross College.
1976 to 1980	Research Staff, Ctr. for Energy & Env. Studies, Princeton Univ.
1980 to 1991	Senior Scientist, National Audubon Society, NY. NY.
1992 to 1995	Chief Scientist & Vice President, National Audubon Society, NY, NY
1996 to date	Senior Scientist, Consulting in the Public Interest, Lambertville, NJ

ADVISORY ACTIVITIES & APPOINTMENTS:

Current:

-Member, Committee on Alternatives to Indian Point, National Research Council
-Nat. Academies of Science, Division Advisor (Division on Engineering and Physical Sciences).
-Consultant on human exposure assessment to 1) Columbia U., 2) NCI's Radiation Division, 3) U Buffalo Dept. of Social & Preventive Med., and 4) UNC Epidemiology Dep't.
-Consultant to law firm of Berger & Montague on dose and health effects reconstruction from the Hanford and Rocky Flats nuclear weapons complexes.
-Consultant to the National Audubon Society on forest habitat research.

Past:

-Peer reviewer for the American Journal of Public Health, Environmental Health Perspectives, Environmental Toxicology and Chemistry, Bioscience, Atmospheric Chemistry and Physics, and various Boards of the National Research Council, including the Board on Radioactive Waste
-Nat. Research Council (Nat. Academies of Science), Committee on Alternatives for the Release of Solid Materials from Nuclear Regulatory Commission-Licensed Facilities, 2001-2002. Chair of technical committee.
-Member, Technical Advisory Committee on Forest Health Monitoring, Assessment and Evaluation, New York State Department of Environmental Conservation, 2001-2002
- Nat. Research Council, Comm. on DOE'S Fine Particulate Research Program, 1999
- Nat. Research Council, Board on Energy and Environmental Systems, 1993-1998.
- Nat. Research Council, Committee on "Linking Sci. & Tech. to Society's Environ. Goals."
- Board Member, Recycling Advisory Council, sponsored by the EPA, 1994-1996
- Composting Committee, Coalition of Northeastern Governors (co-chair) 1994-1996
- Member, Source Reduction Task Force, Coalition of Northeastern Governors 1991-1995
- Secretary of Energy's Advisory Board, Task Force on Economic Modeling, 1991
- National Research Council, Comm. on Alternative Energy R&D Strategies, 1990-1991
- Office of Technology Assessment, Advisor to various studies, 1984-1988

Articles, reports and testimony related to nuclear radiation issues

"Damages from a Major Release of 137Cs into the Atmosphere of the United States," (Beyea, Lyman, von Hippel), Science and Global Security, 2004: 12:125-136. (Addendum to next paper.)

"Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States," (Alvarez, Beyea, Janberg, Kang, Lyman, Macfarlane, Thompson, von Hippel), Science and Global Security, 11:1–51, 2003.

"Response by the Authors to the NRC Review of 'Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States,' (Alvarez, Beyea, Janberg, Kang, Lyman, Macfarlane, Thompson, and von Hippel), Science and Global Security, 2003: 11:213-223."

"Recent developments in the scientific literature concerning radiation and disease." Report to the Public Advocate of the Nuclear Claims Tribunal of the Marshall Islands, September, 2003

"The Disposition Dilemma: Controlling the Release of Solid Materials from USNRC-Licensed Facilities," (With Richard McGee et al.), National Research Council, National Academy Press, 2002.

"The Association Between Radiation and Non-Neoplastic Thyroid Disease: a Brief Review of the Literature," Presentation at the Workshop on Targeted Screening for Thyroid and Parathyroid Disease in a Higher-Risk Population Exposed to Iodine-131, Department of Health and Human Services, Advisory Committee on Energy-Related Epidemiologic Research (ACERER), Columbia, Maryland, June 8, 2000.

"Geographic exposure modeling: A valuable extension of Geographic Information Systems for use in Environmental Epidemiology," (Beyea and Hatch), Environmental Health Perspectives 107, Supplement I: 181-190, 1999

"The importance of specifying the underlying biologic model in estimating the probability of causation," (Beyea and Greenland), Health Physics 76: 269-274, 1999.

"Animal Burrowing Attributes Affecting Hazardous Waste Management," (Smallwood, Morrison, Beyea), Environmental Management, 22(6): 931-847, 1998.

"Issues in the Dose-response Analysis of the Mayak Case-Control Study," Health Physics (letter), 74(6): 726-727, 1998.

"Fallout exposures from US weapon tests: Were the doses high enough to cause autoimmune thyroid diseases?" Statement prepared for the Institute of Medicine's Committee on "Exposure of the American People to I-131 from Nevada Atomic-Bomb Tests"

"Monitoring the Dispersal of Contaminants by Wildlife at Nuclear Weapons and Waste Storage Facilities, USA." (Morrison, Smallwood, Beyea) The Environmentalist, 17: 289-295, 1997.

"Fallout Exposures from US Weapon Tests: Health Effects other than Thyroid Cancer," Before the Appropriations Committee on Labor, Health and Human Services and Education, US Senate, Oct. 1, 1997

"Plutonium distribution in the environs of Rocky Flats." (With Milton Hoenig),Health Physics (letter) 73(1), 271-272 (1997)

"Comments on 'A Reevaluation of Cancer Incidence near the Three Mile Island Nuclear Plant' " (with Hatch and Susser), Environ Health Perspectives 105(1), 12 (1997)

The Use of Film Badge Data to Estimate Radioactive Releases from Nuclear Facilities (with V. Harms), TMI Public Health Fund, August 1993.

"Nuclear Energy", (with Valerie Harms), Environment, April 1991.

"Cancer Rates after the Three Mile Island Nuclear Accident and Proximity of Residence to the Plant", (Hatch, Wallenstein, Beyea, Nieves, Susser), American Journal of Public Health, 18(6), 719-724 June 1991.

"Cancer Near the Three Mile Island Nuclear Plant: Radiation Emissions", (Hatch, Beyea, Nieves, Susser), American Journal of Epidemiology, 132(3), 397-412, Sept. 1990.

"Childhood Cancer Near Three Mile Island: Nuclear Plant Emissions and Background Radiation," (Hatch, Wallenstein, Beyea, Susser), Columbia University, New York, Sept. 1990.

Re-Estimating the Noble Gas Releases from the Three Mile Island Accident (with J. DeCicco), TMI Public Health Fund, August 1990.

"Nuclear Power - Only as a Last Resort to Stave Off Global Warming", Forum for Applied Research and Public Policy," Sept. 1990.

"A Realistic Agenda for Second Generation Nuclear Reactors", before the Subcommittee on Energy and the Environment of the Committee on Interior and Insular Affairs, U.S. Senate, May 10, 1990.

"Is There Any Role for Nuclear Power in Preventing Climate Disruption?", Hearing before the Subcommittee on Energy and Power, House of Representatives,
Serial No. 101-17, March, 1989.

"On Potential Radiation Dosage Consequences of the Accidents that Form the Basis for the NRC Emergency Planning Rules," on behalf of the Attorney General of Massachusetts in the matter of Public Service Company of New Hampshire (Seabrook Station, Units 1 and 2) [with Steven C. Sholly, Gordon Thompson, Jennifer Leaning.] September, 1987. Also, "Sheltering at Seabrook", (with Gordon Thompson and Robert Goble), June 16, 1988.

"Responses to the Chernobyl Accident", before the Committee on Energy and Natural Resources, U. S. Senate, June 19, 1986.

Notes on Long-Range Issues in Nuclear Regulation, in "Regulation and the Nuclear Option," Institute for Energy Analyses, Oak Ridge Associated Universities, 1986.

Proceedings of the Workshop on Three Mile Island Dosimetry, Three Mile Island Public Health Fund, 1622 Locust Street, Phila., Pa., Dec., 1985.

Review of Dose Assessments at Three Mile Island and Recommendations for Future Research, Report to the Three Mile Island Public Health Fund, August 1984. [See also, "Author Challenges Review", Health Physics Newsletter, March, 1985, and "TMI--Six Years Later", Nuclear Medicine, 26, p. 1345, 1985.]

"Containment of a Reactor Meltdown", (with Frank von Hippel), Bulletin of Atomic Scientists, 38, p. 52, August/September, 1982.

"Second Thoughts (about Nuclear Safety)", in Nuclear Power: Both Sides, W. W. Norton and Co. (New York, 1982).

"Some Consequences of Catastrophic Accidents at Indian Point and Their Implications for

Emergency Planning," testimony and cross-examination before the Nuclear Regulatory Commission's Atomic Safety and Licensing Board, on behalf of the New York State Attorney General and others, July, 1982.

"Future Prospects for Commercial Nuclear Power in the United States", before the Subcommittee on Oversight and Investigations, Committee on Interior and Insular Affairs, U. S. House of Representatives, October 23, 1981.

"Stockpiling of Potassium Iodide for the General Public as a Condition for Restart of TMI Unit No. 1", testimony and cross-examination before the Atomic Safety and Licensing Board on behalf of the Anti-Nuclear Group Representing York, April, 1981.

"Emergency Planning for Reactor Accidents", Bulletin of Atomic Scientists, 36, p. 40, December, 1980. (An earlier version of the article appeared in German as Chapter 3 in Im Ernstfall Hilflos, E. R. Koch, Fritz Vahrenholt, editors, Keipenheuer & Witsch, Cologne, 1980.)

Some Long-Term Consequences of Hypothetical Major Releases of Radioactivity to the Atmosphere from Three Mile Island, Report to the President's Council on Environmental Quality, December, 1980.

Decontamination of Krypton 85 from Three Mile Island Nuclear Plant, (with Kendall et al), Report of the Union of Concerned Scientists to the Governor of Pennsylvania, May 15, 1980.

Some Comments on Consequences of Hypothetical Reactor Accidents at the Philippines Nuclear Power Plant (with Gordon Thompson), Audubon EPAD Report #3, April, 1980.

Nuclear Reactor Accidents: The Value of Improved Containment, (with Frank von Hippel), Center for Energy and Environmental Studies Report PU/CEES 94, Princeton University, January, 1980.

"Dispute at Indian Point", Bulletin of Atomic Scientists, 36, p. 63, May, 1980.

"Nuclear Reactors: How Safe Are They?", panel discussion sponsored by the Academy Forum of the National Academy of Sciences, Wash., D.C., May 5, 1980.

"Advice and Recommendations Concerning Changes in Reactor Design and Safety Analysis which should be Required in Light of the Accident at Three Mile Island", statement to the Nuclear Regulatory Commission concerning the proposed rulemaking hearing on degraded cores, December 29, 1980.

"The Crisis of Nuclear Energy", Subject No. 367 on William Buckley's Firing Line, P.B.S. Television. Transcript printed by Southern Education Communications Assoc., 928 Woodrow Street, P. O. Box 5966, Columbia, S.C., 1979.

The Effects of Releases to the Atmosphere of Radioactivity from Hypothetical Large-Scale Accidents at the Proposed Gorleben Waste Treatment Facility, report to the Government of lower Saxony, Federal Republic of Germany, as part of the Gorleben International Review, February, 1979.

"Alternatives to the Indian Point Nuclear Reactors", statement before the Environmental Protection Committee of the New York City Council, December 14, 1979. Also before the Committee, "The Impact on New York City of Reactor Accidents at Indian Point", June 11, 1979. Also "Consequences of a Catastrophic Reactor Accident", statement to the New York City Board of Health, August 12, 1976 (with Frank von Hippel).

Reactor Safety Research at the Large Consequence End of the Risk Spectrum, presented to the Experts' Meeting on Reactor Safety Research in the Federal Republic of Germany, Bonn, September 1,

1978.

"Emergency Planning for a Catastrophic Reactor Accident", testimony before the California Energy Resources and Development Commission, Emergency Response and Evacuation Plans Hearings, p. 171, November 4, 1978.

A Study of Some of the Consequences of Hypothetical Reactor Accidents at Barseback, report to the Swedish Energy Comm., Stockholm, DS I 1978:5, 1978.

"Consequences of Catastrophic Accidents at Jamesport", testimony before the N.Y. State Board on Electric Generation Siting and the Environment in the Matter of Long Island Lighting Co. (Jamesport Nuclear Power Station), May, 1977.

"Short-Term Effects of Catastrophic Accidents on Communities Surrounding the Sundesert Nuclear Installation", testimony before the California Energy Resources and Development Commission, December 3, 1976.

"Comments on WASH-1400," Statement to the Subcommittee on Energy and the Environment, Oversight Hearings on Reactor Safety, June 11, 1976, Serial No. 94-61, p. 210.

"Upper Limit Calculations of Deaths from Nuclear Reactors," Bulletin of American Physics Society, 21, III 1976.

Presentations and articles related to non-radioactive pollutants

"Validation And Calibration Of A Model Used To Reconstruct Historical Exposure To Polycyclic Aromatic Hydrocarbons For Use In Epidemiologic Studies." (Beyea, Hatch et al.), Environ Health Perspect 114:000ə000 (2006). doi:10.1289/ehp.8659 available via http://dx.doi.org/ [Online 13 March 2006]

"Traffic Polycyclic Aromatic Hydrocarbons (PAHs), Genetic Susceptibility and Risk of Breast Cancer." (Nie, Beyea, Bonner, Han, Vena, Rogerson, Vito, Muti, Trevisan, Shields, and Freudenheim). 3rd International Congress of Developmental Origins of Health and Disease, November 16-19, 2005, Toronto.

"Residential environmental exposures and other characteristics associated with detectable PAH-DNA adducts in peripheral mononuclear cells in a population-based sample of adult females." Shantakumar S, et al., J Expo Anal Environ Epidemiol advance online publication, 27 April 2005; doi:10.1038/sj.jea.7500426.

"Emissions of polycyclic aromatic hydrocarbons from US gasoline-powered vehicles from 1960 to 1995 for use in epidemiologic studies." (Beyea, Hatch, Stellman, Gammon). Submitted.

"Environmental exposure to traffic polycyclic aromatic hydrocarbons (PAHs) and risk of breast cancer." (Nie,. Beyea, Bonner, Han, Vena, Rogerson, Freudenheim, et al.) American Association for Cancer Research Annual Meeting. Anaheim, April 18, 2005.

"Polycyclic aromatic hydrocarbons (PAH)-DNA adducts and breast cancer: a pooled analysis," (Gammon MD, Sagiv SK, et al.), Archives of Environmental Health, 2004; December, in press.

"Development of a traffic model for predicting airborne PAH exposures since 1960 on Long Island, New York," Beyea, Hatch et al., Report to the National Cancer Institute and the National Institute

of Environmental Health Sciences for work completed under USPHS Grant U01-CA/ES-66572. http://www.cipi.com/pdf/beyea2005trafficpahmodel.pdf

"The Long Island Breast Cancer Study Project: Description of a multi-institutional collaboration to identify environmental risk factors for breast cancer," (Gammon et al.), Breast Cancer Res Treat, 2002: 74:235-254

"Historical reconstruction of exposure to polycyclic aromatic hydrocarbons and model validation: examples from the Long Island Breast Cancer Study Project." (Beyea, Hatch, Stellman, Gammon et al.) Invited paper to be presented at the Joint Conference of the International Society of Exposure Analysis and the International Society for Environmental Epidemiology, Vancouver, August 2002.

"Validation of airborne PAH exposure opportunity estimates for a large-scale epidemiologic study using soil samples collected at subjects' homes." (Stellman, Beyea, Hatch et al.) Meeting of the International Society of Exposure Analysis, poster, Charleston, 2001.

"Spatial distribution of polycyclic aromatic hydrocarbons in 500 residential soils samples collection on Long Island, NY in relation to traffic patterns." (Beyea, Stellman, Hatch et al.) 22nd Annual Meeting of the Society for Environmental Toxicology and Chemistry, poster, Baltimore, Nov. 12-15, 2001.

"Potential Toxic and Carcinogenic Chemical Contaminants in Source-Separated Municipal Solid Waste Composts: Review of Available Data and Recommendations," (with Jim Cook), Toxicological and Environmental Chemistry, 67:27-69, 1998.

Articles and reports related to urban and community design

Audubon House: Building the Environmentally Responsible, Energy-Efficient Office, John Wiley & Sons, NY, 1994 (with Shaw, Baumgarten, Lee, Croxton, Childs)

"Audubon House," Nat. Inst. of Standards and Technology Special Publication 863, Proceedings of the U.S. Green Building Conference, 1994.

"The Minnesota Source-Separated Composting Project," Interim Report (with rest of project team), July 1995.

"A Vision for Composting," in Proceedings of the 6th Annual Waste Reduction, Prevention, Recycling, and Composting Symposium, Solid Waste Association of North America, Feb. 27- March 1, 1995.

"The Santa Barbara County Pilot Waste Collection Project," (with rest of project team), April 1994.

"Wet Bag Composting Trial Yields Promising Results", (with Lauren DeChant, Margaret Conditt, and Bruce Jones), Biocycle, April 1993.

"Composting Plus Recycling Equals 70 Percent Diversion", (with Lauren DeChant, Bruce Jones, Margaret Conditt), Biocycle, May 1992.

The Power of Composting, The Power of Partnership (with W. Greggs), Proceedings of the Solid Waste Association of North America, August 1993.

Wet Bag Composting Report (with M. Conditt, et al), Audubon and Procter & Gamble Report, September 1993.

"The Power of Composting, The Power of Partnership", speeches for the National Recycling Confernece, Oct. 1993, GMA/FMI environmental conference, March 1993, the U.S. Conference of Mayors, April 1993, and the Biocycle conference, May 1993.

"Paper Versus Plastic" in The Plastic Waste Primer, The League of Women Voters/Handbook for Citizens, Lyons & Burford, Oct. 1992.

The Audubon Proposal for Solid Waste Management in Jefferson County and the City of Louisville, Kentucky, Dec. 1991. Also Review of Proposed Resource Recovery Agreement Between the City of Louisville and Louisville Energy and Environment.

Solid Solutions for Solid Waste, NAS Guidebook for the Community Solid Waste Management Program, (Beyea, Bolze, Lee, Lathan, Hansell), (draft).

"The Great Paper Versus Plastic Debate", Audubon Activist, p. 5, March/April, 1989.

Plastics vs. Paper: Some Environmental Considerations, Audubon Report, 1989.

"Indoor Air Pollution", Bulletin of Atomic Scientists, 37, p. 63, Feb., 1981.

Articles and reports related to energy efficiency

"Green Grocers Mean Energy-Efficient grocers," Store Equipment & Design (with Alys Campaign), April 1995.

"Global Warming", (with Eric Fischer), before the Public Service Commission of Wisconsin, Jan. 13, 1992.

Energy Policy and Global Warming", in Global Climate Change and Life on Earth, Chapman & Hall, New York, 1991.

"The CO2 Diet for a Greenhouse Planet: Assessing Individual Actions for Slowing Global Warming." In Energy Efficiency and the Environment: Forging the Link. American Council for an Energy-Efficient Economy; Washington, DC. (Also: "The CO2 Diet for a Greenhouse Planet: A Citizen's Guide for Slowing Global Warming." National Audubon Society Report). 1991; and "The Audubon Activist Carbon Dioxide Diet", Audubon Activist, p. 8-9, January/February, 1990.) (All with with DeCicco, Cook, and Bolze.)

Confronting Climate Change: Strategies for Energy Research and Development, (Morrison, Beyea, et al), National Research Council, National Academy Press, Washington D.C., Oct. 1990.

"U.S. Appliance Efficiency Standards", (Rollin and Beyea), Energy Policy, 13, p. 425, 1985.

The Audubon Energy Plan, (Beyea et al), 2nd Ed., July 1984 (1st Ed., 1981) [See also, Intro. to Special Issue on Legal Issues Arising From The Audubon Energy Plan 1984, Columbia Journal of Environmental Law, 11, p. 251, 1986].

"Dealing with Uncertainties in Projections of Electricity Consumption", before the Committee on Energy and Natural Resources, U. S. Senate, July 25, 1985.

"Computer Modeling for Energy Policy Analysis", (Medsker, Beyea, and Lyons), Proceedings of the 15th Annual Modeling and Simulation Conference, Pittsburgh, PA, 15, part 3, p. 1111, 1984.

"Comments on Energy Forecasting", material submitted for the record at Hearings before the

Subcommittee on Oversight and Investigations of the House Committee on Science and Technology; Committee Print No. 14, June 1-2, 1981.

"Locating and Eliminating Obscure but Major Energy Losses in Residential Housing", (Harrje, Dutt, and Beyea), ASHRAE Transactions, 85, Part II, 1979. (Winner of ASHRAE outstanding paper award.)

"Attic Heat Loss and Conservation Policy", (Dutt, Beyea, and Sinden). ASME Technology and Society Division Paper 78-TS-5, Houston, Texas, 1978.

"Critical Significance of Attics and Basements in the Energy Balance of Twin Rivers Townhouses", (Beyea et al), Energy and Buildings, Vol. I (1977), p. 261. Also Chapter 3 of Saving Energy in the Home, Ballinger, 1978.

"The Two-Resistance Model for Attic Heat Flow: Implications for Conservation Policy", (Woteki, Dutt, Beyea), Energy--The Intl. Journal, 3, 657, 1978.

"Comments on the Proposed FTC Trade Regulation Rule on Labeling and Advertising of Thermal Insulation", (Beyea and Dutt), before the Federal Trade Commission, 1978.

Articles, reports and speeches related to watershed and river protection

"Long-Term Threats to Canada's James Bay from Hydroelectric Development", Information North, Arctic Institute of North America, Alberta, Canada, Sept. 1990.

Long-Term Threats to Canada's James Bay From Human Development, (Rosenthal and Beyea), Audubon EPAD Report #29, July, 1989.

"The New York Connection to Hydro-Quebec's James Bay Project", speech given for the NYC Bar Association/The Americas Society Debate, January 1992.

National Audubon Society's Direct Testimony Before the Vermont Public Service Board on the Environmental Impacts of the Proposed Contract with Hydro-Quebec on Vermont Wildlife, (with Susan Drennan), December, 1989.

"The Citizens' Acid Rain Monitoring Network", (Bolze and Beyea), Environmental Science & Technology, 23(6), June, 1989.

"Citizens' Acid Rain Monitoring Network", (Bolze, Martyr, and Beyea), presented at a National Workshop on "The Role of Citizen Volunteers in Environmental Monitoring", held at the University of Rhode Island, May, 1988.

Threats to Wildlife and the Platte River, (Safina, Rosenbluth, Pustmueller, Strom, Klataske, Lee, and Beyea), Audubon EPAD Report #33, March, 1989.

Articles and reports on resolving scientific uncertainties through partnership

"Guidelines to Sustain Biodiversity in Northeastern Pennsylvania Forests", (with T.S. Fredericksen, W. Hoffman, B.N. Johnson, and M.B. Lester), A Partnership Project with the Procter & Gamble Co., Poster at Mid-Atlantic Highlands Assessment Conference, Davis, WVA. October, 1995.

"The Power of Composting; The Power of Partnership," in Proceedings of the International Symposium on "The Science of Composting." 30 May - 2 June, 1995, Bologna, Italy.

"On the Importance of Thinking Like an Ecosystem," in Almanac for the Environment, Grosset/Putnam, NY, 1994.

"Beyond the Politics of Blame", EPRI Journal, July/August 1993 (reprinted in Agricultural Engineering).

Bringing Environmental Damage Costs into the Electricity Marketplace: Gains to be Expected and Pitfalls to be Avoided, presented at the National Conference on Environmental Externalities, Wyoming, Oct. 1990.

"Linking Energy Consumption with GNP", Review of Beyond Oil, Chemical & Engineering News, 64, p. 25-26, Dec. 1, l986.

Articles and reports related to biomass and forest research:

Managing White-tailed Deer in Forest Habitat From an Ecosystem Perspective: Pennsylvania Case Study. (Latham, Beyea, Benner, Dunn, Fajvan, Freed, Grund, Horsley, Rhoads and Shissler) Report by the Deer Management Forum for Audubon Pennsylvania and Pennsylvania Habitat Alliance, Harrisburg. xix + 340 pp., 2005 (Accessible at http://pa.audubon.org/deer_forum_report_main.htm)

"Use of meta-analysis to assign bird species to assemblages indicative of responsiveness to logging intensity in northeastern, hardwood forests." (Beyea, Hartley, Burger), 10th Annual Conference of the Wildlife Society, Burlington, 2003.

"Bird Relationships to Habitat Characteristics Created by Timber Harvesting in Pennsylvania," B. Ross, M. Morrison, W. Hoffman, T.S. Fredericksen, R.J. Sawicki, E. Ross, M.B. Lester, J. Beyea, B.N. Johnson, Journal of the Pennsylvania Academy of Sciences, **74**: 71-84, 2001

"The Impact of Logging on Wildlife: A Study in Northeastern Pennsylvania," TS Fredericksen, BD Ross, W Hoffman, E. Ross, M.L. Morrison, J. Beyea, MB Lester, BN Johnson, Journal of Forestry, 98(4): 4-10, 2000.

"Bioenergy in the United States: Progress and Possibilities," (with J Cook), Biomass and Bioenergy, 18. 2000.

"Relative Abundance and Species Richness of Herpetofauna in Forest Stands in Pennsylvania," (with BD Ross, T Fredericksen, E Ross, W Hoffman, ML. Morrison, MB Lester, BN Johnson, NJ Fredericksen), Forest Science, 46: 139-146, 2000.

"Using the Best Scientific Data for Endangered Species Conservation," (Smallwood, Beyea, Morrison), Environmental Management 24(4):421-435. 1999.

"Short-term understory plant community responses to timber harvesting on non-industrial private forestlands in Pennsylvania," (with TS Fredericksen, BD Ross, W Hoffman, ML. Morrison, BN Johnson, MB Lester, E Ross), Forest Ecology and Management, 116:129-139, 1999.

"Adequacy of Natural Hardwood Regeneration on Forestlands in Northeastern Pennsylvania," (with T.S. Fredericksen, B. Ross, W. Hoffman, M. Lester, M. Morrison, B.N. Johnson), Northern Journal of

Applied Forestry, 15(3):130-134,1998.

"Ecology of Agricultural Monocultures: Some Consequences for Biodiversity in Biomass Energy Farms," (with W. Hoffman and J. Cook), Proceedings of the 2nd Biomass Conference of the Americas, 1995, pp. 1618-1627.

"National Biofuels Roundtable : Principles and Guidelines for the Development of Biomass Energy Systems," Biomass and Bioenergy (Overend et al., to be published).

"Economic and Environmental Opportunities Through Biomass Development: Report of the CONEG Governors' Biomass Policy Roundtable," August 1995.

"Biomass Power: The Challenge and the Opportunity," Proceedings of the Annual Meeting of the Utility Biomass Energy Commercialization Association, 1994.

Avian Species Diversity and Policy Issues in Large-Scale Short-Rotation Wood Energy Crops: Annual Reports to the Department of Energy (with Hoffman and Cook). 1992-1994

"Some Ecological Guidelines for Large-scale Biomass Plantations," Proceedings of the First Biomass Conference of the Americas, August 30-September 2, 1993. National Renewable Energy Laboratory. Pp. 33-41. (with Hoffman and Cook)

The Habitat Value of Short-Rotation Poplar Plantations: Avian Population Studies and Management Alternatives (with W. Hoffman, J. Cook), 1993.

Toward Ecological Guidelines for Large-Scale Biomass Energy Development, based on an Audubon/Princeton University Biomass Workshop, 1992.

"Biotechnological Advances in Biomass Energy and Chemical Production: Impacts on Wildlife and Habitat", (with K. Keeler), Critical Reviews in Biotechnology, CRC Press, Florida, February 1991.

"Potential Impacts of Biomass Production in the U.S. on Biological Diversity", (with Jim Cook and Kathleen Keeler), Annual Review of Energy, Calif., 1991. An adaptation appears in Biologue, Sept. 1991.

"Preserving Biodiversity in the Face of Large Scale Demand for Biofuels", (with K.Keeler and J.Cook), Institute for Gas and Technology, Proceedings of Conference on Energy From Biomass Wastes XV (3/25-29/91), Wash.D.C., 1991.

"Biofuels: Answer to Global Warming or Growing Threat to Biodiversity?" In Forestry and Environment...Engineering Solutions - from a conference held June 5-6, 1991. American Society of Agricultural Engineers; St. Joseph, MI. (with Cook and Keeler)

Other Articles, Reports, and Testimony

"Scientific misconceptions among Daubert gatekeepers: the need for reform of expert review procedures." (with Daniel Berger) Law and Contemporary Problems **64**: 325-387, 2001.

"Scientists in the Courtroom," Science, 284:1125,1999 (letter).

"International Standard for Calculating Pollution Taxes," (with Michael Italiano), Proceedings of the 90th Annual Meeting of the Air and Waste Management Association, Toronto, July 1997

"Avian Issues in Wind Development," in Proceedings of the 1995 Annual Meeting of the American Wind Energy Association, March 1995

"Principles for a National Avian-Wind Power Research Plan, " Proceedings of National Avian-Wind Power Planning Meeting, Denver, CO, Department of Energy, February 1995.

"Environmental Concerns Regarding Electric Power Transmission in North American", (with John DeCicco and Stephen Bernow), Energy Policy, Jan. 1992.

Interview of Jan Beyea by Valerie Harms, Annals of Earth, Sept. 1991.

"The Impact of Environmental Issues on Public Support for Fusion Research", Physics and Society, 19(1), p. 6-7, January, 1990.

"Biotechnology's Promise - and Danger", (with J. P. Myers), St. Louis Post Dispatch, 1989.

"Physics Pro Bono", letter to Physics Today, (40,10), October 1987. Also, "Physics Pro Bono Redux," response, (41,8) August 1988.

"Protecting the Arctic National Wildlife Refuge," (with Brock Evans) before the Committee on Energy and Natural Resources, U.S. Senate, June 11, 1987.

"Oil and Gas Resources on Federal Lands: Wilderness and Wildlife Refuges", (Stege and Beyea), Annual Review of Energy, II, p. I43, 1986.

"Land Use Issues and the Media", published debate, Center for Communication, NYC, Oct., 1984.

Implications for Mortality of Weakening the Clean Air Act, (with G. Steve Jordan), Audubon EPAD Report #18, May, 1982.

"In the Matter of Application of Orange and Rockland Counties, Inc. for Conversion to Coal of Lovett Units 4 and 5", testimony and cross-examination on the health impacts of eliminating scrubbers as a requirement for conversion to coal; Department of Environmental Resources, State of N.Y., Nov. 5, 1981.

Supervised Studies:

"The Decision Tree: A partnership for enhancing value on private forests," Matthew Keefer, Brad Ross, Proceedings of the Fragmentation2000 Conference, Anapolis, Maryland, September 17-20, 2000

"Compost and the Regeneration of our Nation's Degraded Lands" (a series of Audubon essays and brochures), 1995.

"Easthampton Residential Compost Pilot," National Audubon Society, 1995

The National Audubon Society's Almanac for the Environment: The Ecology of Everyday Life, Grosset/Putnam, NY, 1994

Alaskan Wildlife Species and Habitats That Are Sensitive to Offshore Oil and Gas Development, by Dorene A. Bolze, EPAD Report #30, January, 1987.

Side Effects of Renewable Energy Sources, by Larry Medsker, Revised Edition, Audubon EPAD Report #15, December, 1982.

Report To The Massachusetts Attorney General On The Potential Consequences Of A Spent-Fuel-Pool Fire At The Pilgrim Or Vermont Yankee Nuclear Plant.

Jan Beyea, Ph.D.

May 25, 2006

Consulting in the Public Interest
53 Clinton Street
Lambertville, NJ 08530

Personal Background. I am a nuclear physicist who has studied the consequences of both real and hypothetical nuclear accidents, as well as strategies for mitigation. I am a regular member of panels and boards of the National Research Council of the National Academy of Sciences and an advisor to the Division of Engineering and Physical Sciences. After receiving my Ph.D. in nuclear physics from Columbia University, I taught environmental studies at Holy Cross College. Next, I did research at Princeton's Center For Energy and Environmental Studies modeling the consequences of nuclear accidents. I then spent 15 years at the National Audubon Society as Senior Policy Scientist, and ultimately as Chief Scientist and Vice President. Currently, I am senior scientist at Consulting in the Public Interest, providing scientific assistance to not-for-profits, universities, government, and injured plaintiffs.

I am the author of over 100 articles and reports that span a diverse range of topics. I am a regular peer reviewer of articles for scientific journals. One of my specialties is geographic exposure modeling of toxic releases (Beyea and Hatch 1999). My reconstruction of exposures following the TMI accident has been used in radiation epidemiologic studies (Hatch et al. 1990; Hatch et al. 1991). My reconstructions of historical exposures to traffic pollution (Beyea et al.; Beyea et al. 2005) are being used in two ongoing epidemiologic studies of breast cancer (Gammon et al. 2002), (Nie et al. 2005). I am a co-author of studies on risks and consequences of spent-fuel-pool fires (Alvarez et al. 2003a), (Beyea et al. 2004a), (Beyea 1979). I presented a briefing on this work to a committee of the National Research Council that was studying risks of spent fuel.

Introduction I have been asked by the Office of the Attorney General, Commonwealth of Massachusetts, to consider the consequences of releases of radioactivity from spent-fuel-pool fires at the Pilgrim and Vermont Yankee nuclear plants, as part of a relicensing proceeding. In my report I consider important new information on the consequences of releases of radioactivity, in general, and spent-fuel-pool fires, in particular, that was not available to the analysts who prepared earlier documents that are relevant to these proceedings. For example, this new information, which deals with damage costs and radiation risks, was not available prior to the publication of the Environmental Reports for Pilgrim and Vermont Yankee; it was not available prior to the publication of the generic relicensing environmental impact statement (NUREG 1996); and, some of it was not available prior to the filing of Entergy's license renewal application. Consequently, these earlier documents are incomplete from the scientific perspective.

I have addressed the consequences of releases from spent-fuel pools prior to these proceedings (Alvarez et al. 2003a), (Beyea et al. 2004a), (Beyea 1979), in some cases in collaboration with Gordon Thompson, Ph.D., who is filing a separate report in these proceedings. The work we have done has led to a study of the National Research Council[1] and has generated considerable debate and commentary (Alvarez et al. 2003b; Alvarez et al. 2003c; Beyea et al. 2004b)). We have revised our calculations to account for criticisms we thought were valid and easily addressable. In particular, Edwin Lyman, Frank von Hippel and I, in our most recent published work (Beyea et al. 2004a), which forms the backbone of this report on Pilgrim and Vermont Yankee, have specifically responded to criticisms by NRC staff concerning the use of constant population densities around nuclear plants (Alvarez et al. 2003c). In this report, I have addressed additional limitations that raised concerns about our earlier work in some circles. Although critiques of our independent work indicate that there are differences among analysts on the quantity of radioactivity that might be released in a spent-fuel-pool fire and the probability of such releases, there is a consensus among the technical community that this problem needs to be addressed.[2, 3]

For my report, I have considered releases of 10% and 100% of the pool inventory, using methodologies outlined in (Alvarez et al. 2003a) and (Beyea et al. 2004a). I have also provided

---

1 For a discussion of the relationship between our study and the National Research Council's report (NatRC 2005), see remarks of Kevin Crowley before the Council on Foreign Relations (Crowley 2005).

2 Allan Benjamin, lead author of the original 1979 spent-fuel paper from Sandia Laboratory, was a reviewer of our 2003 paper in SG&S. He provided a public commentary on it, in which he stated, "In summary, the authors are to be commended for identifying a problem that needs to be addressed, and for scoping the boundaries of that problem. However, they fall short of demonstrating that their proposed solution is cost effective or that it is optimal." (Benjamin 2003). Whether or not we "fell short" in demonstrating cost effectiveness or optimality is not the issue at this stage in the relicensing proceedings.

3 It was in 2005, after the relicensing GEIS was completed, that the National Research Council (NatRC) released its study on risks of spent-fuel-pool fires.

"The committee judges that successful terrorist attacks on spent fuel pools, though difficult, are possible.

... If an attack leads to a propagating zirconium cladding fire, it could result in the release of large amounts of radioactive material.
... Additional analyses are needed to understand more fully the vulnerabilities and consequences of events that could lead to propagating zirconium cladding fires.
... it appears to be feasible to reduce the likelihood of a zirconium cladding fire by rearranging spent fuel assemblies in the pool and making provision for water-spray systems that would be able to cool the fuel, even it the pool or overlying building were severely damaged.
...Dry cask storage has inherent security advantages over spent fuel pool storage, but it can only be used to store older spent fuel.

The committee judges, however, that further engineering analyses and cost-benefit studies would be needed before decisions on this and other mitigative measures are taken." (NatRC 2005)

I note that such engineering analyses and cost-benefit studies have not been published by the applicants.

additional calculations that a) fill in some gaps left in earlier work, and b) take into account new information that has recently become available. 10% and 100% are the release fractions recommended for consideration by Gordon Thompson in his report. I have read his report and find it consistent with my knowledge of this field. These release fractions match earlier published work by Thompson, myself, and co-authors (Alvarez et al. 2003a), (Beyea et al. 2004a). They also are consistent in order of magnitude with values considered appropriate by the analyst who did the original work on releases from spent-fuel pools.[4] In addition to a 10% and 100% release fraction, I have also considered (briefly) a smaller release. I have presented general formulas that can be used to estimate consequences for a wide range of releases, other than 10% or 100%.

Thompson finds the inventory of Cesium-137 to be somewhat higher at Pilgrim and Vermont Yankee than the default inventory for a generic reactor considered in (Alvarez et al. 2003a). The differences are not major. I have reviewed Thompson's analysis and find his values reasonable for me to use.

Thompson has estimated the heat rate of a spent-fuel-pool fire to be higher at Pilgrim and Vermont Yankee than estimated for a generic spent-fuel pool in (Alvarez et al. 2003a). The difference in resulting plume rise is within one standard deviation for plume rise, using standard formulas, so it has not been necessary for me to modify my calculations with respect to plume rise.

Before submitting a report on consequences of a 10% and 100% release, I have made an independent assessment to assure myself that such releases are probable enough to be more than a mathematical exercise. I have already noted that many analysts have found that the generic, spent-fuel-pool problem needs to be addressed. In addition, I have reviewed the treatment of release probabilities in the companion report of Gordon Thompson, Ph.D. I find his analysis reasonable and conservative. I am certainly comfortable relying on his plant-specific probability numbers for this proceeding. I note that his estimate of the probability of a release caused by a malicious act increases his total probability estimate by only a factor of 6. A factor of 6 increase is modest, given the ingenuity that terrorists have shown in the past. Thompson's plant-specific numbers are consistent with generic probability analyses that were part of a scoping cost-benefit analysis that my colleagues and I made in 2003 (Alvarez et al.

[4] Allan Benjamin, lead author of the original 1979 paper from Sandia Laboratory, was a reviewer of our 2003 paper in SG&S. He provided a public commentary on it, in which he stated,. "Although there is clear evidence that some of the fuel would melt in such a situation, we don't know how much. Since we don't, it is conservative and appropriate to assume that a large fraction of the fission product inventory could become released to the environment. Whether that fraction is 0.20 or 1.00 doesn't change the fact that the release would be unacceptable." (Benjamin 2003)

2003a). Our analysis suggests that even using older probability numbers, and without considering threats of terrorism or new data on radiation risks to be discussed later, moving older fuel to dry cask storage is nearly cost-effective.[5] The Nuclear Regulatory Commission's response to the issues raised by the report of the National Research Council (NatRC 2005) and our paper in *Science and Global Security* (SG&S)(Alvarez et al. 2003a) is discussed in (Dorman 2005). The NRC does not appear to be addressing the scenarios of most concern to me, such as those addressed by Thompson in his report for Pilgrim and Vermont Yankee. The Commission essentially sees the spent-fuel pool problem as a non-issue that is diverting resources from more important areas. However, the basis for the Commission's overall judgment is secret, presenting a challenge in relicensing proceedings to independent scientists like myself, who are not allowed to review the secret analysis. Should I simply accept the Commission's judgment without review and remain silent to avoid any chance of providing useful information to terrorists? The problem with such a stance is that I do not believe the Commission (or any government agency) can best protect the public against terrorism in the absence of vigorous pressure from, and critical analysis by, a range of stakeholders. It would be irresponsible to say nothing, but equally irresponsible to say too much. I hope the balance I have struck in this report is the right one. I certainly conclude from all of the analysis carried out, both by me, Thompson, and others, and the lack of response by the NRC to date, that computing the consequences of large releases of Cesium-137 in regulatory proceedings is responsible and in the public interest.

Another reason that I find it important to make consequence calculations in these proceedings is that the NRC's own Inspector General has observed that the NRC appears to have informally established an unreasonably high burden of requiring absolute proof of a safety problem (IG 2003). Considerable evidence is available that a correspondingly high barrier has been set for alternatives to pool storage at reactors, based on comments by NRC staff on our 2003 paper and by my reading of (Dorman 2005). Thus, independent analysts may be the only vehicle for computing state-of-the-art consequences, if the NRC is reluctant to commission such calculations or require applicants to make them.

Consequences of a release. The first realistic study of the economic and land use consequences of

[5] The approach I took for our 2003 report, when it came to dealing with terrorism, was to think of scenarios that a terrorist group might come up with using the technical means I thought would be reasonably available to them. Since at least one of those generic scenarios I came up with seemed plausible, I considered at the time, and still do, that we need to understand the consequences of spent-fuel-pool fires.

releases of long-lived radioactivity that tried to go beyond bounding calculations was published in 1996 (Chanin and Murfin 1996). This work appeared in the same year of publication of the relicensing GEIS (NUREG 1996), so would not likely have been considered in the GEIS. More recently, in 2003 and 2004, estimates of the long-term health consequences of releases from spent-fuel fires were published by our group of independent analysts, as noted above. Some NRC Commissioners have referred to staff analyses refuting our published results, but such analyses have never been made public, as far as I am aware. If the new staff analysis does exist, it was also prepared after the GEIS and so should be incorporated into the EIS for Pilgrim and Vermont Yankee. The staff analysis that has been published is sobering and only applies specifically to decommissioning (Collins and Hubbard 2001).

For this report, components of damage costs not previously considered at other sites have been included. For instance, new damage cost and latent cancer calculations have been made to extend the work by Beyea, Lyman, and von Hippel to areas contaminated by resuspension. Results from "wedge model" calculations (discussed below) have been used for this purpose. Loss of property value outside remediated areas have also been considered, again with reliance on the wedge model. Approximate correction has been made for wind-rose effects, something that was not done in (Beyea et al. 2004a). In addition, I have made cost and latent cancer estimates, assuming that the latest radiation mortality studies are used in the calculations. As for the standard components of damage calculations, I have scaled, interpolated or extrapolated from values computed for other sites as reported in (Beyea et al. 2004a). Since the MACCS2 model was run in the paper by Beyea, Lyman, and von Hippel, with the parameter values listed there, the results in this report on Pilgrim and Vermont Yankee are based on the MACCS2 model.

The models included in the MACCS2 code are based largely on methodologies originally developed for the 1975 Reactor Safety Study (NUREG 1975), as refined in the CRAC2 code (Kocher et al. 1987; Ritchie et al. 1984). See (Young and Chanin 1996). A simpler approach to consequence analysis (wedge model) was developed by an American Physical Society group that reviewed the Reactor Safety Study (APS 1975). The wedge-model provides quick estimates of consequences that usually gives similar results to more detailed models, such as MACCS2, provided one uses appropriate effective parameters. The wedge model may underestimate acute consequences in situations where changing weather classes dominates health effects, but that is not a major issue for releases of cesium-137, where the risk is from long-term exposure.

Details of the calculations made for this report are given in Appendix I. Tables with

quantitative results appear in a subsequent section. Reliance on output from the MACCS2 computer code or the wedge model to estimate consequences from releases of Cesium-137 in this report does not necessarily imply endorsement of the use of these methodologies in other contexts, nor endorsements of the parameter sets that applicants or others may use with them. All models have strengths and weaknesses that must not be forgotten by modelers. MACCS2 does not appear to have undergone extensive field validation (Young and Chanin 1997), but sensitivity studies have been undertaken (Helton et al. 1995; McKay and Beckman 1994), (Neymotin 1994) and a large number of expert elicitations have been carried out that provide uncertainty distribution for input parameters (Goossens et al. 1997; Harper et al. 1993; Little et al. 1997; USNRC 1995). The model has been used in a limited number of peer-reviewed publications. Edwin Lyman, who ran the MACCS2 code for (Beyea et al. 2004a) has probably the greatest number of peer-reviewed papers using MACCS2.

For late health effects, which are of interest in this report, the deposition velocity has been found to be a major parameter affecting MACCS results (Helton et al. 1995). Because the uncertainty distribution for deposition velocity is quite broad (USNRC 1995), the variance in the MACCS2 predictions for cancers (and damage costs) could be large. When possible, I prefer to rely on exposure models that have been tested against field data, such as those I have developed in recent years (Beyea et al.). However, by relying on results from MACCS2 in these proceedings with respect to consequences from releases of Cesium-137, I hope to avoid distracting debate over models.

In the next section, I present results of consequence calculations using standard cancer risk coefficients. In subsequent sections, I discuss major new studies on cancer risks from radiation that suggest the risk coefficients used in most versions of MACCS2 are way too low. I then present consequence calculations using higher cancer coefficients and discuss some of the implications for cost benefit analyses. Finally, I discuss some new developments in dispersion modeling at coastal sites. I suggest that the applicant at Pilgrim should undertake sensitivity studies using appropriate computer codes to see if this new knowledge of meteorology modifies cost-benefit computations.

Quantitative damage estimates for releases from Pilgrim and Vermont Yankee, assuming standard cancer risk coefficients:

This section presents a subset of consequence estimates for hypothetical releases of Cesium-137 from spent-fuel pools at Pilgrim and Vermont Yankee. Estimates are presented for economic costs and latent cancers. Variance in the estimates are not considered for the contention phase. Details of the

estimates are given in the Table footnotes and in Appendix I. Political, psychological, and social impacts of hypothetical releases are not considered, although they could obviously be significant. For instance, there appears to exist a "radiation syndrome" that affects a subset of exposed populations, causing debilitating psychiatric symptoms (Vyner 1983). Psychological effects of radiation disasters are expected to be most serious for children (CEH 2003).

Releases of 10% and ~100% of the radiocesium in the spent-fuel pools at both Pilgrim and Vermont Yankee are considered. Results are presented in this section using the standard risk coefficients assumed in (Beyea et al. 2004a). Releases lower than 10% of the Cesium-137 inventory, even releases too low to justify remediation, could have costs associated with loss in property value in the range of 10 to 100 billion dollars.

The damage estimates shown in the Tables are much less than the GDP of the US, which is about 12 trillion per year. However, some of the numbers exceed the annual payment on the national debt, which is about 350 billion dollars per year, indicating that government borrowing to cover the damage payments from a spent-fuel-pool fire could represent a major perturbation on the economy. Thus, significant macroeconomic effects could be expected depending on the state of the economy at the time of any hypothetical release. The regional impacts would be expected to be the most serious. Estimating such effects are beyond the scope of this report.

The Tables include numbers in some cells to 3-significant figures. This does not imply any comparable level of accuracy.

Table 1. Cost estimates for a release of 10% of spent-fuel pool inventory of radioactive Cesium-137 assuming no change in cancer risk coefficient (billions of dollars)			
Category	Pilgrim	Vermont Yankee	Comment
Direct costs[a)]	49	39	
Indirect administrative costs[b)]	49	39	
Loss in property values adjacent to treated areas[c)]	7-74	9-87	
Costs associated with cleanup or demolition of downtown business and commercial districts, heavy industrial areas, or high-rise apartment buildings.[d)]	??	??	Particularly important for Pilgrim, with its proximity to Boston
Total	> 105-171	> 87-165	

a) As estimated from computations with MACCS2 at comparable sites with the parameters given in (Beyea et al. 2004a). Reduction by 1/3rd to account for wind rose effects.
b) Based on Chanin and Murfin. "We believe . . . that it might be reasonable to double the cost estimates provided [here] in order to account for indirect costs." (Chanin and Murfin 1996), p. 6-3. The factor might not be as great in the current case, however, because of economies of scale. We assume that litigation costs offset any economies of scale.
c) Assumes 5% loss in property value for an area surrounding the plume that includes 1 to 10 times as many persons as are in the (0.24 radian) plume extending out to 250 miles (see Appendix I). A similar 5% loss in property value is assumed in the plume from 250-1000 miles. $132,000 in property value assumed per capita (Beyea et al. 2004a). Although not included in this total for the contention phase, loss in property value upon sale by government of remediated property should be included here. MACCS2 assumes no such loss.
d) We have not attempted an estimate for this category in the contention phase.

Table 2. Cost estimates for a release of ~100% of spent-fuel pool inventory of Cs-137 assuming no increase in cancer risk coefficient (billions of dollars)			
Category	Pilgrim	Vermont Yankee	Comment
Direct costs[a)]	163	173	
Indirect administrative costs[b)]	163	173	
Loss in property values adjacent to treated areas[c)]	16-162	17-172	
Costs associated with cleanup or demolition of downtown business and commercial districts, heavy industrial areas, or high-rise apartment buildings.[d)]	??	??	Particularly important for Pilgrim, with its proximity to Boston
Total	> 342-488	> 364-518	

a) As estimated from computations with MACCS2 at comparable sites with the parameters given in (Beyea et al. 2004a). Figures reduced by 1/3rd to account for wind rose effects.
b) Based on Chanin and Murfin. "We believe . . . that it might be reasonable to double the cost estimates provided [here] in order to account for indirect costs." (Chanin and Murfin 1996), p. 6-3. The factor might not be as great in the current case, however, because of economies of scale. We assume that litigation costs offset the economies of scale.
c) Assumes 5% loss in property value for an area including 1 to 10 times as many persons as are in a 0.24 radian plume extending out to 700 miles (see text). A similar 5% loss in property value is assumed in the plume from 700-1000 miles. $132,000 in property value assumed per capita (Beyea et al. 2004a). Although not included in this total for the contention phase, loss in property value upon sale by government of remediated property should be included here. MACCS2 assumes no such loss.
d) We have not attempted an estimate for this category in the contention phase.

Note that the latent cancer estimates in Table 3, below, are lower limits, because they only include the cancers from Cesium-137. This approximation ignores shorter isotopes in the fresh fuel in the pool, especially Cesium-134 (Benjamin 2003).

Table 3. Estimates for latent cancers following releases from the spent-fuel pools at either Pilgrim or Vermont Yankee (assuming no increase in cancer risk number)

Category	10% release	~100% release
Latent cancers in main plume path from residual contamination[a)]	1300	4000
Latent cancers from deposited resuspension[b)]	1300	4000
Total	2,700	8,000

a) Based on typical numbers for plants analyzed in (Beyea et al. 2004a). Figures reduced by 1/3rd to account for wind rose effects. Cancers in the direct plume are reduced by more than a factor of ten from decontamination and deconstruction.
b) Assumes 10% resuspension and redistribution of deposited Cesium-137 resulting from a) wind removal in the first few weeks, and b) remediation/demolition efforts over successive years. It is possible that even the resuspended Cesium would produce concentrations high enough to justify remediation, with a corresponding reduction in projected cancers. However, clean-up costs would be increased.

I have not been able to incorporate new understanding of the flow of air over and around the New England Coastline that has been achieved in recent years. Still, this new knowledge should be taken into account in EISs for coastal facilities. Releases from Pilgrim headed initially out to sea will remain tightly concentrated due to reduced turbulence until winds blow the puffs back over land (Zagar et al.), (Angevine et al. 2006). This can lead to hot spots of radioactivity in unexpected locations (Angevine et al. 2004). Dismissing radioactivity blowing out to sea is inappropriate. Reduction of turbulence on transport from Pilgrim across the water to Boston should also be studied. Although incorporating such meteorological understanding into a PSA or equivalent at Pilgrim would not be likely to make more that a factor of two difference in risk, the change could bring more SAMAs into play and would be significant in an absolute sense, when combined with the increase arising from incorporation of new values of radiation dose conversion coefficients (discussed below). The program

CALPUFF (Scire et al. 2000) has the capability to account for reduced turbulence over ocean water and could be used in sensitivity studies to see how important the phenomenon is at Pilgrim.

New cancer risk coefficients There have been increases in the value of the cancer risk assigned to low doses of radiation that should be taken into account in EISs. These increases have been steady since 1972,[6] which makes the original EISs out of date. In addition, there has been a marked increase in the value of the cancer mortality risk per unit of radiation at low doses (2-to-3 rem average) as a result of recent studies published on a) radiation workers (Cardis et al. 2005) and b) the Techa River cohort (Krestinina et al. 2005). Both studies give similar values for low dose, protracted exposure, namely about 1 cancer death per Sievert (100 rem).

Worker study: The average dose for the workers was 2-rem. The authors of this large, international study of radiation workers included major figures in the field of radiation studies. The authors state, "On the basis of these estimates, 1-2% of deaths from cancer among workers in this cohort may be attributable to radiation." Although it can be misleading to interpret epidemiologic data in this way (Beyea and Greenland 1999), because it implies to non-experts a single-cause model of cancer, there is no doubt that a 1-2% increase in cancer mortality for a worker population is unusually high.

Techa River Cohort: The results for the Techa River cohort are equally striking, showing a strong linear effect down to a few rads. The average dose was 3 rads. The authors, who once again include major figures in the field of radiation studies, state: "It is estimated that about 2.5% of the solid cancer deaths...are associated with the radiation exposure." As in the worker population, an increase in solid cancer deaths of 2.5% from a dose of 3 rads is extraordinarily high compared to past estimates.

Such high risk coefficients imply that background radiation itself must increase cancer mortality by 3-5%.[7] (It has long been known that background radon concentrations may well increase lung cancer rates by 10% or more (Lubin et al. 1995), (Darby et al. 2005).) Critics of studies like those by

---

[6] For instance, there was a large increase in the risk coefficients estimated between the 1980 BEIR III report and the 1990 BEIR V report. See Table 4-4 of (National Research Council 1990), where the lifetime risk estimates increased by a factor of 4.6-19, depending on the risk model.

7 Assuming 0.1 rem per year background, which ignores the "equivalent" dose to the lung from radon. It is more difficult to compare rates of lung cancer, because the interaction of smoking and radiation has been found to lie between a linear and relative model. Therefore, such interactions must be taken into account, before drawing conclusions about area-wide differences, or lack of differences, in lung cancer rates.

Cardis et al. and by Krestinina et al. argue that such big effects, if they were real, should show up in cancer statistics in places like Colorado, where background radiation is high, when compared to areas of the country where background radiation is lower. However, crude statistical analysis that does not adjust for covariates at an individual level is unlikely to be very reliable (Lubin 1998). Also, there is an issue of the confounding effect of hypoxia (Weinberg et al. 1987). Hypoxia also varies with altitude.

Because the average dose in these two new studies is so low and so close to background radiation dose, there is no way to escape the linear non-threshold model. Even were a hypothetical hormesis effect to lead to a minimum risk at background levels (5 rem lifetime dose), the risk has to rise again after another 2-3 rem dose, based on the studies by Cardis et al. and Krestinina et al.

Could the increased risk numbers be due to a systematic underestimate or underreporting of doses? Random errors in doses would tend, in most cases, to reduce the strength of associations (Carroll et al. 1998), (Thomas et al. 1993). On the other hand, if dose errors were not random, but were proportionately underestimated or proportionately underreported in the worker studies and the Techa River cohort, then the risk coefficients could be inflated. For this to happen in both studies would be a coincidence. And in the radiation worker study, the results for Hanford do not support the missing-dose hypothesis, even though we know the neutron doses were likely underreported at Hanford (CohenAssociates 2005). In fact, the cancer risk numbers at Hanford were lower than average, not higher (Cardis et al. 2005). Finally, should the Techa River cohort dose estimates be too low that would mean that modern dose reconstruction techniques are underestimating doses, suggesting that other modern dose estimation techniques, such as those used in MACCS2 (Chanin and Young 1997), the standard NRC consequence code, could well be too low. In that case, an upward adjustment of doses would be required, if the risk coefficients were kept the same. Certainly, from a public health point of view, the arguments are strong for making use of the new risk coefficients, one way or another, with programs like MACCS2 and other consequence codes.

Recent press reports around the anniversary of the Chernobyl accident seemed to suggest that effects of radiation doses were lower than expected. Not at all. The "new" estimates of 4,000 projected fatalities were merely a re-interpretation of a study from the 1990s. No longer were 5,000 projected cancers outside the most highly contaminated regions counted. Also, another 7,000 cancers projected to occur in Europe were not noted by the press (Cardis et al. 2006). A summary of all of these estimates can be found in (Cardis et al. 2006). Were the new risk coefficients discussed earlier applied to the population dose estimates, the projected numbers of fatalities from the Chernobyl releases would

climb much higher.

The confusion over the Chernobyl numbers appears to be traceable to a typo in a highly publicized IAEA report (Forum 2005) that relied on a WHO report for its cancer numbers (WHO 2005). The WHO report stated that the "Expert Group" concluded that there may be up to 4 000 additional cancer deaths among the three *highest* exposed groups over their lifetime (emphasis added). This was translated in the IAEA report to, "The total number of people that could have died or could die in the future due to Chornobyl originated exposure over the lifetime of emergency workers and residents of *most* contaminated areas is estimated to be around 4 000." (Emphasis added.) In fact, in my view, the last clause should have referred to "residents of *the* most contaminated areas..."[8]

Impact of new cancer risks. As a result of these two radiation studies, all probabilistic safety analyses prepared prior to them need to be revisited. These new studies should change the threshold for adoption of severe accident mitigation alternatives (SAMA). For instance, the current Environmental Report for Pilgrim assigns a value of $2,000 per person rem in deciding whether a proposed SAMA is cost effective. According to the results of the study by Cardis et al., $2,000 per rem implies a valuation of $200,000 per cancer death before discounting, which is way to low.[9] The same low valuation of life would arise from use of the risk numbers derived from the Techa River cohort (Krestinina et al. 2005). As a result, the SAMA analyses prepared for the Pilgrim and Vermont Yankee facilities need to be redone, even without inclusion of spent-fuel-pool fires as a risk to be addressed. Presumably, a number of additional SAMAs that were previously rejected by the applicant's methodology will now become cost effective. In addition to affecting the existing SAMA calculations, the new cancer risk coefficients make the consideration in an EIS of mitigation measures for spent-fuel-pool fires especially important.

In addition to providing motivation for a reanalysis of past PSAs and SAMA thresholds, the results of these new epidemiologic studies throw into doubt the entire basis of the NRC culture, which maintains that the linear non-threshold theory (LNT) is conservative, providing a margin of safety. Although it has always been known that the dose-response at doses below the 25-rad average dose of the Atomic Bomb survivors could be supralinear, as opposed to sublinear, the possibility has not been

8 Note that the IAEA stands by its original wording, not accepting it as a typo. Personal Communication, 2006, D. Kinley, IAEA public information, Vienna.

9 $50,000 net present value for a cancer death occurring 20 years from now, based on the 7% per year discount rate assumed in rhe Pilgrim Environmental Report, which leads to a factor of 4 reduction in present value for a cancer induced 20 years from now.

given much attention in the radiation protection community until now.[10] This is not the time for *pro forma* treatment of licensing applications. Whereas it would be unreasonable to require an applicant to redo analysis after every new paper is published in the scientific literature, the increase at low doses is very dramatic in this case. It represents a 5-fold increase over the risk estimated in BEIR VII (NRC 2005). Based on information in (Little 1998), it appears to represent a factor of 10 over the standard value used in the MACCS2 computer code, which is the code on which the applicants' analyses are based. With such a high reported increase, public health considerations have to take precedence over applicant convenience. The paper by Cardis et al., at the very minimum, demands that a thorough analysis be made of mitigation and alternatives to spent-fuel pool storage.

For example, application of the new risk coefficients would drive the risk of spent-fuel-pool accidents during decommissioning (without even considering terrorist threats) above the NRC's safety goal. See Figures ES-1, ES-2 of (Collins and Hubbard 2001).

Quantitative damage estimates for releases from Pilgrim and Vermont Yankee, assuming cancer risk coefficients are increased to accommodate the new epidemiologic studies:

This section presents a subset of consequence estimates for hypothetical releases of Cesium-137 from spent-fuel pools at Pilgrim and Vermont Yankee, assuming a 3-fold increase in cancer risk coefficients to conservatively account for the latest studies on radiation risk at low dose. To account for some weighting of other studies, I have chosen a value lower than the factor of 5-to-10 increase that is suggested by the study of (Cardis et al. 2005).[11]

As with earlier Tables, estimates are presented for economic costs and latent cancers. Variance in the estimates are not considered for the contention phase. See the Table footnotes and Appendix I for details. Political, psychological, and social impacts of hypothetical releases are not considered, although they could obviously be significant. As stated earlier, there appears to exist a "radiation syndrome" that affects a subset of exposed populations, causing debilitating psychiatric symptoms (Vyner 1983). Psychological effects of radiation disasters are expected to be most serious for children (CEH 2003).

---

[10] There has been some discussion, however, that the A-Bomb survivor data produces low risk coefficients due to a healthy survivor effect (Stewart and Kneale 1993; Stewart and Kneale 1999). In addition, I have always wondered about the lowest dose data in Pierce, which seems to show a supralinear effect below 5 rem (Pierce et al. 1996), page 9.

11 Part of the factor of 5 comes from the use of a dose and dose rate effectiveness factor, which is commonly used with the MACCS2 code, as in (Beyea et al. 2004a).

Once again, releases lower than 10% of the Cesium-137 inventory, even releases too low to justify remediation, could have costs associated with loss in property value in the range of 10 to 100 billion dollars.

The damage estimates shown in the Tables are much less than the GDP of the US, which is about 12 trillion per year. However, some of the numbers are considerably larger than the annual payment on the national debt, which is about 350 billion dollars per year, indicating that government borrowing to cover the damage payments from a spent-fuel-pool fire could represent a major perturbation on the economy. Thus, once again, significant macroeconomic effects could be expected depending on the state of the economy at the time of any hypothetical release. The regional impacts would be expected to be the most serious. Estimating such effects are beyond the scope of this report.

The Tables include numbers in some cells to 3-significant figures. This does not imply any comparable level of accuracy.

Table 4. Cost estimates for a release of 10% of spent-fuel-pool inventory of Cs-137 assuming 3-fold increase in cancer risk coefficient (billions of dollars)			
Category	Pilgrim	Vermont Yankee	Comment
Direct costs[a)]	89	79	
Indirect administrative costs[b)]	89	79	
Loss in property values adjacent to treated areas[c)]	> 7-74	> 9-87	
Costs associated with cleanup or demolition of downtown business and commercial districts, heavy industrial areas, or high-rise apartment buildings.[d)]	??	??	Particularly important for Pilgrim, with its proximity to Boston
Total	> 186-253	> 167-245	

a) As estimated from computations with MACCS2 at comparable sites with the parameters given in (Beyea et al. 2004a). An increase in the cancer risk numbers is mathematically equivalent to an increase in release magnitude, which is how the numbers in the Table were computed. Figures reduced by 1/3rd to account for wind rose effects.
b) Based on Chanin and Murfin. "We believe . . . that it might be reasonable to double the cost estimates provided [here] in order to account for indirect costs." (Chanin and Murfin 1996), p. 6-3. The factor might not be as great in the current case, however, because of economies of scale. We assume that litigation costs offset the economies of scale.
c) Assumed to be at least as great as the figures calculated in Table 1, where the cancer risk coefficient was left unchanged. Although not included in this total for the contention phase, loss in property value upon sale by government of remediated property should be included here. MACCS2 assumes no such loss.
d) We have not attempted an estimate for this category in the contention phase.

Table 5. Cost estimates for a release of ~100% of spent-fuel-pool inventory of Cs-137 assuming a three-fold increase in cancer risk coefficient (billions of dollars)			
Category	Pilgrim	Vermont Yankee	Comment
Direct costs[a)]	283	353	
Indirect administrative costs[b)]	283	353	
Loss in property values adjacent to treated areas[c)]	16-162	17-172	
Costs associated with cleanup or demolition of downtown business and commercial districts, heavy industrial areas, or high-rise apartment buildings[d)]	??	??	Particularly important for Pilgrim, with its proximity to Boston
Costs due to delays in implementing remediation and deconstruction[d)]	??	???	
Total	> 582-728	> 723-878	

a) As estimated from computations with MACCS2 at comparable sites with the parameters given in (Beyea et al. 2004a). An increase in the cancer risk numbers is mathematically equivalent to an increase in release magnitude, which is how the numbers in the Table were computed. Figures reduced by 1/3rd to account for wind rose effects.
b) Based on Chanin and Murfin. "We believe . . . that it might be reasonable to double the cost estimates provided [here] in order to account for indirect costs." (Chanin and Murfin 1996), p. 6-3. The factor might not be as great in the current case, however, because of economies of scale. We assume that litigation costs offset the economies of scale.
c) Assumed to be at least as great as the figures calculated in Table 2, where the cancer risk coefficient was left unchanged. Although not included in this total for the contention phase, loss in property value upon sale by government of remediated property should be included here. MACCS2 assumes no such loss.
d) We have not attempted an estimate for this category in the contention phase.

Note that the latent cancer estimates in Table 6, below, are lower limits, because they only include the cancers from Cesium-137. This approximation ignores shorter isotopes in the fresh fuel in the pool, especially Cesium-134 (Benjamin 2003).

Table 6. Estimates for latent cancers following releases from the spent-fuel pools at either Pilgrim or Vermont Yankee (assuming a 3-fold increase in cancer risk number)

Category	10% release	~100% release
Latent cancers in main plume path from residual contamination[a)]	4,000	12,000
Latent cancers from deposited resuspension[b)]	4,000	12,000
Total	8,000	24,000

a) Based on typical numbers for plants analyzed in (Beyea et al. 2004a) multiplied by a factor of 3. Figures reduced by 1/3rd to account for wind rose effects. Cancers in the direct plume are reduced by more than a factor of ten from decontamination and deconstruction.
b) Assumes 10% resuspension and redistribution of deposited Cesium-137 resulting from a) wind removal in the first few weeks, and b) remediation/deconstruction efforts over successive years. It is possible that even the resuspended Cesium would produce concentrations high enough to justify remediation, with a corresponding reduction in projected cancers. However, clean-up costs would be increased.

Regulatory implications. The results in Tables 1-6, along with the discussion in the text suggest that: The applicant should withdraw and revise its Environmental Reports for Pilgrim and Vermont Yankee. The NRC should prepare supplements to the August 1979 Generic Environmental Impact Statement on handling and storage of spent fuel (NUREG-0575), and the May 1996 GEIS on license renewal (NUREG-1437). The revised documents should consider the new cancer risk coefficients published by Cardis et al. and Kristinina et al. For both reactor accidents and spent-fuel-pool fires, when relevant, the documents should consider loss of property value outside remediated areas. They should consider wind-driven resuspension, especially from remediation activities, that carries radioactivity to new areas in the immediate weeks and years following the release. Although MACCS2 does not directly account

for such refinements, it may be possible to mimic their effects in the program.[12] In their economic calculations, the revised documents should include administrative and litigation costs associated with clean up and demolition. The ER for Pilgrim should consider the reduced turbulence over ocean water, including transport directly over water to the Boston area. The NUREG supplements should consider the impacts of coastal meteorology for reactors on the East and West Coasts. The program CALPUFF can be used to deal with dispersion over coastal waters.

[12] This might be done by adding on extra plume segments to the end of a standard run, with varying delay times, and a total added release equal to the assumed resuspension fraction times the initial release. This will tend to produce the mathematical equivalent of resuspended material being carried in directions different from the main plume.

Appendix I.

Variance in estimates are not considered in this report for the contention phase.

Based on the report of Gordon Thompson, the inventories at Pilgrim and Vermont Yankee are somewhat higher than the 35 MCi considered in (Beyea et al. 2004a). For Pilgrim, Dr. Thompson estimates 44 MCi; for Vermont Yankee, 39 MCi.

Thompson has also estimated a hotter heat rate for releases at Pilgrim and Vermont Yankee than was assumed in the calculations in (Beyea et al. 2004a). 106-128 MW vs 40 MW. Plume rise varies as the 1/3rd power of the heat rate in the standard "Briggs" formula for plume rise (Parks 1997), which implies a 50% greater rise than would have been calculated in the MACCS2 program that was used in the paper by Beyea, Lyman and von Hippel. For the contention phase of these proceedings, this difference has been ignored, since a 50% increase in plume rise is within 1-standard deviation of the value predicted by the formula (Irwin and Hanna 2004).

Rather than make new MACCS2 calculations for the contention phase of these proceedings, the azimuthally-averaged radial population distributions for both Pilgrim and Vermont Yankee have been compared as a function of distance with those for which economic and latent cancer consequences have been calculated in (Beyea et al. 2004a). It is the radial population numbers that drive the economic damage costs and cancer numbers. Figures 1 and 2 show the azimuthally-averaged radial population distributions for Pilgrim and Vermont Yankee for two different maximum distances. The CensusCD computer program (Geolytics 2002) was used to generate these population distributions. The same program was used in (Beyea et al. 2004a) for the five reactors, Catawba, Indian Point, LaSalle, Palo Verde, and TMI.

The effect of variation in wind direction at Pilgrim is to reduce the average damages and latent fatalities. Wind rose data taken from the Pilgrim FSAR shown in Figure 5 for the 300 foot tower suggest a reduction factor of 0.666 for that facility. See caption for Figure 5. I did not find similar data for a high tower in the FSAR for Vermont Yankee, so I have used the 0.666 factor determined for Pilgrim. Wind flows at the surface given in the Vermont Yankee FSAR are not particularly relevant to a hot release during a fire, since the plume will be elevated. The variance with angle appears to be quite large, because the population figures change with release angle, as shown in Figures 3 and 4.

For economic damages from the 10% releases, we are interested in populations out to 250 miles

(based on wedge model calculations). For the ~100% releases, the corresponding distance is 700 miles. The Pilgrim population figures best match Catawba out to 250 miles. For Vermont Yankee the population figures best match Lasalle out to 250 miles. Out to 700 miles, both Pilgrim and Vermont Yankee are most similar to Lasalle, although I discount the Lasalle cost figures to account for the lower population values of Pilgrim and Vermont Yankee.

Table 7, shows the relevant costs extracted from Table 3 of (Beyea et al. 2004a) and adjusted as indicated in the Table footnotes. These numbers were then fit to a power law function of release magnitude. The corresponding functions were used to generate costs estimates for the Pilgrim and Vermont Yankee releases estimated by Thompson, which differ somewhat from the releases assumed for a spent-fuel fire in (Beyea et al. 2004a).

Table 7. Assigning damage cost estimates in billions of dollars based on Table 3 of (Beyea et al. 2004a)

Release magnitude	Pilgrim	Vermont Yankee
3.5 MCi	71[a)]	54[b)]
35 MCi	219[c)]	243[d)]

a) Cost figure for Catawba for a 3.5 MCi release.
b) Cost figure for Lasalle for a 3.5 MCi release.
c) Cost figure for Lasalle for a 35 MCi release reduced by 20%
d) Cost figure for Lasalle for a 35 MCi release reduced by 10%

Extrapolated and interpolated direct damage costs for Pilgrim and Vermont Yankee were computed from the following formulas:

Pilgrim: Damages = $0.66 * 35 * (\text{release in Mci})^{0.5}$

Vermont Yankee: Damages = $0.66 * 24 * (\text{release in MCi})^{0.65}$

The factor of 0.66 comes from wind-rose effects.

Administrative costs are taken equal to direct costs, following the suggestion of (Chanin and Murfin 1996). Property loss estimates are discussed below.

Estimates of losses in property value. It is assumed that an area exists around the "main portion" of the plume, where potential property buyers would be concerned about residual risk. (The main portion of the plume is defined as the area where remediation or demolition takes place.) Outside the main plume, contamination would still be measurable. Lack of trust in statements by government would translate into loss in property values. All things being equal, persons would wish to live as far away from contaminated areas as possible.

Note that radioactive deposition would extend into these non-remediated areas, both from the immediate release and from resuspension in the weeks and years after the release and from subsequent demolition and remediation efforts. People would be accumulating long-term radiation doses, which government sources would say are too trivial to worry about. Expert opinion would differ on the seriousness of the long-term exposures. Confidence in government would likely drop over time based on revelations of government failings. If past patterns are followed, government leaders would early on feel compelled to downplay the true situation to prevent panic. Although it is hard to see how they could act otherwise, it is also hard to see how citizens enthusiasm for purchasing property in the vicinity of the main plume would not be weakened.

How much would property values decline? Based on expert reports filed in litigation concerning the Rocky Flats nuclear weapons facility, and the jury decision favorable to plaintiffs in that litigation (2006), I assume a 5% loss in property value for property lying within measurable contours of contamination. This is quite conservative, since the jury accepted Plaintiffs' expert assessment that residential values dropped by 7%,[13] vacant land by 30%, and commercial land by 53%. For the calculations in this report, I define the main, remediated plume as a 0.24 wedge extending out to 250 miles for the 10% release and 700 miles for the ~100% release.

Areas where property damage loss is assumed to take place extends outward from the plume to 1000 miles, which is where the damage calculations stop in (Beyea et al. 2004a). In addition, property in areas to the side of the plume are also expected to suffer a 5% loss in value. Because I have no firm basis for determining the distance to which property loss would extend, I have picked a ten-fold range. At the low end, as many people outside the main plume are assume to be affected as live in the main plume. At the high end, I pick ten times as many persons.

---

13 The "residential" figure appears to be some sort of compromise. It's within a range reported by expert Radke's year-by-year multiple regressions for 1988-95, but it's less than the 10% that expert Hunsperger ultimately estimated. Personal commuication, 2006, Peter Nordberg, Berger and Montague.

MACCS2 accounts for inhalation of resuspended material at the location where radioactivity is deposited (Chanin et al. 2004), Section 2, page 6-14. However, MACCS2 does not allow for redistribution of resuspended material to new locations. Yet, 10% of radioactivity deposited on vegetation may be blown off in the first few weeks,[14] with additional resuspension over decades,[15] increased dramatically by anthropogenic activity during clean up and remediation (Schershakov 1997). I adopt a net resuspension factor for Cesium-137 of 10% over the long term, which should be a conservative choice in this context.[16] To account for the latent cancers that would be caused by this redistribution of radioactivity, I have made the approximation that no such re-deposited material would be high enough to generate remediation. (If this assumption is violated, the number of latent cancers from redistributed radioactivity would go down, but it would then be necessary to increase clean-up costs.)

Based on wedge model calculations, I know that remediation reduces latent cancers by a factor of 10 or more. Thus, the contribution from redistributed radiation to total cancers, under the assumptions I have made, should be more than the direct contribution from the remediated plume (10% X 10 = 100%). A more precise calculation could be obtained by running MACCS2 in a special way, even though MACCS2 does not directly handle redistributed radioactivity. (MACCS2 only allows straight-line plume segments and does not allow wind trajectories (Chanin et al. 2004), Section 5, page 1-4.) However, MACCS2 does allow multiple straight-line segments with different starting times (Chanin et al. 2004), Section 2, page 6-14. If MACCS2 was run with extra plume segments added on to the end of a standard release sequence, with varying delay times, and a total added release equal to

---

[14] (NUREG 1975), Appendix VI. Radioiodine after weapons fallout shows very rapid decline over periods of days, some of which must be due to wind action (NCI 1997), Table 4.8. The half-life for small particles is longer, about 14 days (Prohl et al. 1995). Resuspension *factors* in the early days after the Chernobyl accident have shown very high values, including 2.4 E-04 m^{-1} at one day after deposition (Schershakov 1997). Such a high rate could not be maintained without completely exhausting the surface concentration in a very short time. The resuspension factor has been estimated to drop as an inverse power of time in days, with an exponent of 0.5-to-1.67 (Schershakov 1997). At issue is the size of the resuspended material, because some radioactivity might deposit on relatively large particles on vegetation that are easily removed by wind.

[15] Resuspension *rates* measured for Chernobyl radiocesium are also high (1E-08 s^{-1}) (Schershakov 1997). When such a high uplift rate is totaled for periods of years, a 10% net loss is quite reasonable, although resuspension rates were measured to decrease by an order of magnitude over time (Schershakov 1997). Studies by my colleagues and I have indicated that underground material is brought to the surface by animal burrowing (Morrison et al. 1997; Smallwood et al. 1998), where it is subject to wind resuspension. Thus, movement into the soil of radiocesium does not keep it away from the surface forever. Smallwood has estimated from his measurements in California and Colorado that about 0.5 % of underground radioactivity should be brought to the surface each year by animal burrowing, including ant burrowing (Smallwood, personal communication, 1998). How relevant this number is to the East Coast is not known.

[16] Because of lack of data on particle sizes, analysts may differ as to how much resuspended material would be in particle sizes large enough to travel outside the main plume before remediation. However, most land area would not be remediated. In any case, it will be important for the field of contamination consequence analysis to have debates on this subject.

the assumed resuspension fraction times the initial release, then MACCS2 will produce as output the mathematical equivalent of resuspended material being carried in directions different from the main plume.

References

Alvarez R, Beyea J, Janberg K, Kang J, Lyman E, Macfarlane A, et al. 2003a. Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States. Science and Global Security 11:1-51.

---. 2003b. Response by the Authors to Per Peterson's Review of ''Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States'': unpublished.

---. 2003c. Response by the Authors to the NRC Review of ''Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States''. Science and Global Security 11:213-223.

Angevine WM, Žagar M, Tjernström M, Senff CJ, White AB. 2004. Coastal boundary layer transport of urban pollution in New England. In: 16th Symposium of boundary layers and turbulence, Portland, Maine, 13th Symposium on Turbulence and diffusion, August 2004, Portland, Maine.

Angevine WM, Tjernström M, Zagar M. 2006. Modeling of the Coastal Boundary Layer and Pollutant Transport in New England. J of Appl Meteorol & Climatol 45:137-154.

APS. 1975. Report to the American Physical Society by the study group on radionuclide release from severe accidents at nuclear power plants". Reviews of Modern Physics 57:S64.

Benjamin AS. 2003. Comments on: ''Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States". Science and Global Security 11:53-58.

Beyea J. 1979. The effects of releases to the atmosphere of radioactivity from hypothetical large-scale accidents at the proposed Gorleben Waste Treatment facility. Report to the Government of Lower Saxony, Federal Republic of Germany, as part of the Gorleben International Review.

Beyea J, Greenland S. 1999. The importance of specifying the underlying biologic model in estimating the probability of causation. Health Phys 76(3):269-274.

Beyea J, Hatch M. 1999. Geographic exposure modeling: a valuable extension of GIS for use in environmental epidemiology. Environ Health Perspect 107, Supplement I:181-190.

Beyea J, Hatch M, Stellman DH, Teitelbaum SL, Prokopczyk B, Camann D, et al. Validation and calibration of a model used to reconstruct historical exposure to polycyclic aromatic hydrocarbons for use in epidemiologic studies. Env Health Perspect:doi:10.1289/ehp.8659 available via http://dx.doi.org/ [Online 1213 March 2006].

Beyea J, Hatch M, Stellman SD, Teitelbaum SL, Gammon MD. 2005. Development of a traffic model for predicting airborne PAH exposures since 1960 on Long Island, New York. Report to the National Cancer Institute and the National Institute of Environmental Health Sciences for work completed under USPHS Grant U01-CA/ES-66572. Lambertville, NJ 08530:Consulting in the Public Interest. Available: http://www.cipi.com/PDF/beyea2005trafficpahmodel.pdf [accessed 1 July 2005].

Beyea J, Lyman E, von Hippel F. 2004a. Damages from a Major Release of 137Cs into the Atmosphere of the United States. Science and Global Security 12:125-136.

---. 2004b. Response to comment by Herschel Specter on "Damages from a major release of 137Cs into the atmosphere of the United States". Science and Global Security 12:251-254.

Bixler NE, Shannon SA, Morrow CW, Meloche BE, Ridgely JN. 2003. SECPOP2000: Sector Population, Land Fraction, and Economic Estimation Program, Sandia National Laboratories, August 2003 NUREG/CR-6525, Rev. 1. Albuquerque: Sandia National Laboratories.

Cardis E, Krewski D, Boniol M, Drozdovitch V, Darby SC, Gilbert ES, et al. 2006. Estimates of the cancer burden in Europe from radioactive fallout from the Chernobyl accident. in press: (DOI) 10.1002/ijc.22037. Int J Cancer.

Cardis E, Vrijheid M, Blettner M, Gilbert E, Hakama M, Hill C, et al. 2005. Risk of cancer after low doses of ionising radiation: retrospective cohort study in 15 countries. doi:10.1136/bmj.38499.599861.E0. BMJ 331(7508):77.

Carroll RJ, Ruppert D, Stefanski LA. 1998. Measurement error in nonlinear models. Boca Raton:Chapman & Hall/CRC.

CEH. 2003. Radiation disasters and children (by Committee on Enviromental Health). Pediatrics 111:1455-1466.

Chanin D, Young M. 1997. Code manual for MACCS2: Volume 1, User's guide SAND97-0594/UC-610. Albuquerque: Sandia National Laboratory.

Chanin D, Young ML, Jow H-N, Sprung JL, Rollstin JA, Ritchie LT, et al. 2004. MACCS2 V.1.13.1. MELCOR Accident Consequence Code System for the Calculation of the Health and Economic Consequences of Accidental Atmospheric Radiological Releases. From the RSICC Computer Code Collection: Sandia National Laboratories, Albuquerque, New Mexico; Oak Ridge National Laboratory, Oak Ridge, Tennessee; Idaho National Engineering Laboratory, Idaho Falls, Idaho.

Chanin DI, Murfin WB. 1996. Site restoration: estimation of attributable costs from plutonium-dispersal accidents SAND96-0957. Albuquerque: Sandia National Laboratory.

CohenAssociates. 2005. Review of NIOSH Site Profile for the Hanford Site, Richland, Washington SCA-TR-TASK1-0004. McClean, Virginia: S. Cohen Associates/Salient, Inc.

Collins TE, Hubbard G. 2001. Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants NUREG-1738INW. Washington: US Nuclear Regulatory Commission.

Cook_v_Rockwell. 2006. Cook v. Rockwell: Rocky Flats jury verdict form:US District Court for the District of Colorado.

Crowley K. 2005. Are nuclear spent fuel pools secure? Presentation to the Council on Foreign Relations. http://www.cfr.org/publication/8967/. Accessed 5/14/2006.

Darby S, Hill D, Auvinen A, Barros-Dios JM, Baysson H, Bochicchio F, et al. 2005. Radon in homes and risk of lung cancer: collaborative analysis of individual data from 13 European case-control studies. BMJ 330(7485):223.

Dorman D. 2005. Are nuclear spent fuel pools secure? Presentation to the Council on Foreign Relations. http://www.cfr.org/publication/8967/. Accessed 5/14/2006.

Forum. 2005. Chernobyl's Legacy: Health, Environmental and Socio-economic Impacts and Recommendations to the Governments of Belarus, the Russian Federation and Ukraine. Vienna: International Atomic Energy Agency.

Gammon MD, Neugut AI, Santella RM, Teitelbaum SL, Britton JA, Terry MB, et al. 2002. The Long Island Breast Cancer Study Project: Description of a multi-institutional collaboration to identify environmental risk factors for breast cancer. Breast Cancer Res Treat 74(3):235-254.

Geolytics. 2002. CensusCD® Neighborhood Change Database (NCDB) 1970-2000. East Brunswick, NJ:Geolytics, Inc.

Goossens LH, Boardman J, Kraan BCP, Harper FT, Young ML, Hora SC, et al. 1997. Probabilistic Accident Consequence Uncertainty Analysis Uncertainty Assessment for Deposited Material and External Doses NUREG/CR-6526/EUR 16772. Washington/Brussels: US Nuclear Regulatory Commission/Commission of the European Communities.

Harper FT, Goossens LHJ, Cooke RM, Hora SC, Miller LA, Young ML, et al. 1993. Summary of uncertainty analysis of dispersion and deposition modules of the MACCS and COSYMA consequence codes - a joint USNRC/CEC study NUREG/CR-6244/EUR 15855EN: US Nuclear Regulatory Commission/Commission of the European Communities.

Hatch M, Beyea J, Nieves J, Susser M. 1990. Cancer Near the Three Mile Island Nuclear Plant: Radiation Emissions. Am J Epidemiol 132(3):397-412.

Hatch MC, Wallenstein S, Beyea J, Nieves JW, Susser M. 1991. Cancer rates after the Three Mile Island nuclear accident and proximity of residence to the plant. Am J Public Health 81(6):719-724.

Helton JC, Johnson JD, Rollstin JA, Shiver W, Sprung JL. 1995. Uncertainty and Sensitivity Analysis of Chronic Exposure Results with the MACCS Reactor Accident Consequence Model NUREG/CR-6134/SAND93-2370. Albuquerque: Sandia National Laboratories.

IG. 2003. NRC's regulation of Davis-Besse regarding damage to the reactor vessel head (Inspector General's Report, Dec. 30, 2002, http://www.nrc.gov/reading-rm/doc-collections/ insp-gen/2003/02-03s.pdf, p. 23).

Irwin JS, Hanna SR. 2004. Characterizing uncertainty in plume dispersion models. In: 9th Int Conf on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes, June 2004, Garmisch-Partenkirchen, Germany., 287-292.

Kocher DC, Ward RC, Killough GG, Dunning DE, Jr., Hicks BB, Hosker RP, Jr., et al. 1987. Sensitivity and uncertainty studies of the CRAC2 computer code. Risk Anal 7(4):497-507.

Krestinina LY, Preston DL, Ostroumova EV, Degteva MO, Ron E, Vyushkova OV, et al. 2005. Protracted radiation exposure and cancer mortality in the Techa River cohort. Radiat Res 164(5):602-611.

Little MP. 1998. Uncertainties in probabilistic nuclear accident consequence analysis. J Rad Protect 18:239-242.

Little MP, Harper FT, Muirhead CR, Hora SC, Groossens LHJ, Kraan BCP, et al. 1997. Probabilistic Accident Consequence Uncertainty Analysis Late Health Effects Uncertainty Assessment. Main Report NUREG/CR-6555, Vol 1/EUR 16774. Washington/Brussels: US Nuclear Regulatory Commission and Commission of European Communities, Joint Report.

Lubin JH. 1998. On the discrepancy between epidemiologic studies in individuals of lung cancer and residential radon and Cohen's ecologic regression [comment] [see comments]. Health Phys 75(1):4-10.

Lubin JH, Boice JD, Jr., Edling C, Hornung RW, Howe GR, Kunz E, et al. 1995. Lung cancer in radon-exposed miners and estimation of risk from indoor exposure. J Natl Cancer Inst 87(11):817-827.

McKay MD, Beckman RJ. 1994. A procedure for assessing uncertainty in models LA-UR -93-3548. Los Alamos: Los Alamos National Laboratory.

Morrison ML, Smallwood KS, Beyea J. 1997. Monitoring the Dispersal of Contaminants by Wildlife at Nuclear Weapons and Waste Storage Facilities, USA. The Environmentalist 17:289-295.

National Research Council. 1990. Health effects of exposure to low levels of ionizing radiation (BEIR V). Washington:National Academy Press.

NatRC. 2005. Safety and Security of Commercial Spent Nuclear Fuel Storage: Public Report. Washington:Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, National Research Council.

NCI. 1997. Estimated Exposures and Thyroid Doses Received by the American People from Iodine-131 in Fallout Following Nevada Atmospheric Nuclear Bomb Tests. Washington: National Cancer Institute.

Neymotin L. 1994. Comparison of MACCS users calculations for the international comparison exercise on probabilistic accident consequence assessment code NUREG/CR--6053; BNL-NUREG--52380. Upton, Long Island: Brookhaven National Laboratory.

Nie J, Beyea J, Bonner MR, Han D, Vena JE, Rogerson P, et al. 2005. Environmental exposure to traffic polycyclic aromatic hydrocarbons (PAHs) and risk of breast cancer, American Association for Cancer Research Annual Meeting. Anaheim, April 18. Proc Amer Assoc Cancer Res: 46:[Abstract #2183].

NRC. 2005. Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII – Phase 2. Washington:National Research Council, National Academy Press.

NUREG. 1975. Reactor Safety Study, NUREG-75/014 NUREG-75/014. Washington: US Nuclear Regulatory Commission.

---. 1996. Generic environmental impact statement for license renewal of nuclear plants NUREG-1437. Washington: U.S. Nuclear Regulatory Commission.

Parks B. 1997. Mathematical models in CAP88-PC. Germantown, Maryland: US Department of Energy.

Pierce DA, Shimizu Y, Preston DL, Vaeth M, Mabuchi K. 1996. Studies of the mortality of atomic bomb survivors. Report 12, Part I. Cancer: 1950-1990 [see comments]. Radiat Res 146(1):1-27.

Prohl G, Muller H, Hoffman FO. 1995. Interception and postdeposition retention of radionuclides by vegetation and their importance for dose assessment. In: Environmental impact of radioactive releases Proceedings of an International Symposium IAEA-SM-339/1421995, Vienna:International Atomic Energy Agency, 269-274.

Ritchie LT, Alpert DJ, Burke RP, Johnson JD, Ostmeyer RM, Aldrich DC, et al. 1984. CRAC2 model

description NUREG/CR-2552;SAND-82-0342. Albuquerque: Sandia National Laboratories.

Schershakov V. 1997. Development of a Computer Model for Calculation of Resuspension of Radioactive Materials into the Atmosphere After an Accident UCRL-CR-129075; S/C # 1B336474. Livermore: Lawrence Livermore National Laboratory.

Scire JS, Strimaitis DG, Yarmatino RJ. 2000. A User's Guide for the CALPUFF Dispersion Model (Version 5). Concord, MA: Earth Tech, Inc.

Smallwood KS, Morrison ML, Beyea J. 1998. Animal Burrowing Attributes Affecting Hazardous Waste Management. Environ Manage 22(6):831-847.

Stewart AM, Kneale GW. 1993. A-bomb survivors: further evidence of late effects of early deaths. Health Phys 64(5):467-472.

---. 1999. A-bomb survivors: reassessment of the radiation hazard. Med Confl Surviv 15(1):47-56.

Thomas D, Stram D, Dwyer J. 1993. Exposure Measurement Error: Influence on Exposure-Disease Relationships and Methods of Correction. Annu Rev Publ Health 14:69-93.

USNRC. 1995. Probabilistic Accident Consequence Uncertainty Analysis: Dispersion & Deposition Uncertainty Assessment, Vols. 1-3 NUREG/CR-6244, EUR 15855EN. Washington, Brussels: Nuclear Regulatory Commission & Commission of European Communities.

Vyner HM. 1983. The psychological effects of ionizing radiation. Cult Med Psychiatry 7(3):241-261.

Weinberg CR, Brown KG, Hoel DG. 1987. Altitude, radiation, and mortality from cancer and heart disease. Radiat Res 112(2):381-390.

WHO. 2005. Health Effects of the Chernobyl Accident and Special Health Care Programmes Report of the UN Chernobyl Forum Expert Group "Health" (EGH). Geneva: World Health Organization.

Young M, Chanin D. 1996. Overview of MACCS and MACCS2 developmental efforts.

---. 1997. MACCS2 development and verification efforts SAND097-0561C. Albuquerque: Sandia National Laboratories.

Zagar M, Tjernström M, Angevine W. 2004. New England coastal boundary layer modeling. In: AMS 16th Symposium on Boundary Layers and Turbulence, August 2004, Portland, Maine.

Figure 1.

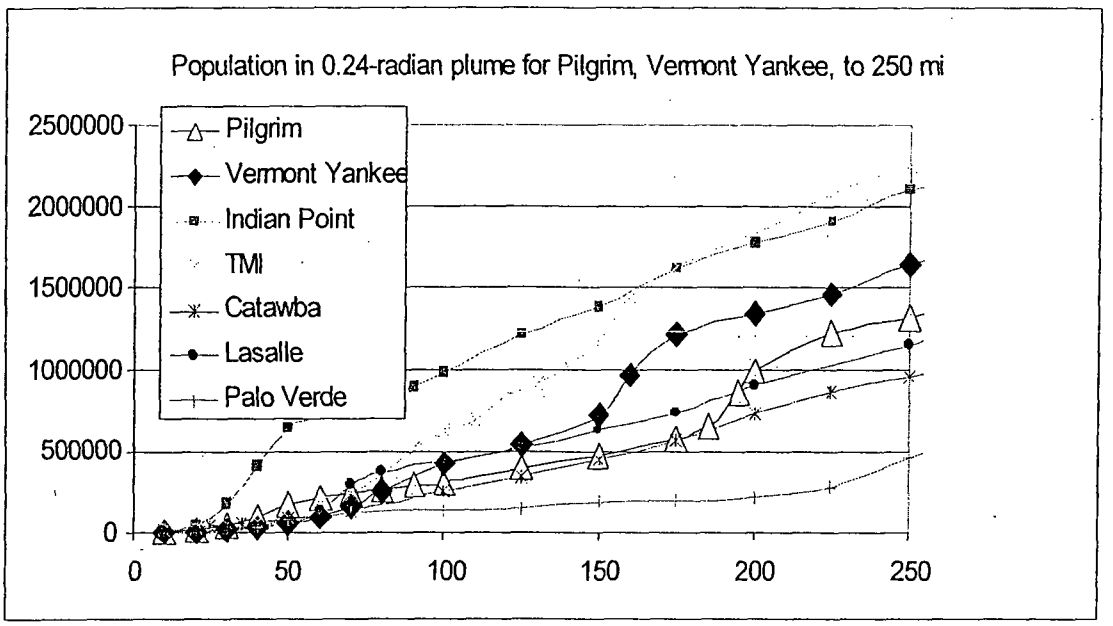

Population in 0.24-radian plume for Pilgrim, Vermont Yankee, to 250 mi
2500000
2000000
1500000
1000000
500000
0
0
50
100
150
200
250
Pilgrim
Vermont Yankee
Indian Point
TMI
Catawba
Lasalle
Palo Verde

Figure 2.

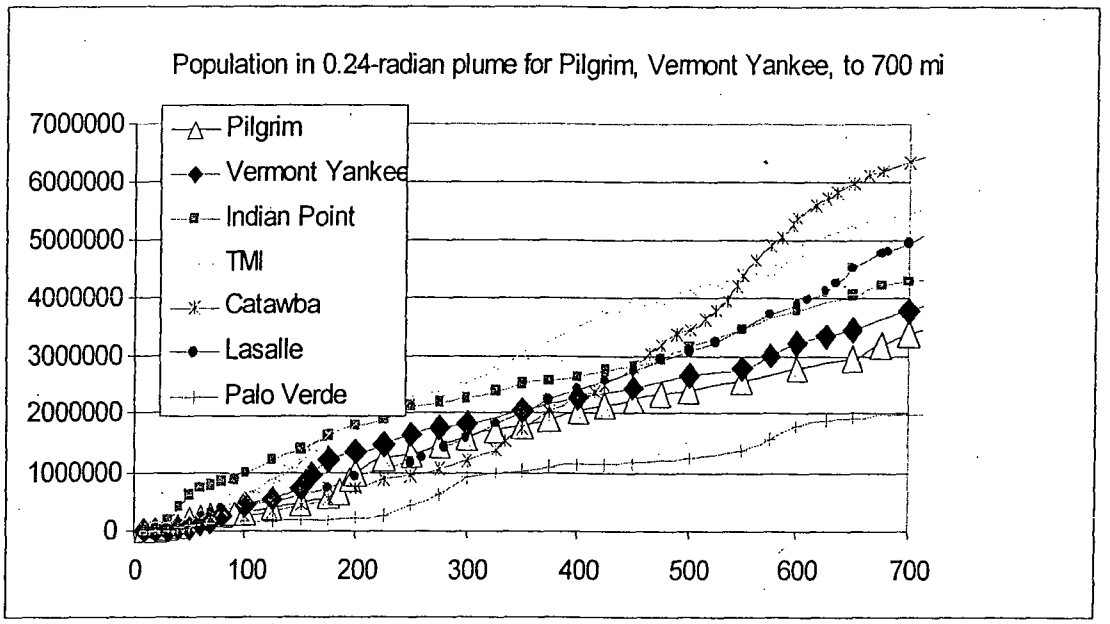

Population in 0.24-radian plume for Pilgrim, Vermont Yankee, to 700 mi
7000000
6000000
5000000
4000000
3000000
2000000
1000000
0
0
100
200
300
400
500
600
700
Pilgrim
Vermont Yankee
Indian Point
TMI
Catawba
Lasalle
Palo Verde

Figure 3. Calculated with the SECPOP 2000 computer code (Bixler et al. 2003).

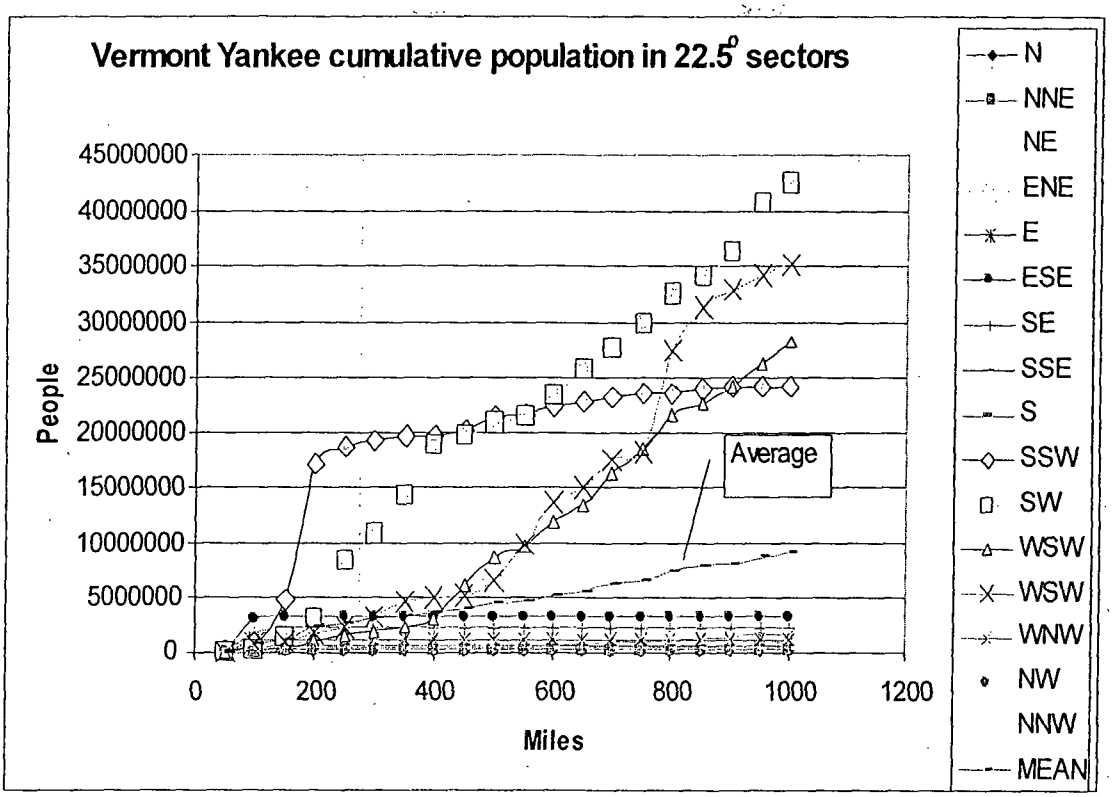


Figure 4. Calculated with the SECPOP 2000 computer code (Bixler et al. 2003).

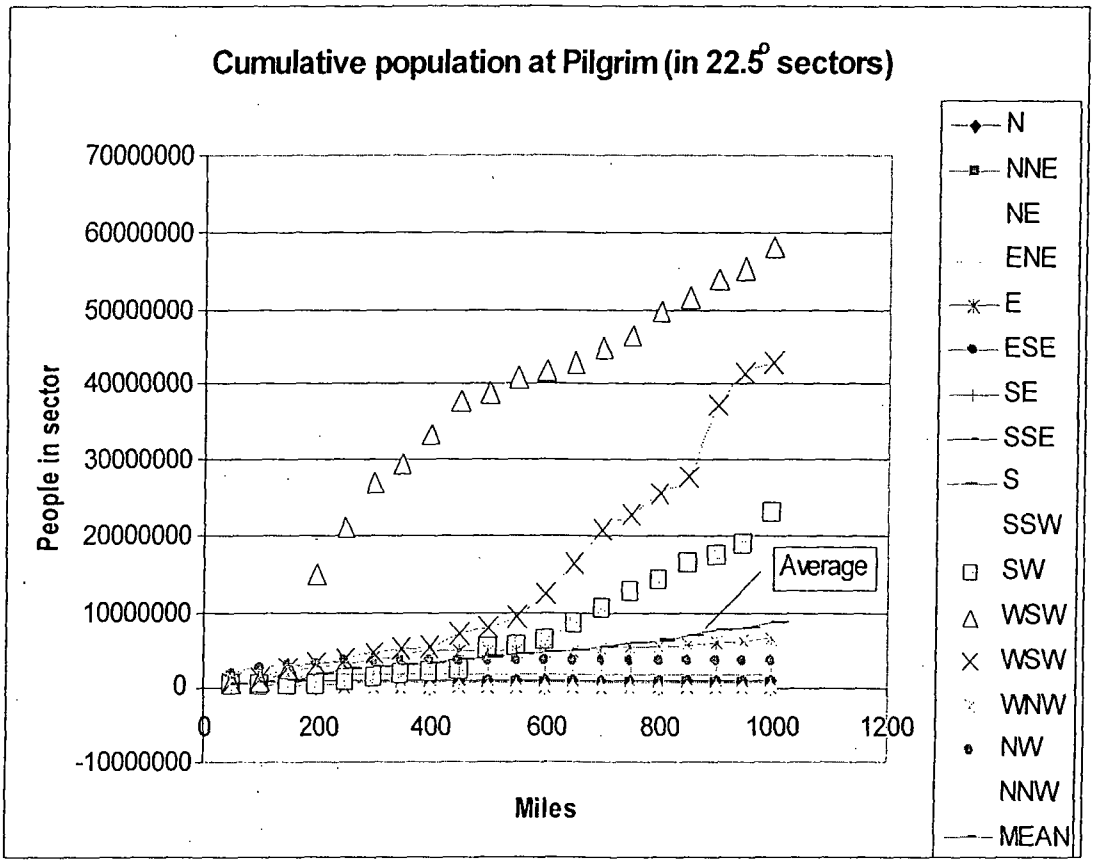


Figure 5: In the wind rose below for Pilgrim, an excess frequency beyond the 4% circle is shown for winds coming from the Southwest, which would blow out over the ocean. Ignoring return flows, such excess flows would not contribute to damage. The excess beyond the 4% circles is about 33% of the total year. Removing this excess leaves a roughly axially-symmetric flow, which matches the assumptions used in the paper by Beyea, Lyman, and von Hippel.

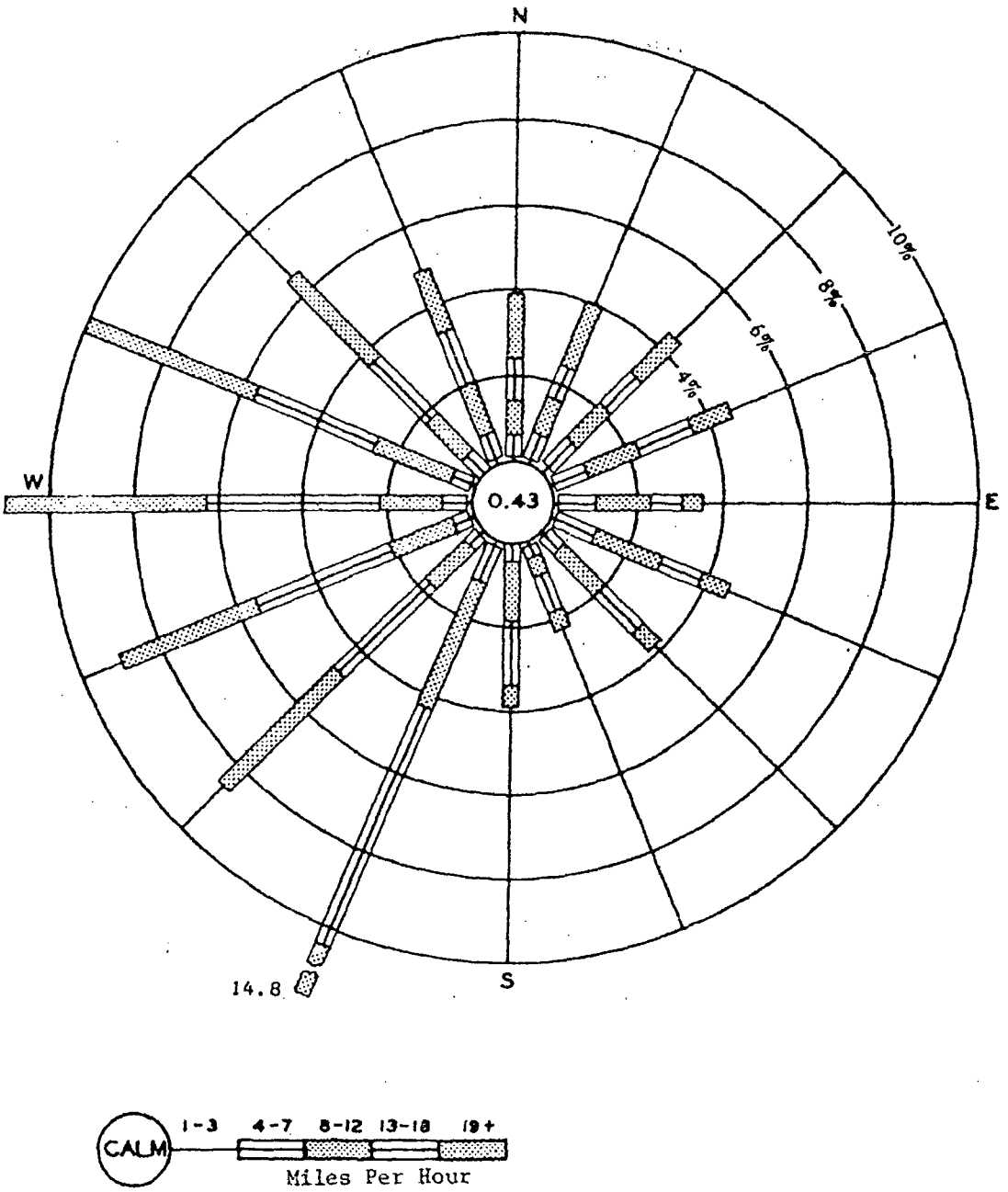


FIGURE 2.3-6
ELEVATION 300 FT. MSL
WIND ROSE ANNUAL
PILGRIM SITE
PILGRIM NUCLEAR POWER STATION
FINAL SAFETY ANALYSIS REPORT

EXHIBIT
3

Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants

October 2000

Technical Contributors

Group Leaders:	Timothy E. Collins, DSSA George Hubbard, DSSA/SPLB
Risk Assessment:	Glenn Kelly, DSSA/SPSB Michael Cheok, DSSA/SPSB Gareth Parry, DSSA Mark Rubin, DSSA/SPSB Robert Palla, DSSA/SPSB
Primary Technical Support:	
Seismic	Goutam Bagchi, DE Robert Rothman, DE/EMEB
Criticality	Larry Kopp, DSSA/SRXB Anthony Ulses, DSSA/SRXB
Thermal-hydraulics	Joseph Staudenmeier, DSSA/SRXB Walt Jenson, DSSA/SRXB Christopher Boyd, RES/DSARE/SMSAB
Consequences	Jason Schaperow, RES/DSARE/SMSAB Charles Tinkler, RES/DSARE
Heavy Loads	Edward Throm, DSSA/SPSB
Secondary Technical Support:	
Additional Support:	Tanya Eaton, DSSA/SPLB David Diec, DSSA/SPLB Diane Jackson, DSSA/SPLB John Lehning, DSSA/SPLB
Study Preparation:	Paula Magnanelli, DSSA

Technical Study of Spent Fuel Pool Accidents at Decommissioning Plants

Table of Contents

List of Figures

List of Tables

Appendices

EXECUTIVE SUMMARY

This report documents a study of spent fuel pool (SFP) accident risk at decommissioning nuclear power plants. The study was undertaken to support development of a risk-informed technical basis for reviewing exemption requests and a regulatory framework for integrated rulemaking.

The staff published a draft study in February 2000 for public comment and significant comments were received from the public and the Advisory Committee on Reactor Safeguards (ACRS). To address these comments the staff did further analyses and also added sensitivity studies on evacuation timing to assess the risk significance of relaxed offsite emergency preparedness requirements during decommissioning. The staff based its sensitivity assessment on the guidance in Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment In Risk-Informed Decisions On Plant-Specific Changes to the Licensing Basis." The staff's analyses and conclusions apply to decommissioning facilities with SFPs that meet the design and operational characteristics assumed in the risk analysis. These characteristics are identified in the study as industry decommissioning commitments (IDCs) and staff decommissioning assumptions (SDAs). Provisions for confirmation of these characteristics would need to be an integral part of rulemaking.

The results of the study indicate that the risk at SFPs is low and well within the Commission's Quantitative Health Objectives (QHOs). The risk is low because of the very low likelihood of a zirconium fire even though the consequences from a zirconium fire could be serious. The results are shown in Figures ES-1 and ES-2. Because of the importance of seismic events in the analysis, and the considerable uncertainty in seismic hazard estimates, the results are presented for both the Lawrence Livermore National Laboratory (LLNL) and the Electric Power Research Institute (EPRI) seismic hazard estimates. In addition, to address a concern raised by the ACRS, the results also include a sensitivity to a large ruthenium and fuel fines release fraction. As illustrated in the figures, the risk is well below the QHOs for both the individual risk of early fatality and the individual risk of latent cancer fatality.

The study includes use of a pool performance guideline (PPG) as an indicator of low risk at decommissioning facilities. The recommended PPG value for events leading to uncovery of the spent fuel was based on similarities in the consequences from a SFP zirconium fire to the consequences from a large early release event at an operating reactor. A value equal to the large early release frequency (LERF) criterion (1×10^{-5} per year) was recommended for the PPG. By maintaining the frequency of events leading to uncovery of the spent fuel at decommissioning facilities below the PPG, the risk from zirconium fires will be low and consistent with the guidance in RG 1.174 for allowing changes to the plant licensing basis that slightly increase risk. With one exception (the H.B. Robinson site) all Central and Eastern sites which implement the IDCs and SDAs would be expected to meet the PPG regardless of whether LLNL or EPRI seismic hazard estimates are assumed. The Robinson site would satisfy the PPG if the EPRI hazard estimate is applied but not if the LLNL hazard is used. Therefore, Western sites and Robinson would need to be considered on a site-specific basis because of important differences in seismically induced failure potential of the SFPs.

The appropriateness of the PPG was questioned by the ACRS in view of potential effects of the fission product ruthenium, the release of fuel fines, and the effects of revised plume parameters. The staff added sensitivity studies to its analyses to examine these issues. The consequences of a significant release of ruthenium and fuel fines were found to be notable, but not so important as to render inappropriate the staff's proposed PPG of $1x10^{-5}$ per year. The plume parameter sensitivities were found to be of lesser significance.

In its thermal-hydraulic analysis, documented in Appendix 1A, the staff concluded that it was not feasible, without numerous constraints, to establish a generic decay heat level (and therefore a decay time) beyond which a zirconium fire is physically impossible. Heat removal is very sensitive to these additional constraints, which involve factors such as fuel assembly geometry and SFP rack configuration. However, fuel assembly geometry and rack configuration are plant specific, and both are subject to unpredictable changes after an earthquake or cask drop that drains the pool. Therefore, since a non-negligible decay heat source lasts many years and since configurations ensuring sufficient air flow for cooling cannot be assured, the possibility of reaching the zirconium ignition temperature cannot be precluded on a generic basis.

The staff found that the event sequences important to risk at decommissioning plants are limited to large earthquakes and cask drop events. For emergency planning (EP) assessments this is an important difference relative to operating plants where typically a large number of different sequences make significant contributions to risk. Relaxation of offsite EP a few months after shutdown resulted in only a "small change" in risk, consistent with the guidance of RG 1.174. Figures ES-1 and ES-2 illustrate this finding. The change in risk due to relaxation of offsite EP is small because the overall risk is low, and because even under current EP requirements, EP was judged to have marginal impact on evacuation effectiveness in the severe earthquakes that dominate SFP risk. All other sequences including cask drops (for which emergency planning is expected to be more effective) are too low in likelihood to have a significant impact on risk. For comparison, at operating reactors additional risk-significant accidents for which EP is expected to provide dose savings are on the order of $1x10^{-5}$ per year, while for decommissioning facilities, the largest contributor for which EP would provide dose savings is about two orders of magnitude lower (cask drop sequence at $2x10^{-7}$ per year).[1] Other policy considerations beyond the scope of this technical study will need to be considered for EP requirement revisions and previous exemptions because a criteria of sufficient cooling to preclude a fire cannot be satisfied on a generic basis.

Insurance does not lend itself to a "small change in risk" analysis because insurance affects neither the probability nor the consequences of an event. As seen in figure ES-2, as long as a zirconium fire is possible, the long-term consequences of an SFP fire may be significant. These long-term consequences (and risk) decrease very slowly because cesium-137 has a half life of approximately 30 years. The thermal-hydraulic analysis indicates that when air flow has been restricted, such as might occur after a cask drop or major earthquake, the possibility of a fire lasts many years and a criterion of "sufficient cooling to preclude a fire" can not be defined on a

---

[1]Consistent with PRA limitations and practice, contributions to risk from safeguards events are not included in these frequency estimates. EP might also provide dose savings in such events.

generic basis. Other policy considerations beyond the scope of this technical study will therefore need to be considered for insurance requirements.

The study also discusses implications for security provisions at decommissioning plants. For security, risk insights can be used to determine what targets are important to protect against sabotage. However, any revisions in security provisions should be constrained by an effectiveness assessment of the safeguards provisions against a design-basis threat. Because the possibility of a zirconium fire leading to a large fission product release cannot be ruled out even many years after final shutdown, the safeguards provisions at decommissioning plants should undergo further review. The results of this study may have implications on previous exemptions at decommissioning sites, devitalization of spent fuel pools at operating reactors and related regulatory activities.

The staff's risk analyses were complicated by a lack of data on severe-earthquake return frequencies, source term generation in an air environment, and SFP design variability. Although the staff believes that decommissioning rulemaking can proceed on the basis of the current assessment, more research may be useful to reduce uncertainties and to provide insights on operating reactor safety. In particular, the staff believes that research may be useful on source term generation in air, which could also be important to the risk of accidents at operating reactors during shutdowns, when the reactor coolant system and the primary containment may both be open.

In summary, the study finds that:

1. The risk at decommissioning plants is low and well within the Commission's safety goals. The risk is low because of the very low likelihood of a zirconium fire even though the consequences from a zirconium fire could be serious.

2. The overall low risk in conjunction with important differences in dominant sequences relative to operating reactors, results in a small change in risk at decommissioning plants if offsite emergency planning is relaxed. The change is consistent with staff guidelines for small increases in risk.

3. Insurance, security, and emergency planning requirement revisions need to be considered in light of other policy considerations, because a criterion of "sufficient cooling to preclude a fire" cannot be satisfied on a generic basis.

4. Research on source term generation in an air environment would be useful for reducing uncertainties.

2.0 THERMAL-HYDRAULIC ANALYSES

Analyses were performed to evaluate the thermal-hydraulic characteristics of spent fuel stored in the spent fuel pools (SFPs) of decommissioning plants and determine the time available for plant operators to take actions to prevent a zirconium fire. These are discussed in Appendix 1A. The focus was the time available before fuel uncovery and the time available before the zirconium ignites after fuel uncovery. These times were utilized in performing the risk assessment discussed in Section 3.

To establish the times available before fuel uncovery, calculations were performed to determine the time to heat the SFP coolant to a point of boiling and then boil the coolant down to 3 feet above the top of the fuel. As can be seen in Table 2.1 below, the time available to take actions before any fuel uncovery is 100 hours or more for an SFP in which pressurized-water reactor (PWR) fuel has decayed at least 60 days.

Table 2.1 Time to Heatup and Boiloff SFP Inventory Down to 3 Feet Above Top of Fuel (60 GWD/MTU)

DECAY TIME	PWR	BWR
60 days	100 hours (>4 days)	145 hours (>6 days)
1 year	195 hours (>8 days)	253 hours (>10 days)
2 years	272 hours (>11 days)	337 hours (>14 days)
5 years	400 hours (>16 days)	459 hours (>19 days)
10 years	476 hours (>19 days)	532 hours (>22 days)

The analyses in Appendix 1A determined that the amount of time available (after complete fuel uncovery) before a zirconium fire depends on various factors, including decay heat rate, fuel burnup, fuel storage configuration, building ventilation rates and air flow paths, and fuel cladding oxidation rates. While the February 2000 study indicated that for the cases analyzed a required decay time of 5 years would preclude a zirconium fire, the revised analyses show that it is not feasible, without numerous constraints, to define a generic decay heat level (and therefore decay time) beyond which a zirconium fire is not physically possible. Heat removal is very sensitive to these constraints, and two of these constraints, fuel assembly geometry and spent fuel pool rack configuration, are plant specific. Both are also subject to unpredictable changes as a result of the severe seismic, cask drop, and possibly other dynamic events which could rapidly drain the pool. Therefore, since the decay heat source remains nonnegligible for many years and since configurations that ensure sufficient air flow[2] for cooling cannot be assured, a zirconium

---

[2]Although a reduced air flow condition could reduce the oxygen levels to a point where a fire would not be possible, there is sufficient uncertainty in the available data as to when this level would be reached and if it could be maintained. It is not possible to predict when a zirconium fire would not occur because of a lack of oxygen. Blockage of the air flow around the fuel could be

fire cannot be precluded, although the likelihood may be reduced by accident management measures.

Figure 2.1 plots the heatup time air-cooled PWR and BWR fuel take to heat up from 30 °C to 900 °C versus time since reactor shutdown. The figure shows that after 4 years, PWR fuel could reach the point of fission product release in about 24 hours. Figure 2.2 shows the timing of the event by comparing the air-cooled calculations to an adiabatic heatup calculation for PWR fuel with a burnup of 60 GWD/MTU. The figure indicates an unrealistic result that until 2 years have passed the air-cooled heatup rates are faster than the adiabatic heatup rates. This is because the air-cooled case includes heat addition from oxidation while the adiabatic case does not. In the early years after shutdown, the additional heat source from oxidation at higher temperatures is high enough to offset any benefit from air cooling. This result is discussed further in Appendix 1A. The results using obstructed airflow (adiabatic heatup) show that at 5 years after shutdown, the release of fission products may occur approximately 24 hours after the accident.

In summary, 60 days after reactor shutdown for boildown type events, there is considerable time (>100 hours) to take action to preclude a fission product release or zirconium fire before uncovering the top of the fuel. However, if the fuel is uncovered, heatup to the zirconium ignition temperature during the first years after shutdown would take less than 10 hours even with unobstructed air flow. After 5 years, the heatup would take at least 24 hours even with obstructed air flow cases. Therefore, a zirconium fire would still be possible after 5 years for cases involving obstructed air flow and unsuccessful accident management measures. These results and how they affect SFP risk and decommissioning regulations are discussed in Sections 3 and 4 of this study.

---

caused by collapsed structures and/or a partial draindown of the SFP coolant or by reconfiguration of the fuel assemblies during a seismic event or heavy load drop. A loss of SFP building ventilation could also preclude or inhibit effective cooling. As discussed in Appendix 1A, air flow blockage without any recovery actions could result in a near-adiabatic fuel heatup and a zirconium fire even after 5 years.

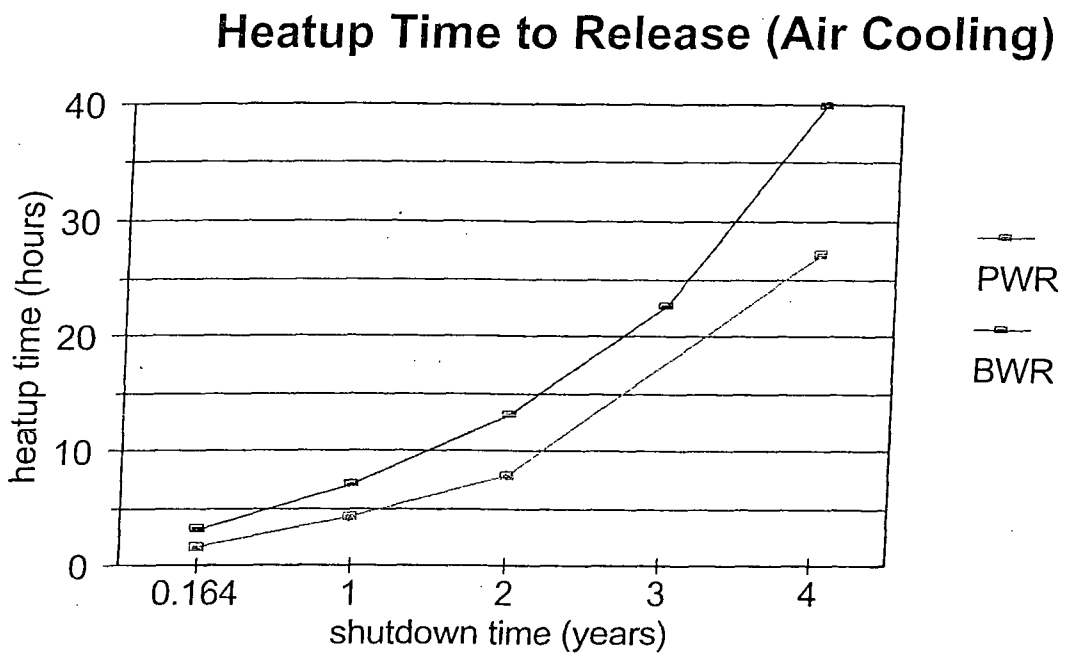


Figure 2.1 Heatup Time From 30 °C to 900 °C

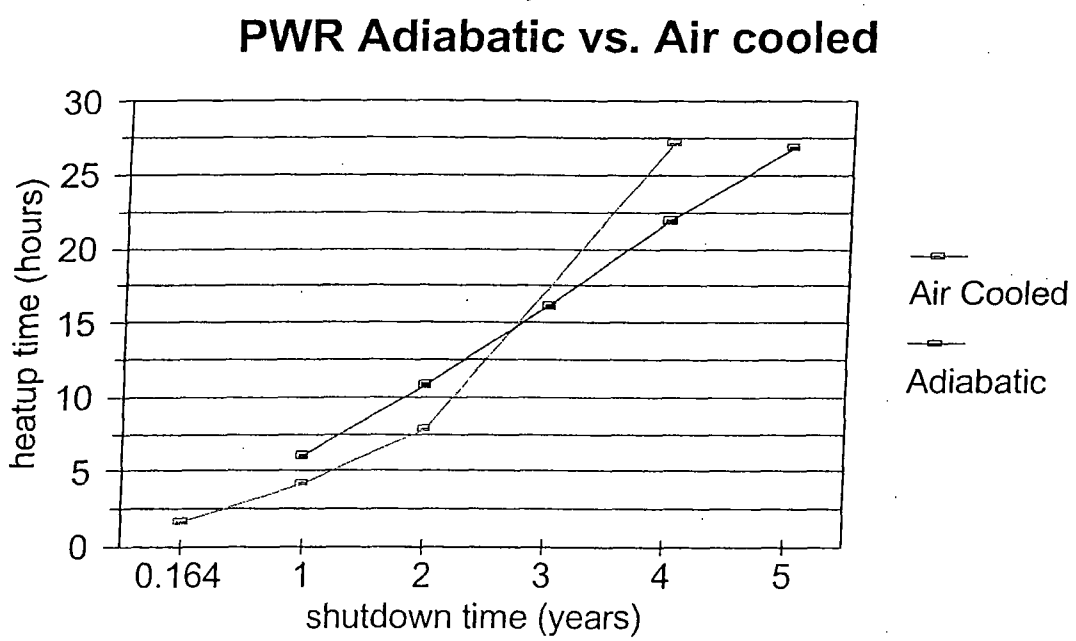
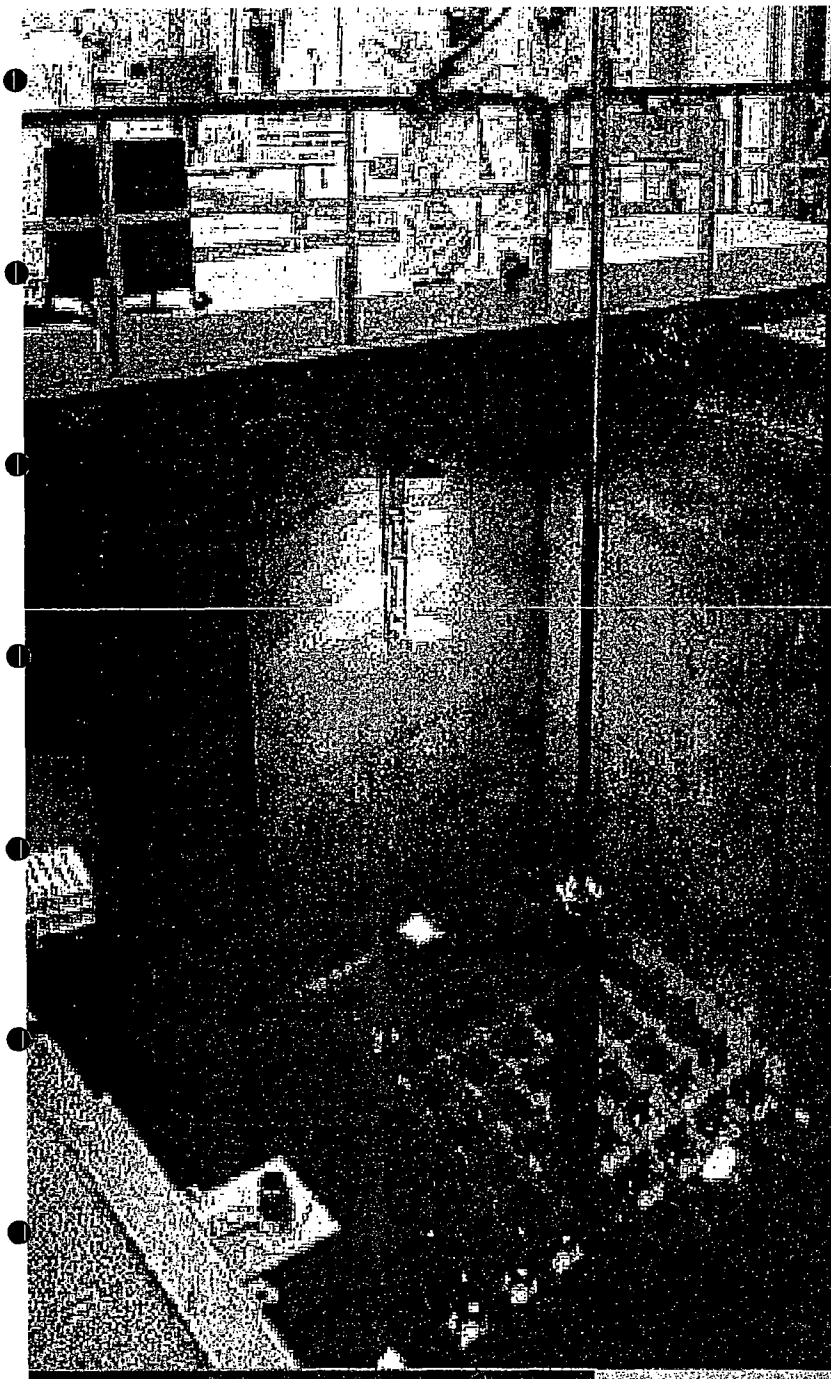


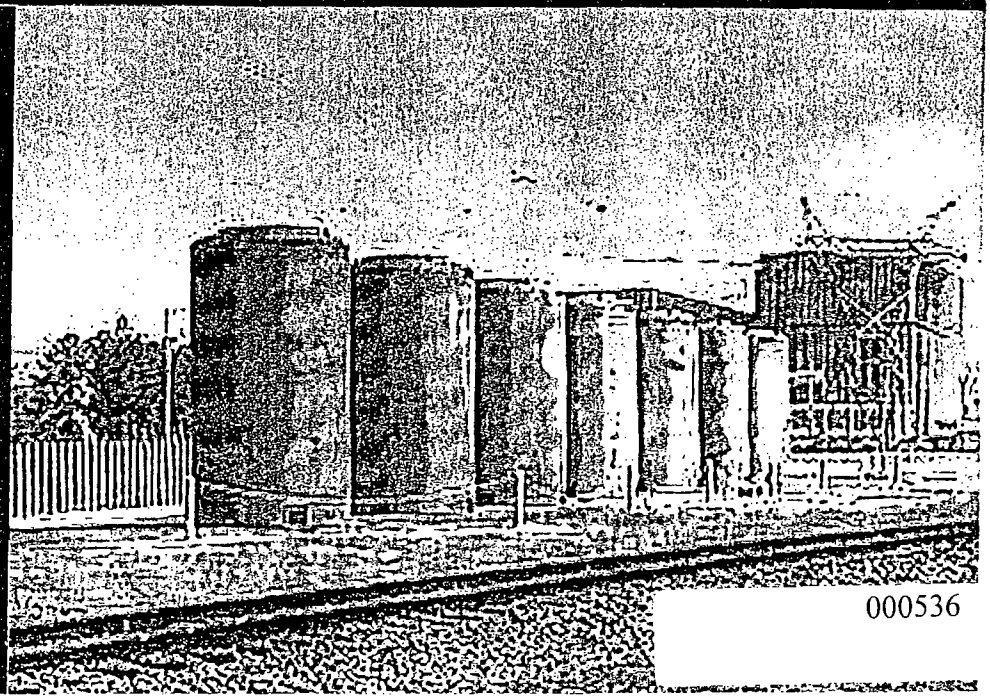
Figure 2.2 PWR Heatup Times for Air Cooling and Adiabatic Heatup

EXHIBIT
4



SAFETY AND SECURITY OF COMMERCIAL SPENT NUCLEAR FUEL STORAGE

PUBLIC REPORT



NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

SAFETY AND SECURITY
OF
COMMERCIAL
SPENT NUCLEAR FUEL STORAGE

Public Report

Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage

Board on Radioactive Waste Management

Division on Earth and Life Studies

NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

THE NATIONAL ACADEMIES PRESS
Washington, D.C.
www.nap.edu

THE NATIONAL ACADEMIES PRESS 500 Fifth Street, N.W. Washington, DC 20001

NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This study was supported by grant number NRC-04-04-067 between the National Academy of Sciences and the U.S. Nuclear Regulatory Commission. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the organizations or agencies that provided support for the project.

International Standard Book Number 0-309-09647-2
Library of Congress Control Number 2005926244

Additional copies of this report are available from the National Academies Press, 500 Fifth Street, N.W., Lockbox 285, Washington, DC 20055; (800) 624-6242 or (202) 334-3313 (in the Washington metropolitan area); Internet, http://www.nap.edu

Printed in the United States of America.

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

The **National Academy of Sciences** is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Ralph J. Cicerone is president of the National Academy of Sciences.

The **National Academy of Engineering** was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. Wm. A. Wulf is president of the National Academy of Engineering.

The **Institute of Medicine** was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, upon its own initiative, to identify issues of medical care, research, and education. Dr. Harvey V. Fineberg is president of the Institute of Medicine.

The **National Research Council** was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Ralph J. Cicerone and Dr. Wm. A. Wulf are chair and vice chair, respectively, of the National Research Council

www.national-academies.org

COMMITTEE ON THE SAFETY AND SECURITY OF COMMERCIAL SPENT NUCLEAR FUEL STORAGE

LOUIS J. LANZEROTTI, *Chair*, New Jersey Institute of Technology, Newark, and Lucent Technologies, Murray Hill
CARL A. ALEXANDER, Battelle Memorial Institute, Columbus, Ohio
ROBERT M. BERNERO, U.S. Nuclear Regulatory Commission (retired), Gaithersburg, Maryland
M. QUINN BREWSTER, University of Illinois, Urbana-Champaign
GREGORY R. CHOPPIN, Florida State University, Tallahassee
NANCY J. COOKE, Arizona State University, Mesa
LOUIS ANTHONY COX, Jr.,[1] Cox Associates, Inc., Denver, Colorado
GORDON R. JOHNSON, Network Computing Services, Minneapolis, Minnesota
ROBERT P. KENNEDY, RPK Structural Mechanics Consulting, Escondido, California
KENNETH K. KUO, Pennsylvania State University, University Park
RICHARD T. LAHEY, Jr., Rensselaer Polytechnic Institute, Troy, New York
KATHLEEN R. MEYER, Keystone Scientific, Inc., Fort Collins, Colorado
FREDERICK J. MOODY, GE Nuclear Energy (retired), Murphys, California
TIMOTHY R. NEAL, Los Alamos National Laboratory, Los Alamos, New Mexico
JOHN WREATHALL,[1] John Wreathall & Company, Inc., Dublin, Ohio
LORING A. WYLLIE, Jr., Degenkolb Engineers, San Francisco, California
PETER D. ZIMMERMAN, King's College London, United Kingdom

Staff

KEVIN D. CROWLEY, Study Director
BARBARA PASTINA, Senior Program Officer
MICAH D. LOWENTHAL, Senior Program Officer
ELISABETH A. REESE, Program Officer
DARLA THOMPSON, Research Associate
TONI G. GREENLEAF, Administrative Associate

[1] Drs. Cox and Wreathall resigned from the committee on February 26 and March 17, 2004, respectively.

BOARD ON RADIOACTIVE WASTE MANAGEMENT

Staff

[1] Dr. Meserve did not participate in the oversight of this study.

ACKNOWLEDGMENTS

This study would not have been possible without the help of several organizations and individuals who were called upon for information and advice. The committee would like to acknowledge especially the following organizations and individuals for their help:

- Congressional staff members Kevin Cook, Terry Tyborowski, and Jeanne Wilson (retired) for their guidance on the study task.
- Nuclear Regulatory Commission staff Farouk Eltawila, who served as the primary liaison for this study, and Charles Tinkler and Francis (Skip) Young for their support of the committee's information-gathering activities.
- Department of Homeland Security staff member Jon MacLaren, who also served as a liaison to the committee.
- Steve Kraft and John Vincent (deceased) of the Nuclear Energy Institute and staff of Energy Resources International for providing information about spent fuel storage practices in industry.
- ENTERGY Corp., Exelon Corp, and Arizona Public Service Corp. staff for organizing tours of the Braidwood, Dresden, Indian Point, and Palo Verde nuclear generating stations.
- German organizations and individuals who helped organize a tour of spent fuel storage facilities in Germany. These organizations and individuals are explicitly acknowledged in Appendix C.
- Speakers (see Appendix A) and participants at committee meetings as well as those who sent written comments for providing their knowledge and perspectives on this important matter.

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Research Council's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The content of the review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their review of this report:

John F. Ahearne, Sigma Xi and Duke University
Romesh C. Batra, Virginia Polytechnic Institute and State University
Robert J. Budnitz, Lawrence Livermore National Laboratory
Philip R. Clark, GPU Nuclear Corporation (retired)
Richard L. Garwin, IBM Thomas J. Watson Research Center
Roger L. Hagengruber, The University of New Mexico
Darleane C. Hoffman, E.O. Lawrence Berkeley National Laboratory
Melvin F. Kanninen, MFK Consulting Services
Milton Levenson, Bechtel International (retired)
Allison Macfarlane, Massachusetts Institute of Technology
Richard A. Meserve, Carnegie Institution of Washington

Donald R. Olander, University of California, Berkeley
Theofanis G. Theofanous, University of California, Santa Barbara
George W. Ullrich, SAIC
Frank N. von Hippel, Princeton University

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the report's conclusions or recommendations, nor did they see the final draft of the report before its release. The review of this report was overseen by Chris G. Whipple, ENVIRON International Corporation, and R. Stephen Berry, University of Chicago. Appointed by the National Research Council, they were responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

CONTENTS

NOTE TO READERS

This report is based on a classified report that was developed at the request of the U.S. Congress with sponsorship from the Nuclear Regulatory Commission and the Department of Homeland Security. This report contains all of the findings and recommendations that appear in the classified report. Some have been slightly reworded and other sensitive information that might allow terrorists to exploit potential vulnerabilities has been redacted to protect national security. Nevertheless, the National Research Council and the authoring committee believe that this report provides an accurate summary of the classified report, including its findings and recommendations.

The authoring committee for this report examined the potential consequences of a large number of scenarios for attacking spent fuel storage facilities at commercial nuclear power plants. Some of these scenarios were developed by the Nuclear Regulatory Commission as part of its ongoing vulnerability analyses, whereas others were developed by the committee based upon the expertise of its members or suggestions from participants at the committee's open meetings. The committee focused its discussions about terrorist attacks on the concept of *maximum credible scenarios.* These are defined by the committee to be physically realistic classes of attacks that, if carried out successfully, would produce the most serious potential consequences within that class. In a practical sense they can be said to *bound* the consequences for a given type of attack. Such scenarios could in some cases be very difficult to carry out because they require a high level of skill and knowledge or luck on the part of the attackers. It was nevertheless useful to analyze these scenarios because they provide decision makers with a better understanding of the full range of potential consequences from terrorist attacks.

The committee uses the term *potential consequences* advisedly. It is important to recognize that a terrorist attack on a spent fuel storage facility would not necessarily result in the release of any radioactivity to the environment. The consequences of such an attack would depend not only on the nature of the attack itself, but also on the construction of the spent fuel storage facility; its location relative to surrounding features that might shield it from the attack; and the ability of the guards and operators at the facility to respond to the attack and/or mitigate its consequences. Facility-specific analyses are required to determine the potential vulnerability of a given facility to a given type of terrorist attack.

Congress asked the National Research Council for technical advice related to the vulnerability of spent fuel storage facilities to terrorist attacks. Congress, the Nuclear Regulatory Commission, and the Department of Homeland Security are responsible for translating this advice into policy actions. This will require the balancing of costs, risks, and benefits across the nation's industrial infrastructure. The committee was not asked to examine the potential vulnerabilities of other types of infrastructure to terrorist attacks or the consequences of such attacks. While such comparisons will likely be difficult, they will be essential for ensuring that the nation's limited resources are used judiciously in protecting its citizens from terrorist attacks.

SUMMARY FOR CONGRESS

The U.S. Congress asked the National Academies to provide independent scientific and technical advice on the safety and security of commercial spent nuclear fuel storage in the United States, specifically with respect to the following charges:

- Potential safety and security risks of spent nuclear fuel presently stored in cooling pools at commercial nuclear reactor sites.
- Safety and security advantages, if any, of dry cask storage versus wet pool storage at these reactor sites.
- Potential safety and security advantages, if any, of dry cask storage using various single-, dual-, and multi-purpose cask designs.
- The risks of terrorist attacks on these materials and the risk these materials might be used to construct a radiological dispersal device.

Congress requested that the National Academies produce a classified report that addresses these charges within 6 months and also provide an unclassified summary for unlimited public distribution. The first request was fulfilled in July 2004. This report fulfills the second request.

The highlights of the report are as follows:

(1) Spent fuel pools are necessary at all operating nuclear power plants to store recently discharged fuel.

(2) The committee judges that successful terrorist attacks on spent fuel pools, though difficult, are possible.

(3) If an attack leads to a propagating zirconium cladding fire, it could result in the release of large amounts of radioactive material.

(4) Additional analyses are needed to understand more fully the vulnerabilities and consequences of events that could lead to propagating zirconium cladding fires.

(5) It appears to be feasible to reduce the likelihood of a zirconium cladding fire by rearranging spent fuel assemblies in the pool and making provision for water-spray systems that would be able to cool the fuel, even if the pool or overlying building were severely damaged.

(6) Dry cask storage has inherent security advantages over spent fuel pool storage, but it can only be used to store older spent fuel.

(7) There are no large security differences among different storage-cask designs.

(8) It would be difficult for terrorists to steal enough spent fuel from storage facilities for use in significant radiological dispersal devices (dirty bombs).

The statement of task does not direct the committee to recommend whether the transfer of spent fuel from pool to dry cask storage should be accelerated. The committee judges, however, that further engineering analyses and cost-benefit studies would be needed before decisions on this and other mitigative measures are taken. The report contains detailed recommendations for improving the security of spent fuel storage regardless of how it is stored.

EXECUTIVE SUMMARY

In the Fiscal Year 2004 Energy and Water Development Conference Report, the U.S. Congress asked the National Academies to provide independent scientific and technical advice on the safety and security[1] of commercial spent nuclear fuel storage in the United States, specifically with respect to the following four charges:

(1) Potential safety and security risks of spent nuclear fuel presently stored in cooling pools at commercial reactor sites.
(2) Safety and security advantages, if any, of dry cask storage versus wet pool storage at these reactor sites.
(3) Potential safety and security advantages, if any, of dry cask storage using various single-, dual-, and multi-purpose cask designs.
(4) The risks of terrorist attacks on these materials and the risk these materials might be used to construct a radiological dispersal device.

Congress requested that the National Academies produce a classified report that addresses these charges within 6 months and also provide an unclassified summary for unlimited public distribution. The first request was fulfilled in July 2004. This report fulfills the second request.

Spent nuclear fuel is stored at commercial nuclear power plant sites in two configurations:

- In water-filled pools, referred to as *spent fuel pools*.
- In *dry casks* that are designed either for storage (single-purpose casks) or both storage and transportation (dual-purpose casks). There are two basic cask designs: bare-fuel casks and canister-based casks, which can be licensed for either single- or dual-purpose use, depending on their design.

Spent fuel pools are currently in use at all 65 sites with operating commercial nuclear power reactors, at 8 sites where commercial power reactors have been shut down, and at one site not associated with an operating or shutdown power reactor. Dry-cask storage facilities have been established at 28 operating, shutdown, or decommissioned power plants. The nuclear industry projects that up to three or four nuclear power plants will reach full capacity in their spent fuel pools each year for at least the next 17 years.

The congressional request for this study was prompted by conflicting public claims about the safety and security of commercial spent nuclear fuel storage at nuclear power plants. Some analysts have argued that the dense packing of spent fuel in cooling pools at nuclear power plants does not allow a sufficient safety margin in the event of a loss-of-pool-coolant event from an accident or terrorist attack. They assert that such events could result in the release of large quantities of radioactive material to the environment if the zirconium cladding of the spent fuel overheats and ignites. To reduce the potential for such fires, these

[1] In the context of this study, *safety* refers to measures that protect spent nuclear fuel storage facilities against failure, damage, human error, or other accidents that would disperse radioactivity in the environment. *Security* refers to measures to protect spent fuel storage facilities against sabotage, attacks, or theft.

analysts have suggested that spent fuel more than five years old be removed from the pool and stored in dry casks, and that the remaining younger fuel be reconfigured in the pool to allow more space for air cooling in the event of a loss-of-pool-coolant event.

The committee that was appointed to perform the present study examined the vulnerability of spent fuel stored in pools and dry casks to accidents and terrorist attacks. Any event that results in the breach of a spent fuel pool or a dry cask, whether accidental or intentional, has the potential to release radioactive material to the environment. The committee therefore focused its limited time on understanding two issues: (1) Under what circumstances could pools or casks be breached? And (2) what would be the radioactive releases from such breaches?

To address these questions, the committee performed a critical review of the security analyses that have been carried out by the Nuclear Regulatory Commission and its contractors, the Department of Homeland Security, industry, and other independent experts to determine if they are objective, complete, and credible. The committee was unable to examine several important issues related to these questions either because it was unable to obtain needed information from the Nuclear Regulatory Commission or because of time constraints. Details are provided in Chapters 1 and 2.

The committee's findings and recommendations from this analysis are provided below, organized by the four charges of the study task. The ordering of the charges has been rearranged to provide a more logical exposition of results.

CHARGE 4: RISKS OF TERRORIST ATTACKS ON THESE MATERIALS AND THE RISK THESE MATERIALS MIGHT BE USED TO CONSTRUCT A RADIOLOGICAL DISPERSAL DEVICE

The concept of *risk* as applied to terrorist attacks underpins the entire statement of task for this study. Therefore, the committee examined this final charge first to provide the basis for addressing the remainder of the task statement. The committee's examination of Charge 4 is provided in Chapter 2. On the basis of this examination, the committee offers the following findings and recommendations numbered according to the chapters in which they appear:

FINDING 2A: The probability of terrorist attacks on spent fuel storage cannot be assessed quantitatively or comparatively. Spent fuel storage facilities cannot be dismissed as targets for such attacks because it is not possible to predict the behavior and motivations of terrorists, and because of the attractiveness of spent fuel as a terrorist target given the well known public dread of radiation. Terrorists view nuclear power plant facilities as desirable targets because of the large inventories of radioactivity they contain. While it would be difficult to attack such facilities, the committee judges that attacks by knowledgeable terrorists with access to appropriate technical means are possible. It is important to recognize, however, that an attack that damages a power plant or its spent fuel storage facilities would not necessarily result in the release of *any* radioactivity to the environment. There are potential steps that can be taken to lower the potential consequences of such attacks.

FINDING 2B: The committee judges that the likelihood terrorists could steal enough spent fuel for use in a significant radiological dispersal device is small. Removal of a spent fuel assembly from the pool or dry cask would prove extremely difficult under almost any terrorist attack scenario. Attempts by a knowledgeable insider(s) to remove single rods and related debris from the pool might prove easier, but the amount of material that could be removed would be small. Moreover, superior materials could be stolen or purchased more easily from other sources. Even though the likelihood of spent fuel theft appears to be small, it is nevertheless important that the protection of these materials be maintained and improved as vulnerabilities are identified.

> **RECOMMENDATION: The Nuclear Regulatory Commission should review and upgrade, where necessary, its security requirements for protecting spent fuel rods not contained in fuel assemblies from theft by knowledgeable insiders, especially in facilities where individual fuel rods or portions of rods are being stored in pools.**

FINDING 2C: A number of security improvements at nuclear power plants have been instituted since the events of September 11, 2001. However, the Nuclear Regulatory Commission did not provide the committee with enough information to evaluate the effectiveness of these procedures for protecting stored spent fuel. Surveillance and other human-factors related security procedures are just as important as the physical barriers in preventing and mitigating terrorist attacks. Although the committee did learn about some of the changes that have been instituted since the September 11, 2001, attacks, it was not provided with enough information to evaluate the effectiveness of procedures now in place.

> **RECOMMENDATION: Although the committee did not specifically investigate the effectiveness and adequacy of improved surveillance and security measures for protecting stored spent fuel, an assessment of current measures should be performed by an independent[2] organization.**

CHARGE 1: POTENTIAL SAFETY AND SECURITY RISKS OF SPENT NUCLEAR FUEL STORED IN POOLS

The committee's examination of Charge 1 is provided in Chapter 3. On the basis of this examination, the committee offers the following findings and recommendations:

FINDING 3A: Pool storage is required at all operating commercial nuclear power plants to cool newly discharged spent fuel. Freshly discharged spent fuel generates too much decay heat to be passively air cooled. This fuel must be stored in a pool that has an active heat removal system (i.e., water pumps and heat exchangers) for at least one year before being moved to dry storage. Most dry storage systems are licensed to store fuel that has been out of the reactor for at least five years. Although spent fuel younger than five years could be stored in dry casks, the changes required for shielding and heat-removal

[2] That is, independent of the Nuclear Regulatory Commission and the nuclear industry.

could be substantial, especially for fuel that has been discharged for less than about three years.

FINDING 3B: The committee finds that, under some conditions, a terrorist attack that partially or completely drained a spent fuel pool could lead to a propagating zirconium cladding fire and the release of large quantities of radioactive materials to the environment. Details are provided in the committee's classified report.

FINDING 3C: It appears to be feasible to reduce the likelihood of a zirconium cladding fire following a loss-of-pool-coolant event using readily implemented measures. The following measures appear to have particular merit: Reconfiguring the spent fuel in the pools (i.e., redistribution of high decay-heat assemblies so that they are surrounded by low decay-heat assemblies) to more evenly distribute decay-heat loads and enhance radiative heat transfer; limiting the frequency of offloads of full reactor cores into spent fuel pools, requiring longer shutdowns of the reactor before any fuel is offloaded, and providing enhanced security when such offloads must be made; and development of a redundant and diverse response system to mitigate loss-of-pool-coolant events that would be capable of operation even if the pool or overlying building were severely damaged.

FINDING 3D: The potential vulnerabilities of spent fuel pools to terrorist attacks are plant-design specific. Therefore, specific vulnerabilities can be understood only by examining the characteristics of spent fuel storage at each plant. As described in Chapter 3, there are substantial differences in the designs of spent fuel pools that make them more or less vulnerable to certain types of terrorist attacks.

FINDING 3E: The Nuclear Regulatory Commission and independent analysts have made progress in understanding some vulnerabilities of spent fuel pools to certain terrorist attacks and the consequences of such attacks for releases of radioactivity to the environment. However, additional work on specific issues is needed urgently. The analyses carried out to date provide a general understanding of spent fuel behavior in a loss-of-pool-coolant event and the vulnerability of spent fuel pools to certain terrorist attacks that could cause such events to occur. The work to date, however, has not been sufficient to adequately understand the vulnerabilities and consequences of such events. Additional analyses are needed to fill in the knowledge gaps so that well-informed policy decisions can be made.

> **RECOMMENDATION: The Nuclear Regulatory Commission should undertake additional best-estimate analyses to more fully understand the vulnerabilities and consequences of loss-of-pool-coolant events that could lead to a zirconium cladding fire. Based on these analyses, the Commission should take appropriate actions to address any significant vulnerabilities that are identified.** The committee provides details on additional analyses that should be carried out in its classified report. Cost-benefit considerations will be an important part of such decisions.

> **RECOMMENDATION: While the work described in the previous recommendation under Finding 3E, above, is being carried out, the Nuclear Regulatory Commission should ensure that power plant operators take prompt and effective measures to reduce the consequences of loss-of-pool-coolant**

events in spent fuel pools that could result in propagating zirconium cladding fires. The committee judges that there are at least two such measures that should be implemented promptly:

- Reconfiguring of fuel in the pools so that high decay-heat fuel assemblies are surrounded by low decay-heat assemblies. This will more evenly distribute decay-heat loads, thus enhancing radiative heat transfer in the event of a loss of pool coolant.
- Provision for water-spray systems that would be able to cool the fuel even if the pool or overlying building were severely damaged.

Reconfiguring of fuel in the pool would be a prudent measure that could probably be implemented at all plants at little cost, time, or exposure of workers to radiation. The second measure would probably be more expensive to implement and may not be needed at all plants, particularly plants in which spent fuel pools are located below grade or are protected from external line-of-sight attacks by exterior walls and other structures.

The committee anticipates that the costs and benefits of options for implementing the second measure would be examined to help decide what requirements would be imposed. Further, the committee does not presume to anticipate the best design of such a system—whether it should be installed on the walls of a pool or deployed from a location where it is unlikely to be compromised by the same attack—but simply notes the demanding requirements such a system must meet.

CHARGE 3: POTENTIAL SAFETY AND SECURITY ADVANTAGES, IF ANY, OF DIFFERENT DRY CASK STORAGE DESIGNS

The third charge to the committee focuses exclusively on the safety and security of dry casks. The committee addressed this charge first in Chapter 4 to provide the basis for the comparative analysis between dry casks and pools as called for in Charge 2.

FINDING 4A: Although there are differences in the robustness of different dry cask designs (e.g., bare-fuel versus canister-based), the differences are not large when measured by the absolute magnitudes of radionuclide releases in the event of a breach. All storage cask designs are vulnerable to some types of terrorist attacks, but the quantity of radioactive material releases predicted from such attacks is relatively small. These releases are not easily dispersed in the environment.

FINDING 4B: Additional steps can be taken to make dry casks less vulnerable to potential terrorist attacks. Although the vulnerabilities of current cask designs are already small, additional, relatively simple steps can be taken to reduce them as discussed in Chapter 4.

RECOMMENDATION: The Nuclear Regulatory Commission should consider using the results of the vulnerability analyses for possible upgrades of requirements in 10 CFR 72 for dry casks, specifically to improve their resistance to terrorist attacks. The committee was told by

Nuclear Regulatory Commission staff that such a step is already under consideration.

CHARGE 2: SAFETY AND SECURITY ADVANTAGES, IF ANY, OF DRY CASK STORAGE VERSUS WET POOL STORAGE

In Chapter 4, the committee offers the following findings and recommendations with respect to the comparative component of Charge 2:

FINDING 4C: Dry cask storage does not eliminate the need for pool storage at operating commercial reactors. Under present U.S. practices, dry cask storage can only be used to store fuel that has been out of the reactor long enough (generally greater than five years under current practices) to be passively air cooled.

FINDING 4D: Dry cask storage for older, cooler spent fuel has two inherent advantages over pool storage: (1) It is a passive system that relies on natural air circulation for cooling; and (2) it divides the inventory of that spent fuel among a large number of discrete, robust containers. These factors make it more difficult to attack a large amount of spent fuel at one time and also reduce the consequences of such attacks. The robust construction of these casks prevents large-scale releases of radioactivity in all of the attack scenarios examined by the committee in its classified report.

FINDING 4E: Depending on the outcome of plant-specific vulnerability analyses described in the committee's classified report, the Nuclear Regulatory Commission might determine that earlier movements of spent fuel from pools into dry cask storage would be prudent to reduce the potential consequences of terrorist attacks on pools at some commercial nuclear plants. The statement of task directs the committee to examine the risks of spent fuel storage options and alternatives for decision makers, not to recommend whether any spent fuel should be transferred from pool storage to cask storage. In fact, there may be some commercial plants that, because of pool designs or fuel loadings, may require some removal of spent fuel from their pools. If there is a need to remove spent fuel from the pools it should become clearer once the vulnerability and consequence analyses described in the classified report are completed. The committee expects that cost-benefit considerations would be a part of these analyses.

IMPLEMENTATION ISSUES

Implementation of the recommendations in Chapters 2-4 will require action and cooperation by a large number of parties. The final chapter of the report provides a brief discussion of two implementation issues that the committee believes are of special interest to Congress: *Timing Issues*: Ensuring that high-quality, expert analyses are completed in a timely manner; and *Communications Issues*: Ensuring that the results of the analyses are communicated to relevant parties so that appropriate and timely mitigating actions can be taken. This discussion leads to the following finding and recommendation.

FINDING 5A: Security restrictions on sharing of information and analyses are hindering progress in addressing potential vulnerabilities of spent fuel storage to

terrorist attacks. Current classification and security practices appear to discourage information sharing between the Nuclear Regulatory Commission and industry. They impede the review and feedback processes that can enhance the technical soundness of the analyses being carried out; they make it difficult to build support within the industry for potential mitigative measures; and they may undermine the confidence that the industry, expert panels such as this one, and the public place in the adequacy of such measures.

> **RECOMMENDATION: The Nuclear Regulatory Commission should improve the sharing of pertinent information on vulnerability and consequence analyses of spent fuel storage with nuclear power plant operators and dry cask storage system vendors on a timely basis.**

The committee also believes that the public is an important audience for the work being carried out to assess and mitigate vulnerabilities of spent fuel storage facilities. While it would be inappropriate to share all information publicly, more constructive interaction with the public and independent analysts could improve the work being carried out and also increase public confidence in Nuclear Regulatory Commission and industry decisions and actions to reduce the vulnerability of spent fuel storage to terrorist threats.

1
INTRODUCTION AND BACKGROUND

In the Fiscal Year 2004 Energy and Water Development Conference Report, the U.S. Congress asked the National Academies to provide independent scientific and technical advice on the safety and security[1] of commercial spent nuclear fuel storage in the United States (see Box 1.1). The Nuclear Regulatory Commission and the Department of Homeland Security jointly sponsored this study, as directed by Congress.

Awareness and concerns about the threat of high-impact terrorism have become acute and pervasive since the attacks on September 11, 2001. The information gathered by the committee during this study led it to conclude that there were indeed credible concerns about the safety and security of spent nuclear fuel storage in the current threat environment. From the outset the committee believed that safety and security issues must be addressed quickly to determine whether additional measures are needed to prevent or mitigate attacks that could cause grave harm to people and cause widespread fear, disruption, and economic loss. The information gathered during this study reinforced that view. Any concern related to nuclear power plants[2] has added stakes: Many people fear radiation more than they fear exposure to other physical insults. This amplifies the concern over a potential terrorist attack involving radioactive materials beyond the physical injuries it might cause, and beyond the economic costs of the cleanup.

1.1 CONTEXT FOR THIS STUDY

The congressional request for this study was prompted by conflicting public claims about the safety and security of commercial spent nuclear fuel storage at nuclear power plants. Some have argued that the dense packing used for storing spent fuel in cooling pools at nearly every nuclear power plant does not provide a sufficient safety margin in the event of a pool breach and consequent water loss from an accident or terrorist attack.[3] In such cases, the potential exists for the fuel most recently discharged from a reactor to heat up sufficiently for its zirconium cladding to ignite, possibly resulting in the release of large amounts of radioactivity to the environment (Alvarez et al., 2003a). The Nuclear Regulatory Commission's own analyses have suggested that such zirconium cladding fires and releases of radioactivity are possible (e.g., USNRC, 2001a).

To reduce the potential for such an event, Alvarez et al. (2003a) suggested that spent fuel more than five years old be removed from the pool and stored in dry casks, and

---

[1] In the context of this study, *safety* refers to measures that protect spent nuclear fuel storage facilities against failure, damage, human error, or other accidents that would disperse radioactivity in the environment. *Security* refers to measures to protect spent fuel storage facilities against sabotage, attacks, or theft.

[2] Safety and security of reactors at nuclear power plants are outside of the committee's statement of task and have been addressed only where they could not be separated from spent fuel storage. The distinctions between spent fuel storage and operating nuclear power reactors are sometimes blurred in public discussions of nuclear and radiological concerns.

[3] The committee refers to such occurrences as *loss-of-pool-coolant events* in this report.

BOX 1.1 STATEMENT OF TASK

The issues to be addressed by this study are specified in the Energy and Water Development Conference Report and are as follows:

(1) Potential safety and security risks of spent nuclear fuel presently stored in cooling pools at commercial reactor sites (see Chapter 3).
(2) Safety and security advantages, if any, of dry cask storage versus wet pool storage at these reactor sites (see Chapter 4).
(3) Potential safety and security advantages, if any, of dry cask storage using various single-, dual-, and multi-purpose cask designs (see Chapter 4).
(4) In light of the September 11, 2001, terrorist attacks, this study will explicitly consider the risks of terrorist attacks on these materials and the risk these materials might be used to construct a radiological dispersal device (see Chapter 2).

that the remaining younger fuel be rearranged in the pool to allow more space for cooling (see also Marsh and Stanford, 2001; Thompson, 2003). The Nuclear Regulatory Commission staff, the nuclear industry, and some others have argued that densely packed pool storage can be carried out both safely and securely (USNRC, 2003a).

Policy actions to improve the safety and security of spent fuel storage could have significant national consequences. Nuclear power plants generate approximately 20 percent of the electricity produced in the United States. The issue of its future availability and use is critical to our nation's present and future energy security. The safety and security of spent fuel storage is an important aspect of the acceptability of nuclear power. Decisions that affect such a large portion of our nation's electricity supply must be considered carefully, wisely, and with a balanced view.

1.2 STRATEGY TO ADDRESS THE STUDY CHARGES

Congress directed the National Academies to produce a classified report that addresses the statement of task shown in Box 1.1 within 6 months and an unclassified summary for unlimited public dissemination within 12 months. This report, which has undergone a security review by the Nuclear Regulatory Commission and found to contain no classified national security or safeguards information, fulfills the second request.[4]

The National Research Council of the National Academies appointed a committee of 15 experts to carry out this study. Biographical sketches of the committee members are provided in Appendix B. The committee met six times from February to June 2004 to gather information and complete its classified report. The committee met again in August, October, and November 2004 and in January 2005 to develop this public report.

Details on the information-gathering sessions and speakers are provided in Appendix A. Most of the information-gathering sessions were not open to the public because they involved presentations and discussions of classified information. The committee recognized, however, that important contributions to this study could be made by industry representatives, independent analysts, and the public, so it scheduled open, unclassified

[4] The classified report was briefed to the agencies and Congress on July 15, 2004.

sessions at three of its meetings to obtain comments from interested organizations and individuals. Public comments at these meetings were encouraged and considered.

Subgroups of the committee visited several nuclear power plants to learn first-hand how spent fuel is being managed in wet and dry storage: the Dresden and Braidwood Nuclear Generating Stations in Illinois, which are owned and operated by Exelon Nuclear Corp.; the Indian Point Nuclear Generating Station in New York, which is owned and operated by ENTERGY Corp.; and the Palo Verde Nuclear Generating Station in Arizona, which is operated by Arizona Public Service Corp. A subgroup of committee members also traveled to Germany to visit spent fuel storage installations at Ahaus and Lingen and to talk with experts about the safety and security of German spent fuel storage. The German government has been concerned about security for a long time, and the German nuclear industry has made adjustments to spent fuel storage designs and operations that reduce their vulnerability to accidents and terrorist attacks. A summary of the trip to Germany is provided in Appendix C.

The statement of task for this study directed the committee to examine both the safety and the security of spent fuel storage. It is important to recognize that these are two sides of the same coin in the sense that any event that results in the breach of a spent fuel pool or a dry cask, whether accidental or intentional, has the potential to release radioactive material to the environment. The committee therefore focused its limited time on understanding two issues: (1) Under what circumstances could pools or casks be breached? And (2) what would be the radioactive releases from such breaches?

The initiating events that could lead to the *accidental* breach of a spent fuel pool are well known: A large seismic event or the accidental drop of a cask on the pool wall that could lead to the loss of pool coolant. The condition that could lead to an accidental breach of a dry storage cask is similarly well known: an accidental drop of the cask during handling operations. Current Nuclear Regulatory Commission regulations are designed to prevent such accidental conditions by imposing requirements on the design and operation of spent fuel storage facilities. These regulations have been in place for decades and have so far been effective in preventing accidental releases of radioactive materials from these facilities into the environment.

The initiating events that could lead to the *intentional* breach of a spent fuel pool or dry storage cask are not as well understood. The Nuclear Regulatory Commission has had long-standing requirements in place to deal with radiological sabotage (included in the "design basis threat"; see Chapter 2), but the September 11, 2001, terrorist attacks provided a graphic demonstration of a much broader array of potential threats. As described in the following chapters, the Nuclear Regulatory Commission is currently sponsoring studies to better understand the potential consequences of such terrorist attacks on spent fuel storage facilities.

Early on in this study, the committee made a judgment that it should focus most of its attention concerning such initiating events on the security aspects of its task statement. Many of the phenomena that follow an initiating event (e.g., loss of pool coolant or cask breach) would be the same whether it arose from an accident or terrorist attack, as noted previously. While the mitigation strategies for such events might be similar, they would require different kinds of preparation.

Given the relatively short time frame for this study, the committee focused its efforts

on performing a critical review of the security analyses that have been carried out by the Nuclear Regulatory Commission and its contractors, the Department of Homeland Security, industry (i.e., EPRI, formerly named the Electric Power Research Institute; ENTERGY Corp.; and dry cask vendors), and other independent experts to determine if they are objective, complete, and credible. The committee could only perform limited independent safety and security analyses based on the information it gathered.

The committee made many requests for information from the Nuclear Regulatory Commission, its Sandia National Laboratories contractor, and other organizations and individuals, often with little advance notice. For the most part, all parties responded well to these requests. The committee was able to access experts who could answer its technical questions and was pleased with the cooperation and information it received during its visits to spent fuel storage facilities. This cooperation was essential in enabling the committee to complete its task within the requested six-month timeframe.

The committee was forced to circumscribe some aspects of its examinations, however, due to time and/or information constraints. In particular, the committee did not pursue in-depth examinations of the following topics:

- Human factors issues involved in responding to terrorist attacks on spent fuel storage. These include surveillance activities to identify potential threats (both inside and outside the plant); the response of security forces; and the preparation of plant personnel to deploy mitigative measures in the event of an attack.
- The behavior of radioactive material after it enters the environment from a spent fuel pool or dry cask. The committee assumed that any large release of radioactivity from a spent fuel storage facility would be problematic even in the absence of knowledge of how it would disperse in the environment. The committee instead focused its efforts on understanding how much radioactive material would be released, if any, in the case of an attack.
- The economic consequences of potential terrorist attacks, except insofar as noting the possible magnitude of cleanup costs after a catastrophic release of radioactivity.
- The costs of potential measures to mitigate spent fuel storage vulnerabilities. The committee understands that the Nuclear Regulatory Commission would include cost-benefit considerations in decisions to impose any new requirements on industry for such measures.

The committee also did not examine the potential vulnerability of commercial spent fuel while being transported. That topic is not only outside of the committee's task, but there is another National Academies study currently underway to examine transportation issues.[5]

Because most of the studies on spent fuel storage vulnerabilities undertaken for the Nuclear Regulatory Commission are still in progress, the committee was not able to review completed technical documents. Instead, the committee had to rely on presentations by and discussions with technical experts. The committee does not believe that these difficulties prevented it from developing sound findings and recommendations from the information it

[5] Committee on Transportation of Radioactive Waste. See *http://national-academies.org/transportofradwaste*. That committee's final report is now planned for completion in the late summer of 2005.

did receive. The committee was able to draw upon other information sources both domestic and foreign,[6] including the experience and expertise of its members, to fill some of the information gaps.

1.3 REPORT ROADMAP

The sections that follow in this chapter provide background on storage of spent nuclear fuel, which may be helpful to non-experts in understanding the issues discussed in the following chapters. The other chapters are organized to explicitly address the four charges of the committee's statement of task:

- Chapter 2 addresses the last charge to the committee to "explicitly consider the risks of terrorist attacks on these materials and the risk these materials might be used to construct a radiological dispersal device."
- Chapter 3 addresses the first charge to the committee to examine the "potential safety and security risks of spent nuclear fuel presently stored in cooling pools at commercial reactor sites."
- Chapter 4 addresses the second and third charges to examine the "safety and security advantages, if any, of dry cask storage versus wet pool storage at these reactor sites" and the "potential safety and security advantages, if any, of dry cask storage using various single-, dual-, and multi-purpose cask designs."
- Chapter 5 concerns implementation of the recommendations in this report, specifically concerning timing and communication issues.

The appendixes provide supporting information, including a glossary and acronym list, descriptions of the committee's meetings, and biographical sketches of the committee members.

1.4 BACKGROUND ON SPENT NUCLEAR FUEL AND ITS STORAGE

This section is provided for readers who are not familiar with the technical features of spent nuclear fuel and its storage. Other readers should skip directly to Chapter 2.

Spent nuclear fuel is fuel that has been irradiated or "burned" in the core of a nuclear reactor. In power reactors, the energy released from fission reactions in the nuclear fuel heats water[7] to produce steam that drives turbines to generate electricity. Spent nuclear fuel from non-commercial reactors (such as research reactors, naval propulsion reactors, and plutonium production reactors) is not considered in this study.

1.4.1 Nuclear Fuel

Almost all commercial reactor fuel in the United States is in the form of solid, cylindrical pellets of uranium dioxide. The pellets are about 0.4 to 0.65 inch (1.0 to 1.65 centimeters) in length and about 0.3 to 0.5 inch (0.8 to 1.25 centimeters) in diameter. The

[6] For example, the aforementioned visits to Lingen and Ahaus, in Germany.
[7] A different coolant can be used, but all power reactors now operating in the United States are water cooled.

pellets are loaded into tubes, called *fuel cladding*, made of a zirconium metal alloy, called zircaloy. A loaded tube, which is typically 11.5 to 14.75 feet (3.5 to 4.5 meters) in length, is called a *fuel rod* (also referred to as a *fuel pin* or *fuel element*). Fuel rods are bundled together, with a 0.12 to 0.18 inch (0.3 to 0.45 centimeter) space left between each for coolant to flow, to form a square fuel assembly (see FIGURE 1.1) measuring about 6 to 9 inches (15 to 23 centimeters) on a side.

Typical fuel assemblies for boiling water nuclear reactors (BWRs) hold 49 to 63 fuel rods, and fuel assemblies for pressurized water nuclear reactors (PWRs) hold 164 to 264 fuel rods.[8] Depending on reactor design, typically between 190 and 750 assemblies, each weighing from 275 to 685 kg (600 to 1500 pounds), make up a power reactor core. New fuel assemblies (i.e., those that have not been irradiated in a reactor) do not require special cooling or radiation shielding; they can be moved with a crane in open air. Once in the reactor, however, the fuel undergoes nuclear fission and begins to generate the radioactive fission products and activation products that require shielding and cooling.

The uranium oxide fuel essentially is composed of two isotopes of uranium: Initially, about 3-5 percent[9] by weight is fissile uranium (uranium-235), which is the component that sustains the fission chain reaction; and about 95-97 percent is uranium-238, which can capture a neutron to produce fissile plutonium and other radioactive heavy isotopes (actinides). Each fission event, whether in uranium or plutonium, releases energy and neutrons as the fissioning nucleus splits into two (and infrequently three) radioactive fragments, called fission products.

When the fissile material has been consumed to a level where it is no longer economically viable (typically 4.5 to 6 years of operation for current fuel designs), the fuel is considered *spent* and is removed from the reactor core. Spent fuel assemblies are highly radioactive. The decay of radioactive fission products and other constituents generates heat (called *decay heat*) and penetrating (gamma and neutron) radiation. Therefore cooling, shielding, and remote handling are required for spent nuclear fuel.

The amount of heat and radiation generated by a spent fuel assembly after its removal from a reactor depends on the number of fissions that have occurred in the fuel, called the *burn-up*, and the time that has elapsed since the fuel was removed from the reactor. The rate of decay-heat generation by spent reactor fuel and how it will change with time after the fuel is removed from the reactor can be calculated. The results of an example calculation are shown in FIGURE 1.2.

At discharge from the reactor, a spent fuel assembly generates on the order of tens of kilowatts of heat. Decay-heat production diminishes as very short-lived radionuclides decay away, dropping heat generation by a factor of 100 during the first year; dropping by another factor of 5 between year one and year five; and dropping about 40 percent between year five and year ten (see FIGURE 1.2). Within a year of discharge from the reactor, decay-heat production in spent nuclear fuel is dominated by four radionuclides: Ruthenium-106 (with a 372.6-day half-life), cerium-144 (284.4-day half-life), cesium-137 (30.2-year half-life),

---

[8] Technical specifications for the fuel assemblies are taken from the American National Standard document for pool storage of spent nuclear fuel (American Nuclear Society, 1988).

[9] With only a few exceptions, commercial nuclear power reactors in the United States have been fueled with low-enriched uranium, that is, less than 20 percent of the uranium is uranium-235. Uranium found in nature has about 0.71 percent uranium-235 by weight.

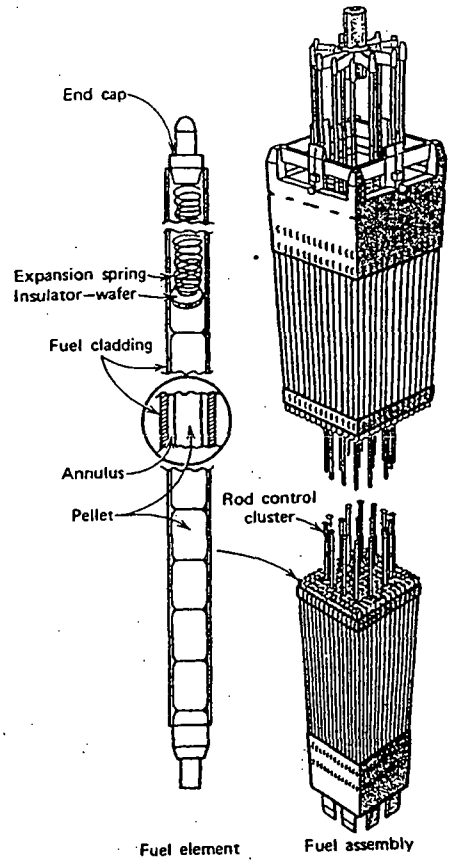


FIGURE 1.1 Fuel rods, also called fuel pins or elements, are bundled together into fuel assemblies as shown here. This fuel assembly is for a PWR reactor. SOURCE: Duderstadt and Hamilton (1976; Figure 3-7).

and cesium-134 (2.1-year half-life) and their short-lived decay products contribute nearly 90 percent of the decay heat from a spent fuel assembly.

Longer-lived radionuclides persist in the spent fuel even as the decay heat drops further. Cesium-137 decays to barium-137, emitting a beta particle and a high-energy gamma ray. The cesium-137 half-life of 30.2 years is sufficiently long to ensure that this radionuclide will persist during storage. It and other materials present in the fuel will form small particles, called *aerosols*, in a zirconium cladding fire.

Shorter-lived radionuclides decay away rapidly after removal of the spent fuel from the reactor. One of these is iodine-131, which is of particular concern in reactor core accidents because it can be taken up in large quantities by the human thyroid. This radionuclide has a half-life of about 8 days and typically persists in significant quantities in spent fuel only on the order of a few months.

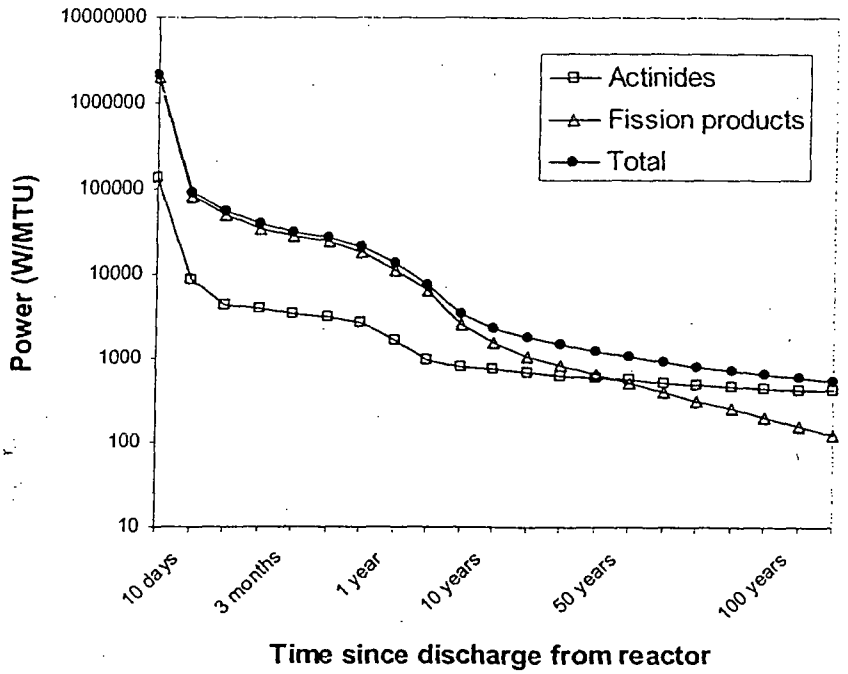


FIGURE 1.2 Decay-heat power for spent fuel (measured in watts per metric ton of uranium) plotted on a logarithmic scale as a function of time after reactor discharge. Note that the horizontal axis is a data series, not a scale. SOURCE: Based on data from USNRC (1984).

1.4.2 Storage of Spent Nuclear Fuel

Storage technologies for spent nuclear fuel have three primary objectives:

- Cool the fuel to prevent heat-up to high temperatures from radioactive decay.
- Shield workers and the public from the radiation emitted by radioactive decay in the spent fuel and provide a barrier for any releases of radioactivity.
- Prevent criticality accidents (uncontrolled fission chain reactions).

After the fuel assemblies are unloaded from the reactor they are stored in water pools, called *spent fuel pools.* The water in the pools provides radiation shielding and cooling and captures all but noble gas radionuclides in case of fuel rod leaks.[10] The geometry of the fuel and neutron absorbers (such as boron, hafnium, and cadmium) within the racks that hold the spent fuel or in the cooling water help prevent criticality events.[11] The water in the pool is circulated through heat exchangers for cooling and ion exchange filters to capture any radionuclides and other contaminants that get into the water. Makeup water is also added to the pool to replace pool water lost to evaporation. The operation of the pumps and heat exchangers is especially important during and immediately after reactor

[10] If the cladding in the fuel rods is breached some radioactive materials will be released into the pool.
[11] See the Glossary (Appendix E) for a definition of criticality. Most of the fuel's capacity for sustaining criticality is expended in the reactor as the uranium and plutonium are fissioned.

refueling operations, because this is when larger quantities of higher heat-generating spent fuel are placed into the pool.

Current U.S. regulations require that spent fuel be stored in the power plant's fuel pool for at least one year after its discharge from the reactor before being moved to dry storage. After that time the spent fuel can be moved, but only with active cooling. Active cooling is generally necessary for about three years after the spent fuel is removed from the reactor core (USNRC, 2003b).

When a spent fuel pool is filled to capacity, older fuel, which has lower decay-heat, is moved to other pools or placed into dry casks. Heat generated in the loaded dry casks is removed by air convection and thermal radiation. The cask provides shielding of penetrating radiation and confinement of the radionuclides in the spent fuel. As with pool storage, criticality control is accomplished by placing the fuel in a fixed geometry and separating individual fuel assemblies with neutron absorbers. Standard industry practice is to place in dry storage only spent fuel that has cooled for five years or more after discharge from the reactor.[12] Most spent fuel in wet or dry storage is located at nuclear power plant sites (i.e., on-site storage).

There are significant differences in the design and construction of wet and dry storage installations at commercial nuclear power plants. The characteristics depend on the type of the nuclear power plant, the age of the spent fuel storage installation, or the type of dry casks used. The design and features of spent fuel pools and dry storage facilities are discussed in Chapters 3 and 4, respectively.

1.4.3 Spent Fuel Inventories

As of 2003, approximately 50,000 MTU (metric tons of uranium) of spent fuel have been generated over the past four decades in the United States. A typical nuclear power plant generates about 20 MTU per year. The entire U.S. nuclear industry generates about 2000 MTU per year.

Of the approximately 50,000 MTU of commercial spent fuel in the United States, 43,600 MTU are currently stored in pools and 6200 MTU are in dry storage. Pool storage exists at all 65 sites with operating commercial nuclear power reactors[13] and at 8 sites where commercial power reactors are no longer operating (i.e., they have been shut down or decommissioned) (FIGURE 1.3). Additionally, there is an away-from-reactor spent fuel pool operating at the G.E. Morris Facility in Illinois (see Appendix D).

Of the spent fuel in dry storage, 4500 MTU are in storage at 22 sites with operating commercial nuclear power reactors, and 1700 MTU are in storage at 6 sites where the commercial reactors are no longer operating. An additional dry-storage facility is operated by the federal government at the Idaho National Laboratory. It stores most of the damaged fuel from the Three Mile Island Unit 2 reactor accident.

---

[12] Fuel aged as little as three years could be stored in passively cooled casks, but fewer assemblies could be accommodated in each cask because of the higher heat load.

[13] There are 103 operating commercial nuclear power reactors in the United States. Many sites have more than one operating reactor.

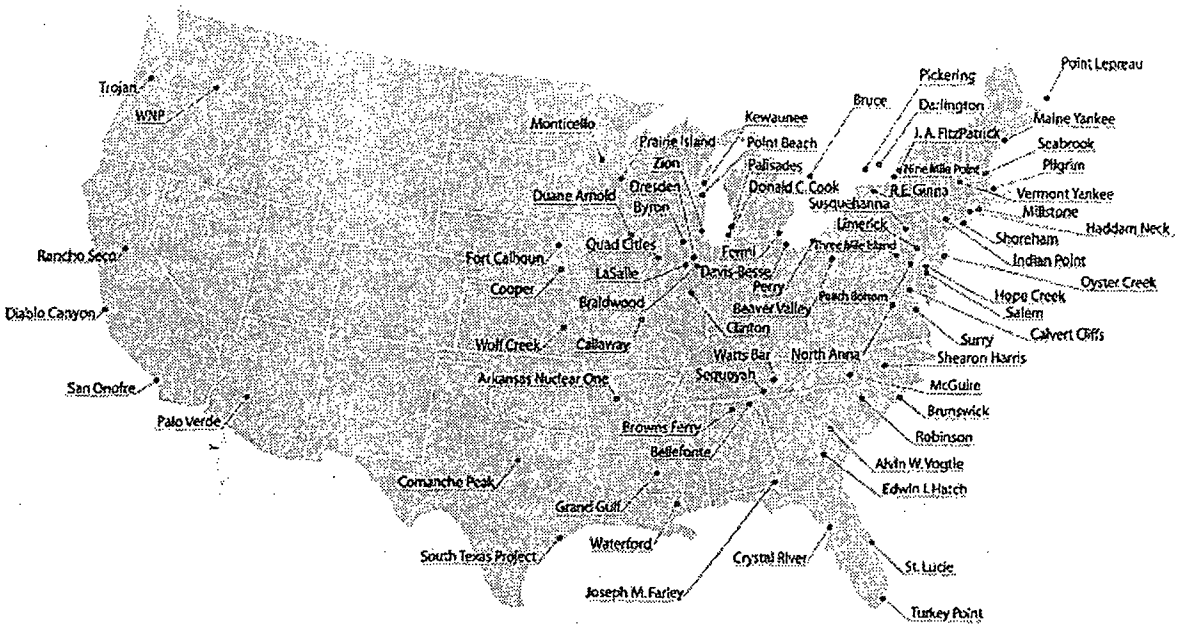


FIGURE 1.3 Locations of spent fuel storage facilities in the United States.

TABLE 1.1 provides a listing of the 30 operating Independent Spent Fuel Storage Installations (ISFSIs[14]) in the United States. These ISFSIs include the dry storage facilities at operating and shutdown commercial power reactor sites as well as the storage facilities at the Morris and Idaho sites, as described above. The committee did not examine the Morris and Idaho facilities as part of this study. At-reactor pool storage is not considered to be an ISFSI because it operates under the power reactor license.

1.4.4 History of Spent Fuel Storage

Spent fuel pools at commercial nuclear power plants were not designed to accommodate all the fuel used during the operating lifetime of the reactors they service. Most commercial power plants were designed with small pools under the assumption that fuel would be cooled for a short period of time after discharge from the reactor and then be sent offsite for recycling (i.e., reprocessing).[15] A commercial reprocessing industry never developed, however, for the reasons discussed in Appendix D. Newer power plants were designed with larger pool storage capacities. Even plants with larger-capacity pools will run out of pool space if they operate beyond their initial 40-year licenses. In 2000, the nuclear power industry projected that roughly three or four plants per year would run out of needed storage space in their pools without additional interim storage capacity (see FIGURE 1.4).

Another development that logically could reduce the demand for storage of spent nuclear fuel at the sites of power plants is the availability of a geologic repository for

[14] An ISFSI is a facility for storing spent fuel in wet pools or dry casks and is defined in Title 10, Part 72 of the Code of Federal Regulations.
[15] Residual uranium-235 and plutonium in the spent fuel would be recovered for the manufacture of new fuel. The waste products in the fuel, principally the fission products, would be immobilized in solid matrices and stored for eventual disposal.

TABLE 1.1: Operating ISFSIs in the United States as of July 2004

Name	Location
Palo Verde	Arizona
Arkansas Nuclear One	Arkansas
Rancho Seco	California
San Onofre	California
Diablo Canyon	California
Fort St. Vrain [1]	Colorado
Edwin L. Hatch	Georgia
DOE-INL [2]	Idaho
G.E. Morris [3]	Illinois
Dresden	Illinois
Duane Arnold	Iowa
Maine Yankee	Maine
Calvert Cliffs	Maryland
Big Rock Point	Michigan
Palisades	Michigan
Prairie Island	Minnesota
Yankee Rowe	Massachusetts
Oyster Creek	New Jersey
J.A. FitzPatrick	New York
McGuire	North Carolina
Davis-Besse	Ohio
Trojan	Oregon
Susquehanna	Pennsylvania
Peach Bottom	Pennsylvania
Robinson	South Carolina
Oconee	South Carolina
North Anna	Virginia
Surry	Virginia
Columbia Gen. Station	Washington
Point Beach	Wisconsin

NOTES:
[1]The Fort St. Vrain ISFSI stores fuel from a commercial gas-cooled reactor. The facility is operated by the Department of Energy.
[2]The DOE-INL facility stores fuel from the Three-Mile Island Unit 2 reactor. The facility is operated by the Department of Energy.
[3]The G.E. Morris ISFSI is a wet storage facility.

SOURCES: Data from the USNRC (2004).

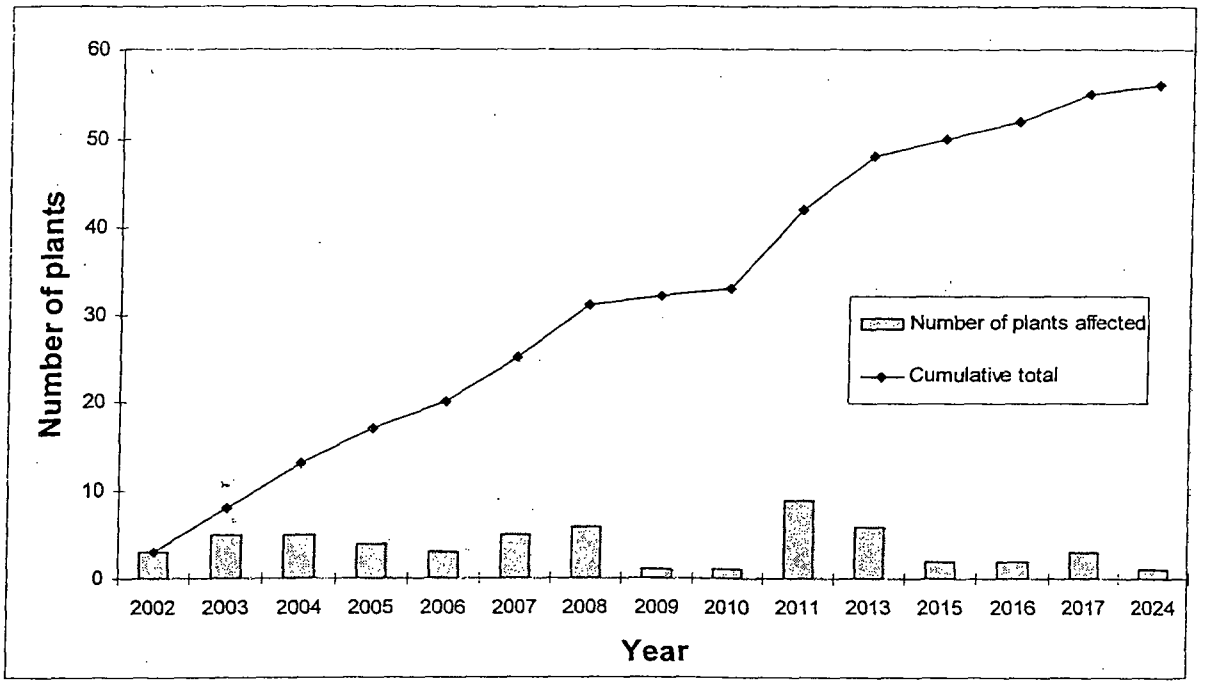


FIGURE 1.4 Projection of the number of commercial nuclear power plants that will run out of needed space in their spent fuel pools in coming years if they do not add interim storage. These data, looking only at plants that did not already use dry cask storage, were provided to the Nuclear Regulatory Commission in 2000. SOURCE: USNRC (2001b).

disposal of spent nuclear fuel. But a nuclear waste repository is not expected to be in operation until at least 2010, and even then it will take several decades for all of the spent fuel to be shipped for disposal. Thus, onsite storage of spent fuel is likely to continue for at least several decades.

Power plant operators have made two changes in spent fuel storage procedures to increase the capacity of onsite storage. First, starting in the late 1970s, plant operators began to install high-density racks that enable more spent fuel to be stored in the pools. This has increased storage capacities in some pools by up to about a factor of five (USNRC, 2003b). Second, as noted above, many plant operators have moved older spent fuel from the pools into dry cask storage systems (see Chapter 4) or into other pools when available to make room for freshly discharged spent fuel and to maintain the capacity for a full-core offload.[16]

The original spent fuel racks, sometimes called "open racks," were designed to store spent fuel in an open array, with open vertical and lateral channels between the fuel assemblies to promote water circulation. The high-density storage racks eliminated many of the channels so that the fuel assemblies could be packed closer together (FIGURE 1.5). This configuration does not allow as much water (or air circulation in loss-of-pool-coolant events) through the spent fuel assemblies as the original open-rack design.

[16] Although not required by regulation, it is standard practice in the nuclear industry to maintain enough open space in the spent fuel pool to hold the entire core of the nuclear reactor. This provides an additional margin of safety should the fuel have to be removed from the reactor core in an emergency or for maintenance purposes.

Several nuclear utilities have already submitted license applications to the Nuclear Regulatory Commission to build 16 new ISFSIs. Among the potential new ISFSIs, a consortium of utilities has submitted a license for a private fuel storage facility (PFS) in Utah for interim dry storage of up to 40,000 metric tons of spent fuel.

Most or all pools store some spent fuel that has aged more than five years after discharge from the reactor, and so could be transferred to dry-cask storage. The amount that could be transferred depends on plant-specific information such as pool size and configuration, operating history of the reactor, the enrichment and burn-up level in the fuel, and availability of an ISFSI.

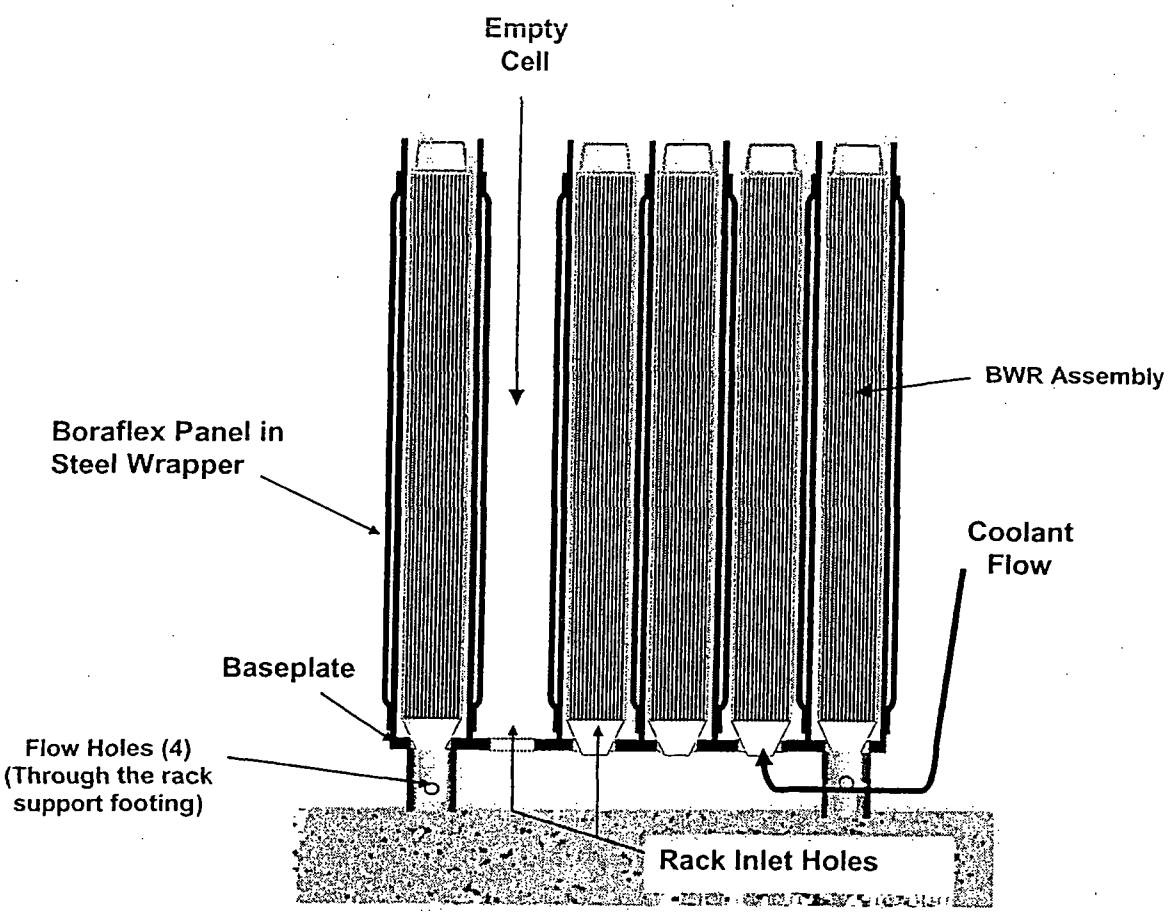


FIGURE 1.5 Dense spent fuel pool storage racks for BWR fuel. This cross-sectional illustration shows the principal elements of the spent fuel rack, which sits on the bottom of the pool. SOURCE: Nuclear Regulatory Commission briefing materials (2004).

2

TERRORIST ATTACKS ON SPENT FUEL STORAGE

This chapter addresses the final charge to the committee to "explicitly consider the risks of terrorist attacks on [spent fuel] and the risk these materials might be used to construct a radiological dispersal device." The concept of *risk* as applied to terrorist attacks underpins the entire statement of task for this study. Therefore, the committee addresses this final charge first to provide the basis for addressing the remainder of the task statement.

The chapter is organized into the following sections:

- Background on risk.
- Terrorist attack scenarios.
- Risks of terrorist attacks on spent fuel storage facilities.
- Findings and recommendations.

2.1 BACKGROUND ON RISK

"Risk" is a function of three factors (Kaplan and Garrick, 1981):

- The *scenario* describing the undesirable event.
- The *probability* that the scenario will occur.
- The *consequences* if the scenario should occur.

In the context of the present report, a *scenario* describes the modes and mechanisms of a possible terrorist attack against a spent fuel storage facility. For example, a scenario might involve a suicide attack with a hijacked civilian airliner. Another might involve a ground assault with a truck bomb. Several such scenarios are described later in this chapter and discussed in more detail in the committee's classified report.

Probability is a dimensionless quantity that expresses the likelihood that a given scenario will occur over a specified time period. If the occurrence of a scenario is judged to be impossible, it would have a probability of 0.0. On the other hand, if the scenario were judged to be certain, it has a probability of 1.0. A scenario that had a 50 percent chance of occurrence during the period contemplated would have a probability of 0.5.

Consequences describe the undesirable results if the scenario were to occur. For example, a terrorist attack on a spent fuel storage facility could release ionizing radiation to the environment.[1] The exposure of the public to this radiation could have both deterministic and stochastic effects. The former would occur from short-term exposures to very high doses of ionizing radiation, the latter to smaller doses that might have no immediate effects

[1] Terrorist scenarios and consequences are being described here for the sake of illustration. One should not conclude from this description that the committee believes that such consequences would necessarily occur as the result of a terrorist attack on a spent fuel storage facility.

but could result in cancer induction some years or decades later.[2] Consequences also could be described in terms of economic damage. These could arise, for example, from the loss of use of the facility and surrounding areas or costs to clean up those areas. There also could be severe psychological consequences that could drive changes in public acceptance of commercial nuclear energy.

The quantitative expression for the risk of a particular scenario, for example a suicide terrorist attack with a hijacked airliner, is

$$\text{Risk}_{\text{airliner attack}} = \text{Probability}_{\text{airliner attack}} \times \text{Consequences}_{\text{airliner attack}} \quad (1)$$

The total risk would be the sum of the risks for all possible independent attack scenarios. For example, if a spent fuel storage facility was determined to be vulnerable to attacks using airliners, truck bombs, and armed assaults, the total risk would be calculated as

$$\text{Risk}_{\text{total}} = \text{Risk}_{\text{airliner attack}} + \text{Risk}_{\text{truck bomb attack}} + \text{Risk}_{\text{armed assault attack}} \quad (2)$$

Such equations are routinely used to calculate the risks of various industrial accidents, including accidents at nuclear power plants, through a process known as *probabilistic risk assessment*. Each accident is assigned a numerical probability based on a careful analysis of the sequence of failures (e.g., human or mechanical failures) that could produce the accident. The consequences of such accidents are typically expressed in terms of injuries, deaths, or economic losses.

It is possible to estimate the risks of industrial accidents because there are sufficient experience and data to quantify the probabilities and consequences. This is not the case for terrorist attacks. To date, experts have not found a way to apply these quantitative risk equations to terrorist attacks because of two primary difficulties: The first is to develop a complete set of bounding scenarios for such attacks; the second is to estimate their probabilities. These depend on impossible-to-quantify factors such as terrorist motivations, expertise, and access to technical means.[3] They also depend on the effectiveness of measures that might prevent or mitigate such attacks.

In the absence of quantitative information on risks, one could attempt to make qualitative risk comparisons. Such comparisons could estimate, for example, the relative risks of attacks on spent fuel storage facilities versus attacks on commercial nuclear power reactors or other critical infrastructure such as chemical plants. Although a comparison of such risks is beyond the scope of this study, the committee recognizes that policy decisions about spent fuel storage may need to take into account such comparative risk issues,

---

[2] Such cancers would likely not be directly traceable to the radiation dose received from a terrorist attack and would likely be indistinguishable from the large population of cancers that result from other causes.

[3] Political scientists and counter-terror specialists have argued whether terrorists seek headlines, casualties, or both (e.g., Jenkins 1975, 1985). The September 11, 2001, attacks in the United States and the March 11, 2004, attacks in Spain demonstrate that some terrorists, particularly those of al-Qaida and its allies, intend to commit mass murder and/or mass economic disruption, both of which may have important political consequences. Further information about the motivation of terrorists is provided in NRC (2002).

especially for decisions regarding the expenditure of limited societal resources to address terrorist threats.

The 2002 National Research Council report *Making the Nation Safer: The Role of Science and Technology in Countering Terrorism* framed this issue as follows (NRC, 2002, p. 43):

> The potential vulnerabilities of NPPs [nuclear power plants] to terrorist attack seem to have captured the imagination of the public and the media, perhaps because of a perception that a successful attack could harm large populations and have severe economic and environmental consequences. There are, however, many other types of large industrial facilities that are potentially vulnerable to attack, for example, petroleum refineries, chemical plants, and oil and liquefied natural gas supertankers. These facilities do not have the robust construction and security features characteristic of NPPs, and many are located near highly populated urban areas.

Groups seeking to carry out high-impact terrorism will likely choose targets that have a high probability of being attacked successfully.[4] If success is measured by the number of people killed and injured or the permanent destruction of property, then spent fuel storage facilities may not make good terrorist targets owing to their relatively robust construction (see Chapters 1 and 3) and security. Industrialized societies like the United States provide terrorists a large number of "soft" (i.e., unprotected) targets that could be attacked more easily with greater effect than spent fuel storage facilities. These include chemical plants, refineries, transportation systems, and other facilities where large numbers of people gather (see NRC, 2002).

On the other hand, there are other success criteria that might influence a terrorist's decision to attack a "hard" (i.e., robust or well protected) target such as a commercial nuclear power plant and its spent fuel storage facilities. Such attacks could spread panic and shut down the power plant for an extended period of time even with no loss of life. Moreover, an attack that resulted in the release of radioactive material could threaten the viability of commercial nuclear power.

These considerations led the committee to conclude that it could not address its charge using quantitative and comparative risk assessments. The committee decided instead to examine a range of possible terrorist attack scenarios in terms of (1) their potential for damaging spent fuel pools and dry storage casks; and (2) their potential for radioactive material releases. This allowed the committee to make qualitative judgments about the vulnerability of spent fuel storage facilities to terrorist attacks and potential measures that could be taken to mitigate them.

---

[4] This point was made to the committee in a briefing by the Department of Homeland Security, where "success" means that the terrorist was able to achieve the goals of the attack, whatever they might be.

2.2 TERRORIST ATTACK SCENARIOS

It is possible to imagine a wide range of terrorist attacks against spent fuel storage facilities. Each would have a range of potential consequences depending on the characteristics of the attack and the facility being targeted as well as any post-attack mitigative actions to prevent or reduce the release of radioactive material. The committee focused its discussions about terrorist attacks around the concept of a *maximum credible scenario*—that is, an attack that is physically possible to carry out and that produces the most serious potential consequences within a given class of attack scenarios.

The following example illustrates the concept: One of the scenario classes considered by the committee in this chapter involves suicide attacks against spent fuel storage facilities with civilian passenger aircraft. The physics of such attacks are well understood: In general, heavier and higher-speed aircraft produce greater impact forces than lighter and slower aircraft, all else being equal. Consequently, the maximum credible scenario for suicide attacks involving civilian passenger aircraft would utilize the largest civilian passenger aircraft widely used in the United States flying at maximum cruising speed and hitting the facility at its most vulnerable point. Such an attack provides an upper bound to the damage that could be inflicted by this type of aircraft attack.

The maximum credible scenario is particularly useful for obtaining a general understanding of the damage that could be inflicted, but it would not necessarily apply to every spent fuel storage facility. To be judged a "credible" scenario, the terrorist must be able to successfully carry it out as designed—for example, to hit a spent fuel storage facility with the largest civilian aircraft at its most vulnerable point. This would rule out attacks that are physically impossible, such as flying a large civilian aircraft into a facility that is located below ground level or protected by surrounding hills or buildings. This also would rule out attacks involving weapons that are not available to terrorists (e.g., aircraft-launched weapons such as "bunker-buster" bombs or nuclear weapons).

This is not intended, however, to rule out attacks that are judged to have a low probability for success simply because terrorists might lack the skill and knowledge or luck to carry them out. In fact, if the consequences of such attacks were severe, policy makers might still decide that prudent mitigating actions should be taken regardless of their low probabilities of occurrence.[5] This might be especially true if quick, inexpensive fixes could be implemented. The main benefit of analyzing the maximum credible scenario is that it provides decision makers with a better characterization of the full range of potential consequences so that sound policy judgments can be made.

The analyses carried out for the Nuclear Regulatory Commission (described in the committee's classified report) do not consider maximum credible scenarios. Instead, the analyses employ *reference scenarios* that are based either on the characteristics of previous terrorist attacks or on qualitative judgments of the technical means and methods that might be employed in attacks against spent fuel storage facilities. Although such reference scenarios are useful for gaining insights on potential consequences of terrorist attacks, they

[5] The Department of Energy, for example, routinely examines the consequences of very low probability events involving nuclear weapons safety and security; see, for example, AL 56XB Development and Production Manual published by the U.S. Department of Energy, National Nuclear Security Administration. See *http://prp.lanl.gov/documents/d_p_manual.asp*.

are not necessarily bounding. This becomes important when the reference scenario attack results in damage to a facility that verges on failure.

The committee prefers a maximum credible scenario approach for one important reason: It believes that terrorists who choose to attack hardened facilities like spent fuel storage facilities would choose weapons capable of producing maximum destruction. **Of course, once the consequences of such attacks are known, an element of expert judgment is required to determine whether such attacks have a high likelihood of being carried out as designed. Such judgment is especially important when making policy decisions about actions to reduce the vulnerabilities of facilities to such attacks.**

The consequences of terrorist attacks can be described in terms of either *maximum credible releases* or *best-estimate releases*. The former describes the largest releases of radioactive material following an attack based on quantitative analytical models (e.g., the MELCOR computer code described in Chapter 3). The latter describes the median estimates from such models. In both cases, the estimates may not account for mitigative actions that could be taken after an attack to reduce or even eliminate releases. The Nuclear Regulatory Commission analyses reviewed by the committee in its classified report are best-estimate releases for various terrorist attack scenarios. The estimates in NUREG-1738 (USNRC, 2001a) and Alvarez et al. (2003a), on the other hand, describe maximum-credible to worst-case releases.[6]

The committee considered four classes of terrorist attack scenarios in this study:

- Air attacks using large civilian aircraft or smaller aircraft laden with explosives.
- Ground attacks by groups of well-armed and well-trained individuals.
- Attacks involving combined air and land assaults.
- Thefts of spent fuel for use by terrorists (including knowledgeable insiders) in radiological dispersal devices.

The committee devoted time at its meetings discussing these scenarios. It also received briefings on possible scenarios from Nuclear Regulatory Commission staff and suggestions for scenarios from the Department of Homeland Security (DHS), other experts, and the public. Some scenarios were dismissed by the committee as not credible. An example of such a scenario is an attack on a spent fuel storage facility with a nuclear weapon. Such weapons would be relatively difficult[7] for terrorists to build or steal. Even if such a weapon could be obtained, the committee can think of no reason that it would be used against a spent fuel storage facility rather than another target. There are easier ways to attack spent fuel storage facilities, as discussed in the classified report, and there are more attractive targets for nuclear weapons, for example, large population centers.

---

[6] Worst-case releases are based on the most unfavorable conditions that could occur in a given scenario, regardless of whether those conditions were physically realistic. For example, a worst-case estimate of the radionuclide releases from an attack on a spent fuel pool might assume that all of the volatile radionuclides contained in the spent fuel would be released, even if quantitative analytical models showed that such releases were very unlikely to occur.

[7] Difficult but certainly not impossible. See Chapter 2 in NRC (2002).

Given the experience of September 11, 2001, and the attacks that have occurred in other parts of the world, it is clear to the committee that the ability of the most capable terrorists to carry out attacks is limited only by their access to technical means. It is probably not limited by the ability of terrorist organizations to recruit or train attackers or bring them and any needed equipment into the United States—if indeed they are not already here. Moreover, the demonstrated willingness of terrorists to carry out suicide attacks greatly expands the scenarios that need to be considered when analyzing potential threats.

As is discussed in some detail in Chapters 3 and 4, the facilities used to store spent fuel at nuclear power plants are very robust. Thus, only attacks that involve the application of large energy impulses or that allow terrorists to gain interior access have any chance of releasing substantial quantities of radioactive material. This further restricts the scenarios that need to be considered. For example, attacks using rocket-propelled grenades (RPGs) of the type that have been carried out in Iraq against U.S. and coalition forces would not likely be successful if the intent of the attack is to cause substantial damage to the facility. Of course, such an attack would get the public's attention and might even have economic consequences for the attacked plant and possibly the entire commercial nuclear power industry.

The threat scenarios summarized in this chapter are based on documents provided to the committee, briefings received at committee meetings, and the committee's own expert judgment.[8] Further overview and information on nuclear and radiological threats in general can be found in the NRC (2002) report and references therein.

2.2.1 Air Attacks

The September 11, 2001, attacks[9] demonstrated that terrorists are capable of successfully attacking fixed infrastructure with large civilian jetliners. The security of civilian passenger airliners has been improved since these attacks were carried out, and the vulnerability of civilian passenger aircraft to highjacking has been reduced. Nevertheless, the committee judges, based on the evidence made available to it during this study, that attacks with civilian aircraft remain a credible threat. Such aircraft are used routinely in freight and charter services, and large numbers of such aircraft enter the United States from other countries each day. Improvements to ground security or cargo inspection would likely not eliminate the threat posed by an air crew willing to stage a suicide attack with a chartered air freighter.

Although the September 11, 2001, attacks utilized Boeing 757 and 767 airliners, larger aircraft (Boeing 747, 777; Airbus 340) are in routine use around the world, and an even larger aircraft (Airbus 380) is entering production. Assaults by such large aircraft could impart enormous energy impulses to spent fuel storage facilities. Additionally, attacks with

---

[8] The committee found limited information in the open literature on various scenarios for terrorist attacks on nuclear plants and their spent fuel storage facilities.

[9] The al-Qaida terrorist organization hijacked and crashed two Boeing 767 airliners into Towers 1 and 2 of the World Trade Center building in New York and a Boeing 757 airliner into the Pentagon building in Arlington, Virginia. A second Boeing 757, which was believed to be targeted either on the White House or the U.S. Capitol (see National Commission on Terrorist Attacks Upon the United States, Staff Statement No. 16 [Outline of the 9/11 Plot], pages 18-19) crashed in an open field near Jennerstown, Pennsylvania.

aircraft carrying large fuel loads could produce fires that would greatly complicate rescue and recovery efforts.

Previous studies on aircraft crash impacts (Droste et al., 2002; Lange et al., 2002; HSK, 2003; RBR Consultants, 2003; Thomauske, 2003) suggest that the consequences of a heavy aircraft crash on a nuclear installation depend on factors such as the following:

- Type and design of the aircraft.
- Speed of the aircraft.
- Fuel loading of the aircraft and total weight at impact.
- Angle-of-attack and point-of-impact on the facility.
- Construction of the facility.
- Location of the target with respect to ground level (i.e., below or above grade).[10]
- The presence of surrounding buildings and other obstacles (e.g., hills, transmission lines) that might block certain potential flight paths into the facility.

In other words, the consequences of such attacks are scenario- and plant-design specific. It is not possible to make any general statements about spent fuel storage facility vulnerabilities to air attacks that would apply to all U.S. commercial nuclear power plants.

U.S. commercial nuclear power plants are not required by the Nuclear Regulatory Commission to defend against air attacks. The Commission believes that it is the responsibility of the U.S. government to implement security measures to prevent such attacks. The commercial nuclear industry shares this view. The Nuclear Regulatory Commission staff informed the committee that the Commission has directed power plant operators to take steps to reduce the likelihood of serious consequences should such attacks occur. The staff also informed the committee that the Commission may issue additional directives once the vulnerability analyses it is sponsoring at Sandia National Laboratories are completed. These analyses are described in the committee's classified report (see also Chapters 3 and 4 in this report).

2.2.2 Ground Attacks

Ground attacks on a nuclear facility could take three forms: (1) a direct assault on the facility by armed groups, (2) a stand-off attack using appropriate weapons, or (3) an assault having both air and ground components. The direct assault would likely be carried out by a group of well-armed and trained attackers, perhaps working with the assistance of an insider. The objective of such an attack would likely be to gain entry to protected and vital areas of the plant (FIGURE 2.1) to carry out radiological sabotage. The attackers would need to have knowledge of the design, location, and operation of the spent fuel facility to carry out such an attack successfully.

Commercial nuclear power plants are required by the Nuclear Regulatory Commission to maintain a professional guard force at each plant to defend against a Commission-developed design basis threat (DBT), which includes a ground assault. The protective force is a critical part of a nuclear power plant's security system for deterring,

[10] All current dry cask storage facilities in the United States are constructed at ground level, whereas spent fuel pools can be located above or below grade, depending on plant design (see Chapter 3).

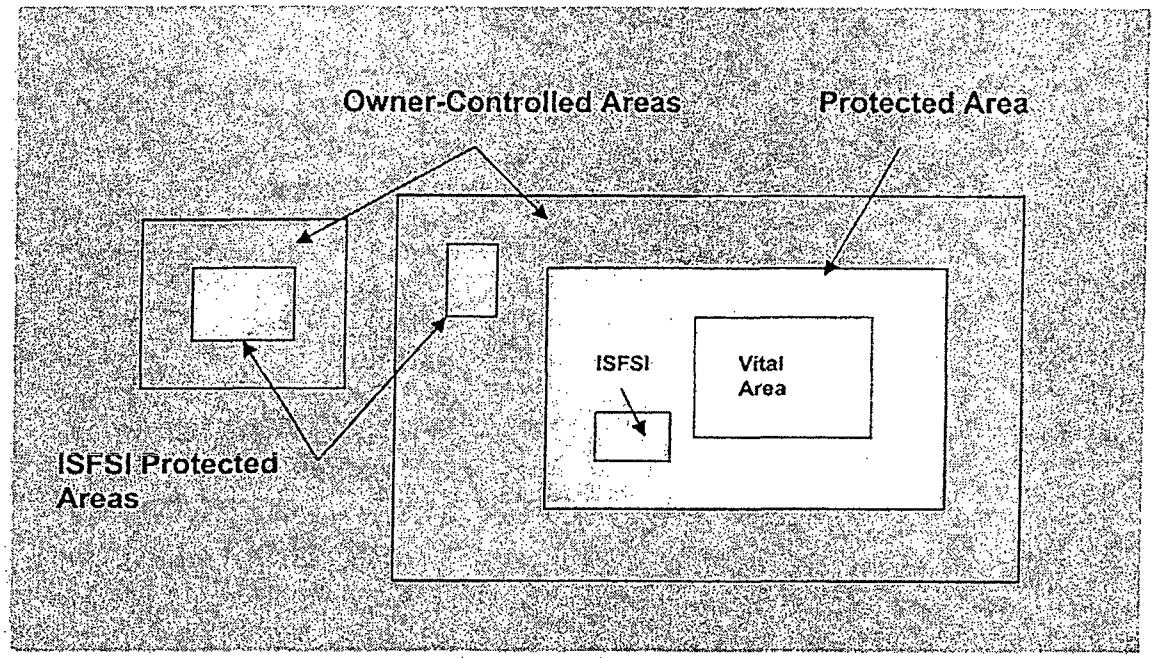


FIGURE 2.1 Commercial nuclear power plant sites are demarcated as shown for security purposes. The part of the power plant site over which the plant operator exercises control is referred to as the *owner-controlled area*. This usually corresponds to the boundary of the site. Located within this area are one or more *protected areas* to which access is restricted using guards, fences, and other barriers. Dry cask storage facilities, formally referred to as Independent Spent Fuel Storage Installations (ISFSIs), are located within these areas. The *vital area* of the plant contains the reactor core, support buildings, and the spent fuel pool. It is the most carefully controlled and guarded part of the plant site. SOURCE: Modified from Nuclear Regulatory Commission briefing materials (2004).

detecting, thwarting, or impeding attacks. The Commission staff declined to provide a formal briefing to the committee on the DBT for radiological sabotage, asserting that the committee did not have a need to know this information. Nevertheless, the committee was able to discern the details of the DBT from a series of presentations made by Nuclear Regulatory Commission staff. Commission staff also provided a fact check of this information as the classified report was being finalized.

Power plant operators are required to demonstrate to the Commission's satisfaction that there is "high assurance" that their guard forces can thwart the Commission-defined DBT assault. This guard force also must be able to provide deterrence against a beyond-DBT attack depending on the adversarial force. Reinforcing forces would be provided by local and state law enforcement as well as federal forces. The Commission staff also informed the committee that since the September 11, 2001, attacks, the Commission has been working with DHS to improve coordination procedures with federal, state, and local agencies to improve their response capabilities in the event of an attack. DHS also is making grants to local law enforcement agencies around power plant sites to raise their capabilities to respond to requests for assistance.

Since the September 11, 2001, attacks, the Nuclear Regulatory Commission has issued directives to power plant operators to enhance protection against vehicle bombs. The Commission also has issued directives to power plant operators to enhance protection against insider threats.

The committee does not have enough information to judge whether the measures at power plants are in fact sufficient to defend against either a DBT or a beyond-DBT attack on spent fuel storage. The Nuclear Regulatory Commission declined to provide detailed briefings to the committee on surveillance, security procedures, and security training at commercial nuclear power plants. Consequently, the committee was unable to evaluate their effectiveness. A recent General Accounting Office report (GAO, 2003) was critical of some of these procedures, but the committee has no basis for judging whether these criticisms were justified. Nevertheless, the committee judges that surveillance and security procedures at commercial nuclear power plants are just as important as physical barriers in preventing successful terrorist attacks and mitigating their consequences.

2.2.3 Attacks Having Both Air and Ground Components

Hybrid attacks that combine aspects of both air and ground attacks also could be mounted by terrorists. These could deliver attacking forces directly to a spent fuel storage facility, bypassing the security perimeters and security personnel deployed to protect against a ground attack. The committee considered various scenarios for such attacks. The committee judges that some scenarios are feasible. Details are provided in the classified report.

2.2.4 Terrorist Theft of Spent Fuel for Use in a Radiological Dispersal Device (RDD)

An RDD, or so-called dirty bomb, is a device that disperses radioactive material using chemical explosives or other means (NRC, 2002). RDDs do not involve fission-induced explosions of the kind associated with nuclear weapons. While RDD attacks can be carried out with any source of radioactivity, this discussion is confined to scenarios that involve the theft of spent fuel for such use.[11] A crude RDD device could be fabricated simply by loading stolen spent fuel onto a truck carrying high explosives. The truck could be driven to another location and detonated. The dispersal of radioactivity from such an attack would be unlikely to cause many immediate deaths, but there could be fatalities from the chemical explosion as well as considerable cleanup costs and adverse psychological effects.

It would be difficult for terrorists to steal a large quantity of spent fuel (e.g., a single spent fuel assembly) for use in an RDD for three reasons. First, spent fuel is highly radioactive and therefore requires heavy shielding to handle. Second, the use of heavy equipment would be required to remove spent fuel assemblies from a pool or dry cask. Third, controls are in place at plants to deter and detect such thefts. Additional details on these controls are provided in the classified report.

Theft and removal of an assembly or individual fuel rods during an assault on the plant might be easier, because the guard force would likely be preoccupied defending the plant. However, the amount of material that could be removed would be small, and getting it

[11] An attack on a spent fuel facility that resulted in the direct release of radioactivity would be an act of radiological sabotage of the kind considered previously in this chapter.

out of the plant would be time consuming and obvious to the plant defenders and other responding forces.

There are broken fuel rods and other debris, mostly from older assemblies, in storage at many plants. These materials are typically stored along the sides of the spent fuel pools and could be more easily removed from the plant than an entire assembly. Pieces of fuel rods also are sometimes intentionally removed from assemblies for offsite laboratory analysis. Some plants have misplaced fuel rod pieces.[12] A knowledgeable insider might be able to retrieve some of this material from the pool, but getting it out of the plant under normal operating conditions would be difficult.

Even the successful theft of a part of a spent fuel rod would provide a terrorist with only a relatively small amount of radioactive material. Superior materials could be obtained from other facilities. This material also can be purchased (Zimmerman and Loeb, 2004).

Moreover, even with explosive dissemination, it is unlikely that much of the spent fuel will be aerosolized unless it is incorporated into a well-designed RDD. More likely, such an event would break up and scatter the fuel pellets in relatively large chunks, which would not pose an overwhelming cleanup challenge.

Even though the likelihood of spent fuel theft appears to be small, it is nevertheless important that the protection of these materials be maintained and improved as vulnerabilities are identified.

2.3 RISKS OF TERRORIST ATTACKS ON SPENT FUEL STORAGE FACILITIES

Nuclear Regulatory Commission staff told the committee that it believes that the consequences of a terrorist attack on a spent fuel pool would likely unfold slowly enough that there would be time to take mitigative actions to prevent a large release of radioactivity. They also pointed out that since the September 11, 2001, attacks, the Nuclear Regulatory Commission has issued several orders that contain Interim Compensatory Measures that require power plant operators to consider potential mitigative actions in the event of such an attack. The committee received a briefing on some of these measures at one of its meetings. According to Commission staff, such measures provide an additional margin of safety.

The nuclear industry and the Nuclear Regulatory Commission have also asserted that the robust construction and stringent security requirements at nuclear power plants[13] make them less vulnerable to terrorist attack than softer targets such as chemical plants and refineries (e.g., Chapin et al., 2002). They argue that scarce resources should be devoted to

[12] For example, at the Millstone and Vermont Yankee plants in 2000 and 2003, respectively. In the case of Millstone, the Nuclear Regulatory Commission determined on the basis of extensive analysis that these rods were likely disposed of as low-level waste. After the committee's classified report was published, Commission staff informed the committee that Vermont Yankee had accounted for the missing rod segments and that Humbolt Bay had uncovered and is investigating an inventory discrepancy involving spent fuel rod segments.

[13] These arguments tend to be generic in nature and do not differentiate spent fuel pools from the rest of the power plant.

upgrading security at these other critical facilities rather than at already well-protected nuclear plants.

There are two unstated propositions in the argument that nuclear plants are less vulnerable than other facilities. The first speaks to the probability of terrorist attacks on such facilities; the second speaks to the consequences:

- *Proposition 1:* Nuclear power plants (and their spent fuel facilities) are less desirable as terrorist targets because they are robust and well protected.
- *Proposition 2:* If attacked, nuclear plants (and their spent fuel storage facilities) are likely to sustain little or no damage because they are robust and well protected.

The committee obtained a briefing from the Department of Homeland Security to address the first proposition. Details are provided in the classified report.

While the committee's classified report was in review, the National Commission on Terrorist Attacks Upon the United States issued a staff paper (Staff Statement No. 16, Outline of the 9/11 Plot, pages 12-13) suggesting that al-Qaida initially included unidentified nuclear plants among an expanded list of targets for the September 11, 2001, attacks. According to that report, these plants were eliminated from the target list along with several other facilities when the terrorist organization scaled back the number of planned attacks. Nevertheless, if this information is correct, it provides further indications that commercial nuclear power plants are of interest to terrorist groups,[14] even though softer targets may have a higher priority with many terrorists.

With respect to the first proposition, the committee judges that it is not prudent to dismiss nuclear plants, including their spent fuel storage facilities, as undesirable targets for attacks by terrorists.

As to the second proposition that terrorist attacks are likely to cause little or no damage, a poorly designed attack or an attack by unsophisticated terrorists might produce little physical damage to the plant. There could, however, be severe adverse psychological effects from such an attack that could have considerable economic consequences. On the other hand, attacks by knowledgeable terrorists with access to advanced weapons might cause considerable physical damage to a spent fuel storage facility, especially in a suicide attack.

It is important to recognize that an attack that damages a power plant or its spent fuel facilities would not necessarily result in the release of *any* radioactivity to the environment. While it may not be possible to deter such an attack, there are many potential mitigation steps that can be taken to lower its potential consequences should an attack occur. These are discussed in some detail in the committee's classified report (see also Chapters 3 and 4 in this report).

[14] In another example of concern, police in Toronto, Canada, detained 19 men in August 2003 based on suspicious activities that included surveillance and flying lessons that would take them over a nuclear power plant (Ferguson et al., 2004).

In summary, the committee judges that the plausibility of an attack on a spent fuel storage facility, coupled with the public fear associated with radioactivity, indicates that the possibility of attacks cannot be dismissed.

2.4 FINDINGS AND RECOMMENDATIONS

With respect to the committee's task to "explicitly consider the risks of terrorist attacks on [spent fuel] and the risk these materials might be used to construct a radiological dispersal device," the committee offers the following findings and recommendations:

FINDING 2A: The probability of terrorist attacks on spent fuel storage cannot be assessed quantitatively or comparatively. Spent fuel storage facilities cannot be dismissed as targets for such attacks because it is not possible to predict the behavior and motivations of terrorists, and because of the attractiveness of spent fuel as a terrorist target given the well-known public dread of radiation.

Terrorists view nuclear power plant facilities as desirable targets because of the large inventories of radionuclides they contain. The committee believes that knowledgeable terrorists might choose to attack spent fuel pools because (1) at U.S. commercial power plants, these pools are less well protected structurally than reactor cores; and (2) they typically contain inventories of medium- and long-lived radionuclides that are several times greater than those contained in individual reactor cores.

FINDING 2B: The committee judges that the likelihood terrorists could steal enough spent fuel for use in a significant radiological dispersal device is small.

Spent fuel assemblies in pools or dry casks are large, heavy, and highly radioactive. They are too large and radioactive to be handled by a single individual. Removal of an assembly from the pool or dry cask would prove extremely difficult under almost any terrorist attack scenario. Attempts by a knowledgeable insider(s) to remove single rods and related debris from the pool might prove easier, but it would likely be very difficult to get it out of the plant under normal operating conditions. Theft and removal during an assault on the plant might be easier because the guard force would likely be occupied defending the plant. However, the amount of material that could be removed would be small. Moreover, there are other facilities from which highly radioactive material could be more easily stolen, and this material also can be purchased. Even though the likelihood of spent fuel theft appears to be small, it is nevertheless important that the protection of these materials be maintained and improved as vulnerabilities are identified.

RECOMMENDATION: The Nuclear Regulatory Commission should review and upgrade, where necessary, its security requirements for protecting spent fuel rods not contained in fuel assemblies from theft by knowledgeable insiders, especially in facilities where individual fuel rods or portions of rods are being stored in pools.

FINDING 2C: A number of security improvements at nuclear power plants have been instituted since the events of September 11, 2001. The Nuclear Regulatory Commission did not provide the committee with enough information to evaluate the effectiveness of these procedures for protecting stored spent fuel.

Surveillance and security procedures are just as important as physical barriers in preventing and mitigating terrorist attacks. The Nuclear Regulatory Commission declined to provide the committee with detailed briefings on the surveillance and security procedures that are now in place to protect spent fuel facilities at commercial nuclear power plants against terrorist attacks. Although the committee did learn about some of the changes that have been instituted since the September 11, 2001, attacks, it was not provided with enough information to evaluate the effectiveness of procedures now in place.

RECOMMENDATION: Although the committee did not specifically investigate the effectiveness and adequacy of improved surveillance and security measures for protecting stored spent fuel, an assessment of current measures should be performed by an independent[15] organization.

[15] That is, independent of the Nuclear Regulatory Commission and the nuclear industry.

3

SPENT FUEL POOL STORAGE

This chapter addresses the first charge of the committee's statement of task to assess "potential safety and security risks of spent nuclear fuel presently stored in cooling pools at commercial reactor sites."[1] As noted in Chapter 1, storage of spent fuel in pools at commercial reactor sites has three primary objectives:

- Cool the fuel to prevent heat-up to high temperatures from radioactive decay.
- Shield workers and the public from the radiation emitted by radioactive decay in the spent fuel and provide a barrier for any releases of radioactivity.
- Prevent criticality accidents.

The first two of these objectives could be compromised by a terrorist attack that partially or completely drains the spent fuel pool.[2] The committee will refer to such scenarios as "loss-of-pool-coolant" events. Such events could have several deleterious consequences: Most immediately, ionizing radiation levels in the spent fuel building rise as the water level in the pool falls. Once the water level drops to within a few feet (a meter or so) of the tops of the fuel racks, elevated radiation fields could prevent direct access to the immediate areas around the lip of the spent fuel pool building by workers. This might hamper but would not necessarily prevent the application of mitigative measures, such as deployment of fire hoses to replenish the water in the pool.

The ability to remove decay heat from the spent fuel also would be reduced as the water level drops, especially when it drops below the tops of the fuel assemblies. This would cause temperatures in the fuel assemblies to rise, accelerating the oxidation of the zirconium alloy (zircaloy) cladding that encases the uranium oxide pellets. This oxidation reaction can occur in the presence of both air and steam and is strongly exothermic—that is, the reaction releases large quantities of heat, which can further raise cladding temperatures. The steam reaction also generates large quantities of hydrogen:

Reaction in air:	$Zr + O_2 \rightarrow ZrO_2$	heat released = 1.2×10^7 joules/kilogram
Reaction in steam:	$Zr + 2H_2O \rightarrow ZrO_2 + 2H_2$	heat released = 5.8×10^6 joules/kilogram

[1] A basic description of pool storage can be found in Chapter 1 and historical background can be found in Appendix D. Section 3.1 provides additional technical details about pool storage.

[2] The committee could probably design configurations in which fuel might be deformed or relocated to enable its re-criticality, but the committee judges such an event to be unlikely. Also, the committee notes that while re-criticality would certainly be an undesirable outcome, criticality accidents have happened several times at locations around the world and have not been catastrophic offsite. An accompanying breach of the fuel cladding would still be the chief concern.

These oxidation reactions can become locally self-sustaining (i.e., autocatalytic[3]) at high temperatures (i.e., about a factor of 10 higher than the boiling point of water) if a supply of oxygen and/or steam is available to sustain the reactions. (These reactions will not occur when the spent fuel is under water because heat removal prevents such high temperatures from being reached).The result could be a runaway oxidation reaction—referred to in this report as a *zirconium cladding fire*—that proceeds as a burn front (e.g., as seen in a forest fire or a fireworks sparkler) along the axis of the fuel rod toward the source of oxidant (i.e., air or steam). The heat released from such fires can be even greater than the decay heat produced in newly discharged spent fuel.

As fuel rod temperatures increase, the gas pressure inside the fuel rod increases and eventually can cause the cladding to balloon out and rupture. At higher temperatures (around 1800°C [approximately 3300°F]), zirconium cladding reacts with the uranium oxide fuel to form a complex molten phase containing zirconium-uranium oxide. Beginning with the cladding rupture, these events would result in the release of radioactive fission gases and some of the fuel's radioactive material in the form of aerosols into the building that houses the spent fuel pool and possibly into the environment. If the heat from one burning assembly is not dissipated, the fire could spread to other spent fuel assemblies in the pool, producing a propagating zirconium cladding fire.

The high-temperature reaction of zirconium and steam has been described quantitatively since at least the early 1960s (e.g., Baker and Just, 1962). The accident at the Three Mile Island Unit 2 reactor and a set of experiments (e.g., CORA, FPT 1-6, CODEX, ORNL-VI, VERCORS) have provided a basis for understanding the phenomena of zirconium cladding fires and fission-product releases from irradiated fuel in a reactor core accident. This understanding and data from the experiments form the foundation for computer simulations of severe accidents involving nuclear fuel. These experiments and computer simulations are for inside-reactor vessel events rather than events in an open-air spent fuel pool array.

This chapter examines possible initiating factors for such loss-of-pool-coolant events and the potential consequences of such events. It is organized into the following four main sections:

- Background on spent fuel pool storage.
- Previous studies on safety and security of pool storage.
- Evaluation of the potential risks of pool storage.
- Findings and recommendations.

[3] That is, the reaction heat will increase temperatures in adjacent areas of the fuel rod, which in turn will accelerate oxidation and release even more heat. Autocatalytic oxidation leading to a "runaway" reaction requires a complex balance of heat and mass transfer, so assigning a specific ignition temperature is not possible. Empirical equations have been developed to predict the reaction rate as a function of temperature when steam and oxygen supply are not limited (see, e.g., Tong and Weisman, 1996, p. 223). Numerous scaled experiments have found that the oxidation reaction proceeds very slowly below approximately 900°C (1700°F).

3.1 BACKGROUND ON SPENT FUEL POOL STORAGE

After a power reactor is shut down, its nuclear fuel continues to produce heat from radioactive decay (see FIGURE 1.2). Although only one-third of the fuel in the reactor core is replaced during each refueling cycle, operators commonly offload the entire core (especially at pressurized water reactors [PWRs]) into the pool during refueling[4] to facilitate loading of fresh fuel or for inspection or repair of the reactor vessel and internals. Heat generation in the pool is at its highest point just after the full core has been offloaded.

Pool heat loads can be quite high, as exemplified by a "typical" boiling water reactor (BWR) which was used in some of the analyses discussed elsewhere in this chapter (this BWR is hereafter referred to as the "reference BWR"). This pool has approximately 3800 locations for storage of spent fuel assemblies, about 3000 of which are occupied by four-and-one-third reactor cores (13 one-third-core offloads) in a pool approximately 35 feet wide, 40 feet long, and 39 feet deep (10.7 meters wide, 12.2 meters long, and 11.9 meters deep) with a water capacity of almost 400,000 gallons (1.51 million liters). According to Nuclear Regulatory Commission staff, the total decay heat in the spent fuel pool is 3.9 megawatts (MW) ten days after a one-third-core offload. The vast majority of this heat is from decay in the newly discharged spent fuel. Heat loads would be substantially higher in spent fuel pools that contained a full-core offload.

Although spent fuel pools have a variety of designs, they share one common characteristic: Almost all spent fuel pools are located outside of the containment structure that holds the reactor pressure vessel.[5] In some reactor designs, the spent fuel pools are contained within the reactor building,[6] which is typically constructed of about 2 feet of reinforced concrete (see FIGURE 3.1). In other designs, however, one or more walls of the spent fuel pool may be located on the exterior wall of an auxiliary building that is located adjacent to the containment building (see FIGURE 3.2). As described in more detail below, some pools are built at or below grade, whereas others are located at the top of the reactor building.

The enclosing superstructures above the pool are typically steel, industrial-type buildings designed to house cranes that are used to move reactor components, spent fuel, and spent fuel casks. These superstructures above the pool are designed to resist damage from seismic loads but not from large tornado-borne missiles (e.g., cars and telephone poles), which would usually impact the superstructures at low angles (i.e., moving horizontally). In contrast, the typical spent fuel pool is robust. The pool walls and the external walls of the building housing the pool (these external walls may incorporate one or more pool walls in some plants) are designed for seismic stability and to resist horizontal

---

[4] A 1996 survey by the Nuclear Regulatory Commission (USNRC, 1996) found that the majority of commercial power reactors routinely offload their entire core to the spent fuel pool during refueling outages. The practice is more common among PWRs than BWRs, which tend to offload only that fuel that is to be replaced, but some BWRs do offload the full core. In response to a committee inquiry, an Energy Resources International staff member confirmed that this is still the case today.

[5] The exceptions in the United States are the Mark III BWRs, which have two pools, one of which is inside the containment. As discussed in Appendix C, spent fuel pools at German commercial nuclear power plants also are located inside reactor containment structures.

[6] A PWR containment structure is a large, domed building that houses the reactor pressure vessel, the steam generators, and other equipment. In a BWR, the containment structure houses less equipment, is located closer in to the pressure vessel, and sits inside a building called the reactor building, which also houses the spent fuel pool and safety-related equipment to support the reactor.

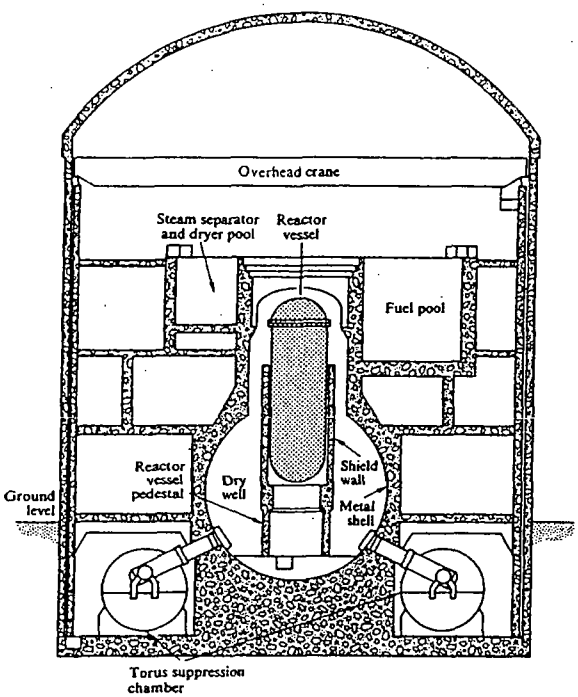


FIGURE 3.1 Schematic section through a G.E. Mark I BWR reactor plant. The spent fuel pool is located in the reactor building well above ground level. This diagram is for a BWR with a reinforced concrete superstructure (roof). Most designs have thin steel superstructures. SOURCE: Lamarsh (1975, Figure 11.3).

strikes of tornado missiles. The superstructures and pools were not, however, specifically designed to resist terrorist attacks.

The typical spent fuel pool is about 40 feet (12 meters) deep and can be 40 or more feet (12 meters) in each horizontal dimension. The pool walls are constructed of reinforced concrete typically having a thickness between 4 and 8 feet (1.2 to 2.4 meters). The pools contain a ¼- to ½-inch-thick (6 to 13 mm) stainless steel liner, which is attached to the walls with studs embedded in the concrete. The pools also contain vertical storage racks for holding spent and fresh fuel assemblies, and some pools have a gated compartment to hold a spent fuel storage cask while it is being loaded and sealed (see Chapter 4).

The storage racks are about 13 feet (4 meters) in height and are installed near the bottom of the spent fuel pool. The racks have feet to provide space between their bottoms and the pool floor. There is also space between the sides of the rack and the steel pool liners for circulation of water (FIGURE 3.3). There are about 26 feet (8 meters) of water above the top of the spent fuel racks. This provides substantial radiation shielding even when an assembly is being moved above the rack. Transfers of spent fuel from the reactor core to the spent fuel pool or from the pool to storage casks are carried out underwater to provide shielding and cooling.

The general elevation of the spent fuel pool matches that of the vessel containing the reactor core. Pressurized water reactor designs use comparatively shorter reactor

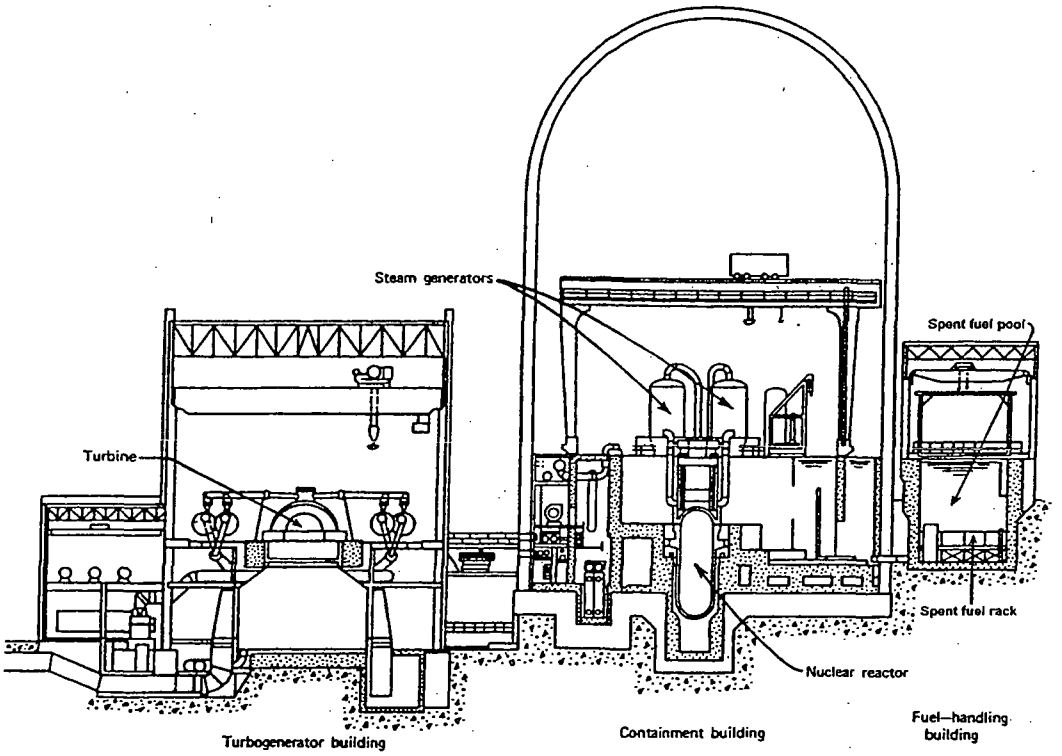


FIGURE 3.2 Schematic section through a PWR reactor plant. The spent fuel pool is located in the fuel-handling building next to the domed reactor containment building at or slightly below ground level. SOURCE: Modified from Duderstadt and Hamilton (1976, Figure 3-4).

vessels closer to ground level (grade) and also have spent fuel pools that are close to grade (FIGURE 3.2). The design shown in this figure is typical of the fuel pool arrangement for PWRs. Nuclear power plant sites that contain two reactors are usually arranged in a mirror-image fashion, with the two spent fuel pools (or a shared pool) located in a common area adjoining both reactor buildings. For single-plant or two-plant arrangements, the building covering the spent fuel pool and crane structures is typically an ordinary steel industrial building. There are 69 PWRs currently in operation in the United States; 6 PWRs have been decommissioned but continue to have active spent fuel pool storage.

In contrast, in boiling water reactor designs, the reactor vessel is at a higher elevation, and the BWR vessels are somewhat taller than PWR vessels.[7] Consequently, BWRs have more elevated spent fuel pools, generally well above grade. FIGURE 3.1 shows the general design for the 22 BWR Mark I plants operating in the United States.

Nuclear Regulatory Commission staff is conducting a survey of the plants to obtain a better understanding of the variations in design of spent fuel pools across the nation. The following information was provided to the committee from that survey:

[7] The higher elevation accommodates control mechanisms that sit under the reactor, and the extra height accommodates steam separation and drying equipment at the top of the vessel. The fuel is about the same length as PWR fuel.

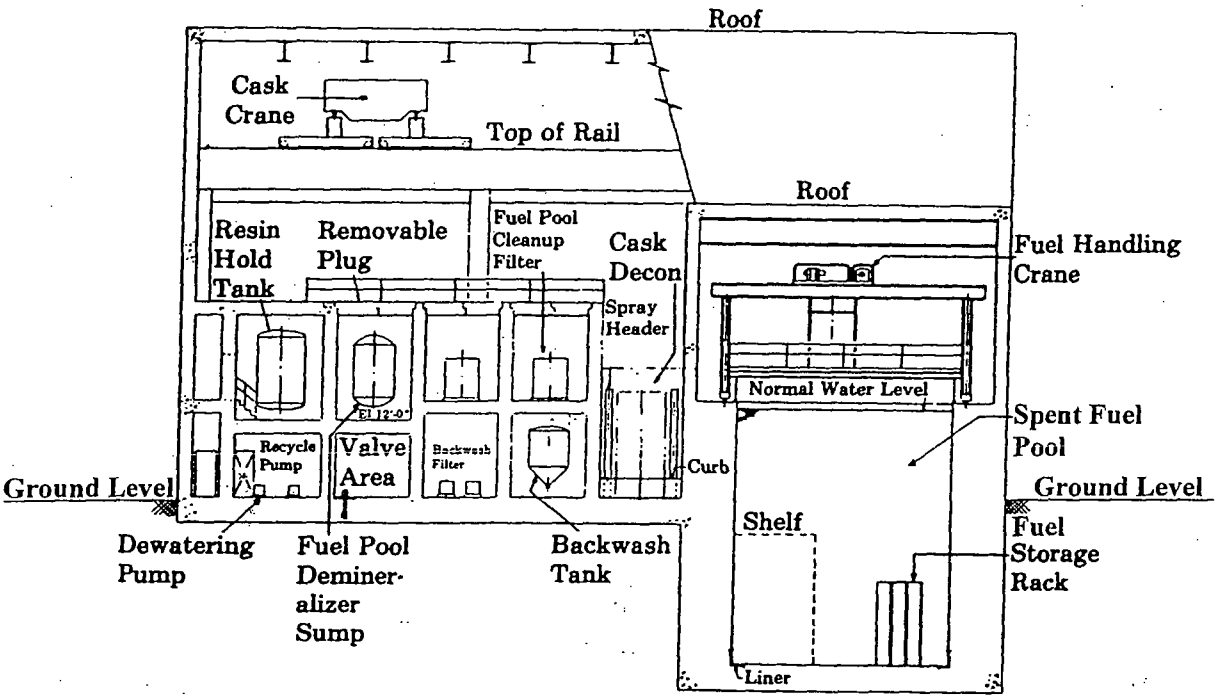


FIGURE 3.3 Example of a section of a PWR spent fuel pool and support facilities. The pool is located to the right in the figure; the support equipment to the left. SOURCE: American Nuclear Society (1988).

- PWR spent fuel pools: Spent fuel pools are located in buildings adjoining the reactor containment buildings at PWR plants (see FIGURE 3.2). Some pools are positioned such that their spent fuel is below grade. As shown in Figure 3.2, some pool walls also serve as the external walls of the spent fuel pool buildings. Some plants have structures surrounding the spent fuel pool building that would provide some shielding of the pools from low-angle line-of-sight attacks. A more complete plant survey would be needed to establish the extent of pool exposure to such attacks.
- BWR spent fuel pools: MARK I and II BWR plants are located above grade and are shielded by at least one exterior building wall. Some pools are also shielded by the reactor buildings. Some pools are also shielded by "significant" surrounding structures, and some have supplemental floor and column supports.

The vulnerability of a spent fuel pool to terrorist attack depends in part on its location with respect to ground level as well as its construction. Pools are potentially susceptible to attacks from above or from the sides depending on their elevation with respect to grade and the presence of surrounding shielding structures.

As noted in Chapter 1, nearly all pools contain high-density spent fuel racks. These racks allow approximately five times as many assemblies to be stored in the pool as would have been possible with the original racks, which had open lateral channels between the fuel assemblies to enhance water circulation.

3.2 PREVIOUS STUDIES ON SAFETY AND SECURITY OF POOL STORAGE

Several reports have been published on the safety of spent fuel pool storage. One of the earliest analyses was contained in the *Reactor Safety Study* (U.S. Atomic Energy Commission, 1975), which concluded that spent fuel pool safety risks were very much smaller than those involving the cores of nuclear reactors. This conclusion is not surprising: The cooling system in a spent fuel pool is simple. The coolant is at atmospheric pressure; the spent fuel is in a subcritical configuration and generates little heat relative to that generated in an operating reactor; and the design and location of piping in the pool make a severe loss-of-pool-coolant event unlikely during normal operating conditions. Despite changes in reactor and fuel storage operations, such as longer fuel residence times in the core and higher-density pool storage, the conclusions of that study are still broadly applicable today. It is important to recognize, however, that the *Reactor Safety Study* did not address the consequences of terrorist attacks.

The Nuclear Regulatory Commission and its contractors have periodically re-analyzed the safety of spent nuclear fuel storage (see Benjamin et al., 1979; BNL, 1987, 1997; USNRC, 1983, 2001a, 2003b). All of these studies suggest that a loss-of-pool-coolant event could trigger a zirconium cladding fire in the exposed spent fuel. The Nuclear Regulatory Commission considered such an accident to be so unlikely that no specific action was warranted, despite changes in reactor operations that have resulted in increased fuel burn-ups and fuel storage operations that have resulted in more densely packed spent fuel pools.

In 2001, the Nuclear Regulatory Commission published NUREG-1738, *Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants,* to provide a technical basis for rulemaking for power plant decommissioning (USNRC, 2001a). A draft of the study was issued for public comments, including comments by the Advisory Committee on Reactor Safeguards and a quality review of the methods, assumptions, and models used in the analysis was carried out by the Idaho National Engineering and Environmental Laboratory.

The study provided a probabilistic risk assessment that identified severe accident scenarios and estimated their consequences. The analysis determined, for a given set of fuel characteristics, how much time would be required to boil off enough water to allow the fuel rods to reach temperatures sufficient to initiate a zirconium cladding fire.

The analysis suggested that large earthquakes and drops of fuel casks from an overhead crane during transfer operations were the two event initiators that could lead to a loss-of-pool-coolant accident. For cases where active cooling (but not the coolant) has been lost, the thermal-hydraulic analyses suggested that operators would have about 100 hours (more than four days) to act before the fuel was uncovered sufficiently through boiling of cooling water in the pool to allow the fuel rods to ignite. This time was characterized as an "underestimate" given the simplifications assumed for the loss-of-pool-coolant scenario.

The overall conclusion of the study was that the risk of a spent fuel pool accident leading to a zirconium cladding fire was low despite the large consequences because the predicted frequency of such accidents was very low. The study also concluded, however, that the consequences of a zirconium cladding fire in a spent fuel pool could be serious and, that once the fuel was uncovered, it might take only a few hours for the most recently discharged spent fuel rods to ignite.

A paper by Alvarez et al. (2003a; see also Thompson, 2003) took the analyses in NUREG-1738 to their logical ends in light of the September 11, 2001, terrorist attacks: Namely, what would happen if there were a loss-of-pool-coolant event that drained the spent fuel pool? Such an event was not considered in NUREG-1738, but the analytical results in that study were presented in a manner that made such an analysis possible.

Alvarez and his co-authors concluded that such an event would lead to the rapid heat-up of spent fuel in a dense-packed pool to temperatures at which the zirconium alloy cladding would catch fire and release many of the fuel's fission products, particularly cesium-137. They suggested that the fire could spread to the older spent fuel, resulting in long-term contamination consequences that were worse than those from the Chernobyl accident. Citing two reports by Brookhaven National Laboratory (BNL, 1987, 1997), they estimated that between 10 and 100 percent of the cesium-137 could be mobilized in the plume from the burning spent fuel pool, which could cause tens of thousands of excess cancer deaths, loss of tens of thousands of square kilometers of land, and economic losses in the hundreds of billions of dollars. The excess cancer estimates were revised downward to between 2000 and 6000 cancer deaths in a subsequent paper (Beyea et al., 2004) that more accurately accounted for average population densities around U.S. power plants.

Alvarez and his co-authors recommended that spent fuel be transferred to dry storage within five years of discharge from the reactor. They noted that this would reduce the radioactive inventories in spent fuel pools and allow the remaining fuel to be returned to open-rack storage to allow for more effective coolant circulation, should a loss-of-pool-coolant event occur. The authors also discussed other compensatory measures that could be taken to reduce the consequences of such events.

The Alvarez et al. (2003a) paper received extensive attention and comments, including a comment from the Nuclear Regulatory Commission staff (USNRC, 2003a; see Alvarez et al., 2003b, for a response). None of the commentators challenged the main conclusion of the Alvarez et al. (2003a) paper that a severe loss-of-pool-coolant accident might lead to a spent fuel fire in a dense-packed pool. Rather, the commentators challenged the likelihood that such an event could occur through accident or sabotage, the assumptions used to calculate the offsite consequences of such an event, and the cost-effectiveness of the authors' proposal to move spent fuel into dry cask storage. One commentator summarized these differences in a single sentence (Benjamin, 2003, p. 53): "In a nutshell, [Alvarez et al.] correctly identify a problem that needs to be addressed, but they do not adequately demonstrate that the proposed solution is cost-effective or that it is optimal."

The Nuclear Regulatory Commission staff provided a briefing to the committee that provides a further critique of the Alvarez et al. (2003a) analysis that goes beyond the USNRC (2003a) paper. Commission staff told the committee that the NUREG-1738 analyses attempted to provide a bounding analysis of current and conceivable future spent fuel pools at plants undergoing decommissioning and therefore relied on conservative assumptions. The analysis assumed, for example, that the pool contained an equivalent of three-and-one-half reactor cores of spent fuel, including the core from the most recent reactor cycle. The staff also asserted that NUREG-1738 did not provide a realistic analysis of consequences. Commission staff concluded that "the risks and potential societal cost of [a] terrorist attack on spent fuel pools do not justify the complex and costly measures

proposed in Alvarez et al. (2003) to move and store 1/3 of spent fuel pools [sic] inventory in dry storage casks."[8]

The committee provides a discussion of the Alvarez et al. (2003a) analysis in its classified report. The committee judges that some of their release estimates should not be dismissed.

The 2003 Nuclear Regulatory Commission (USNRC, 2003b) staff publication NUREG-0933, *A Prioritization of Generic Safety Issues*,[9] discusses beyond-design-basis accidents in spent fuel pools. The study draws some of the same consequence conclusions as the Alvarez et al. (2003a) paper. It notes that in a dense-packed pool, a zirconium cladding fire "would probably spread to most or all of the spent fuel pool" (p. 1). This could drive what the report refers to as "borderline aged fuel" into a molten condition leading to the release of fission products comparable to molten fuel in a reactor core.

The NUREG-0933 report (USNRC, 2003b) summarizes technical analyses of the frequencies of severe accidents for three BWR scenarios. The report concludes that the greatest risk is from a beyond-design-basis seismic event. While the consequences of such accidents are considerable, the report concludes that their frequencies are no greater than would be expected for reactor core damage accidents due to seismic events beyond the design basis safe shutdown earthquake.

An analysis of spent fuel operating experience by the Nuclear Regulatory Commission staff (USNRC, 1997) showed that several accidental partial-loss-of-pool-coolant events have occurred as a result of human error. Two of these involved the loss of more than 5 feet of water from the pool, but none had serious consequences. Nevertheless, Commission staff suggested that plant-specific analyses and corrective actions should be taken to reduce the potential for such events in the future.

It is important to recognize that with the exception of the Alvarez et al. (2003a) paper, all of the previous U.S. work reviewed by the committee has focused on safety risks, not security risks. The Nuclear Regulatory Commission analyses of spent fuel storage vulnerabilities were not completed by the time the committee finalized its information gathering for this report, but the committee did receive briefings on this work. In addition, analyses have been undertaken of external impacts on power plant structures by aircraft for the few commercial power plants that are located close enough to airports to consider hardening of the plant design to resist accidental aircraft crashes. These analyses were done as part of the plants' licensing safety analyses. The committee did not look further into these few plants because the aircraft considered were smaller and the impact velocities considered were much lower than those that might be brought to bear in a well-planned terrorist attack.

The committee did learn about work to assess the risks of spent fuel storage to terrorist attacks in Germany (see Appendix C for a description). However, the details of this work are classified by the German government and therefore are unavailable to the

---

[8] The quote is from a PowerPoint presentation made by Nuclear Regulatory Commission staff to the committee at one of its meetings.

[9] NUREG-0933 is a historical record that provides a yearly update of generic safety issues. It does not provide any additional technical analysis of these issues.

committee for review. Consequently, the committee was unable to provide a technical assessment.

3.3 EVALUATION OF THE POTENTIAL RISKS OF POOL STORAGE

Prior to the September 11, 2001, terrorist attacks, spent fuel pool analyses by the Nuclear Regulatory Commission were focused almost exclusively on safety. On the basis of these analyses, the Commission concluded that spent fuel storage carried risks that were no greater (and likely much lower) than risks for operating nuclear reactors, as discussed in the previous section of this chapter.

The September 11, 2001, terrorist attacks raised the possibility of a new kind of threat to commercial power plants and spent fuel storage: premeditated, carefully planned, high-impact attacks by terrorists to damage these facilities for the purpose of releasing radiation to the environment and spreading fear and panic among civilian populations. The Commission informed the committee that its conclusions about risks of spent fuel storage are now being reevaluated in light of these new threats.

Prior to September 11, the Nuclear Regulatory Commission viewed the most credible sabotage event as a violent external land assault by small groups of well-trained, heavily armed individuals aided by a knowledgeable insider.[10] The Commission has long-established requirements for physical protection systems at power plants to thwart such assaults. The committee was told that these requirements have been increased since the September 11, 2001, attacks. To the committee's knowledge, there are currently no requirements in place to defend against the kinds of larger-scale, premeditated, skillful attacks that were carried out on September 11, 2001, whether or not a commercial aircraft is involved. Staff from the Nuclear Regulatory Commission and representatives from the nuclear industry repeatedly told the committee that they view detecting, preventing, and thwarting such attacks as the federal government's responsibility.

It is important to recognize that nuclear power plants in the United States and most of the rest of the world[11] were designed primarily with safety, not security, in mind.[12] The reinforced concrete containment buildings that house the reactors were designed to contain internal pressures of up to about 4 atmospheres in case steam is released in the event of various hypothetical reactor accidents. These and other plant structures were not specifically designed to resist external terrorist attacks, although their robust construction would certainly provide significant protection against external assaults with airplanes or other types of weapons. Moreover, commercial power plants are substantially more robust than other critical infrastructure such as chemical plants, refineries, and fossil-fuel-fired electrical generating stations.

---

[10] This is known as the "design basis threat" for radiological sabotage of nuclear power plants. See Chapter 2.

[11] Spent fuel storage facilities in Germany are designed to survive the impact of a Phantom military jet without a significant release of radiation. Since September 11, 2001, the Germans have also examined the impact of a range of aircraft, including large civilian airliners, on these facilities. A discussion is provided in Appendix C.

[12] No nuclear power plant ordered after the mid-1970s has been built in the United States, so the designs were developed long before domestic terrorism of the kind seen on September 11, 2001, became a concern.

In the wake of the September 11, 2001, attacks, a great deal of additional work has been or is being carried out by government and private entities to assess the security risks posed by terrorist attacks against nuclear power plants and spent fuel storage. The committee provides a discussion of these studies in the following subsections. Some of these studies are still in progress.

The committee's discussion of this work in the following subsections is organized around the following two questions:

(1) Could an accident or terrorist attack lead to a loss-of-pool-coolant event that would partially or completely drain a spent fuel pool?
(2) What would be the radioactive releases if a pool were drained?

3.3.1 Could a Terrorist Attack Lead to a Loss-of-Pool-Coolant Event?

A terrorist attack that either disrupted the cooling system for the spent fuel pool or damaged or collapsed the pool itself could potentially lead to a loss-of-pool-coolant event. The cooling system could be disrupted by disabling or damaging the system that circulates water from the pool to heat exchangers to remove decay heat. This system would not likely be a primary target of a terrorist attack, but it could be damaged as the result of an attack on the spent fuel pool or other targets at the plant (e.g., the power for the pumps could be interrupted). The loss of cooling capacity would be of much greater concern were it to occur during or shortly after a reactor offloading operation, because the pool would contain a large amount of high decay-heat fuel.

The consequences of a damaged cooling system would be quite predictable: The temperature of the pool water would rise until the pool began to boil. Steam produced by boiling would carry away heat, and the steam would cool as it expanded into the open space above the pool.[13] Boiling would slowly consume the water in the pool, and if no additional water were added the pool level would drop. It would likely take several days of continuous boiling to uncover the fuel. Unless physical access to the pool were completely restricted (e.g., by high radiation fields or debris), there would likely be sufficient time to bring in auxiliary water supplies to keep the water level in the pool at safe levels until the cooling system could be repaired. This conclusion presumes, of course, that technical means, trained workers, and a sufficient water supply were available to implement such measures. The Nuclear Regulatory Commission requires that alternative sources of water be identified and available as an element of each plant's operating license.

The pool-boiling event described above could result in the release of small amounts of radionuclides that are normally present in pool water.[14] These radionuclides would likely have little or no offsite impacts given their small concentrations in the steam and their subsequent dilution in air once released to the environment. Moreover, as long as the spent fuel is covered with a steam-water mixture, it would not heat up sufficiently for the cladding to ignite.

A loss-of-pool-coolant event resulting from damage or collapse of the pool could

[13] The building above the spent fuel pool contains blow-out panels that could be removed to provide additional ventilation.
[14] This contamination may enter the water from damaged fuel or from neutron-activated materials that build up on the external surfaces of the fuel assemblies. The latter material is referred to as "crud."

have more severe consequences. Severe damage of the pool wall could potentially result from several types of terrorist attacks, for instance:

(1) Attacks with large civilian aircraft.
(2) Attacks with high-energy weapons.
(3) Attacks with explosive charges.

The committee reviewed two independent analyses of aircraft impacts on power plant structures: A study sponsored by EPRI completed in 2002 provides a generic analysis of civilian airliner impacts on commercial power plant structures (EPRI, 2002). A study in progress by Sandia National Laboratories for the Nuclear Regulatory Commission examines the consequences of an aircraft impact on an actual BWR power plant.

The EPRI and Sandia analyses used different finite element and finite difference codes that are in common use in research and industry.[15] Both sets of analyses attempted to validate the codes against physical tests, such as the Sandia "slug tests" that impacted water barrels into a concrete test wall at high speeds. EPRI's analysis used a Riera impact loading condition, which models the aircraft impact on a rigid structure and is a slightly conservative assumption because the structures are in fact deformable. The Sandia analysis was carried out on powerful computers that allowed the aircraft to be included explicitly in the calculations.

The committee also reviewed the preliminary results of Nuclear Regulatory Commission studies on the response of thick reinforced concrete walls such as those used in spent fuel pools to attacks involving simple explosive charges and other high-energy devices. The details of the analyses were not provided and therefore could not be evaluated quantitatively. However, some of these preliminary results are described in the committee's classified report.

The results of these aircraft and assault studies are classified or safeguards information. The committee has concluded that there are some scenarios that could lead to the partial failure of the spent fuel pool wall, thereby resulting in the partial or complete loss of pool coolant. A zirconium cladding fire could result if timely mitigative actions to cool the fuel were not taken. Details are provided in the classified report.

3.3.2 What would be the Radioactive Releases if a Pool Were Drained?

There are two ways in which an attack on a spent fuel pool could spread radioactive contamination: mechanical dispersion and zirconium cladding fires. An explosion or high-energy impact directly on the spent fuel could mechanically pulverize and loft fuel out of the pool. This would contaminate the plant and surrounding site with pieces of spent fuel. Large-

[15] The EPRI analyses used several finite element models (ABAQUS, LS DYNA, ANACAP, and WINFRITH) and Riera impact functions. The Sandia analyses used the CTH finite difference model and the Pronto3D finite element analysis model. The CTH code has been used for a wide range of impact penetration and explosive detonation problems by the Department of Energy, the Department of Defense, and industry during the past decade. CTH results have been compared extensively with experimental results. As an Eulerian code (where material flows through a fixed grid) it can readily handle severe distortions. It also has a variety of computational material models for dynamic (high-strain-rate) conditions, although it is limited in that it does not explicitly model structural members, such as rebar and metal liners in the concrete structure, because of computational requirements.

scale offsite releases of the radioactive constituents would not occur, however, unless they were mobilized by a zirconium cladding fire that melted the fuel pellets and released some of their radionuclide inventory. Such fires would create thermal plumes that could potentially transport radioactive aerosols hundreds of miles downwind under appropriate atmospheric conditions.

The Nuclear Regulatory Commission is now sponsoring work at Sandia National Laboratories to improve upon the analyses in NUREG-1738 (USNRC, 2001a), and in particular to obtain an improved phenomenological understanding of the thermal and hydraulic processes that would occur in a spent fuel pool from a loss-of-pool-coolant event. The committee received briefings on this work from Commission and Sandia staff during the course of this study. Additionally, the committee received a briefing from ENTERGY Corp. staff and its consultants under contract to analyze and understand the consequences of a loss-of-pool-coolant event in a spent fuel pool in a PWR plant.

The Sandia analyses were carried out on the reference BWR described in Section 3.1. Sandia's analysis of a PWR spent fuel pool had only just begun by the end of May 2004 and has not yet yielded any results. The committee had less opportunity to examine ENTERGY's approach and results. Because of these limitations, the committee was unable to examine in any detail the effects of the differences between BWR and PWR pools and fuel, except as noted with respect to their locations relative to grade.

The analyses were carried out using several well-established computer codes. The MELCOR code, which was developed by Sandia for use in analyzing severe reactor core accidents, was used to model fluid flow, heat transfer, fuel cladding oxidation kinetics, and fission product release phenomena associated with spent fuel assemblies. This code has been benchmarked against data from experiments (e.g., the FPT experiments on the Phébus test facility, and the VERCORS, CORA, and ORNL VI experiments)[16] that involve zirconium oxidation kinetics and fission product release. However, none of the experiments was designed to simulate the physical conditions in a spent fuel pool. Many of the phenomena are not significantly different in a reactor core and in a spent fuel pool, but a few important differences, particularly concerning fire propagation from hotter fuel assemblies to cooler fuel assemblies and nuclear fuel volatilities, warrant more detailed analyses or further experiments. In principle, MELCOR can perform "best-estimate" calculations that address a range of accident evolutions, accounting for temperature, availability of oxidizing air and steam,[17] and speciation and transport of radionuclides.

Sandia calculated the decay heat in the assemblies using the ANSI/ANS 5.1 code based on actual characteristics of the spent fuel (i.e., actual fuel ages, burn-ups, and locations) in the reference BWR pool. Flow and mixing behavior in the pool and reactor building enclosing the pool were modeled using a separate computational fluid dynamics (CFD) code.

Two types of analyses were carried out. A "separate effects" analysis was undertaken to examine the thermal responses of a spent fuel assembly (FIGURE 3.4) in a

[16] These experiments were designed to examine phenomena that occur in reactor cores during severe accidents. The phenomena include core degradation.

[17] Oxygen feeds the zirconium reaction and enhances release and transport of ruthenium-106, and the steam reaction releases hydrogen; whereas limited availability of oxygen starves the reaction. Steam can also entrain released fission products.

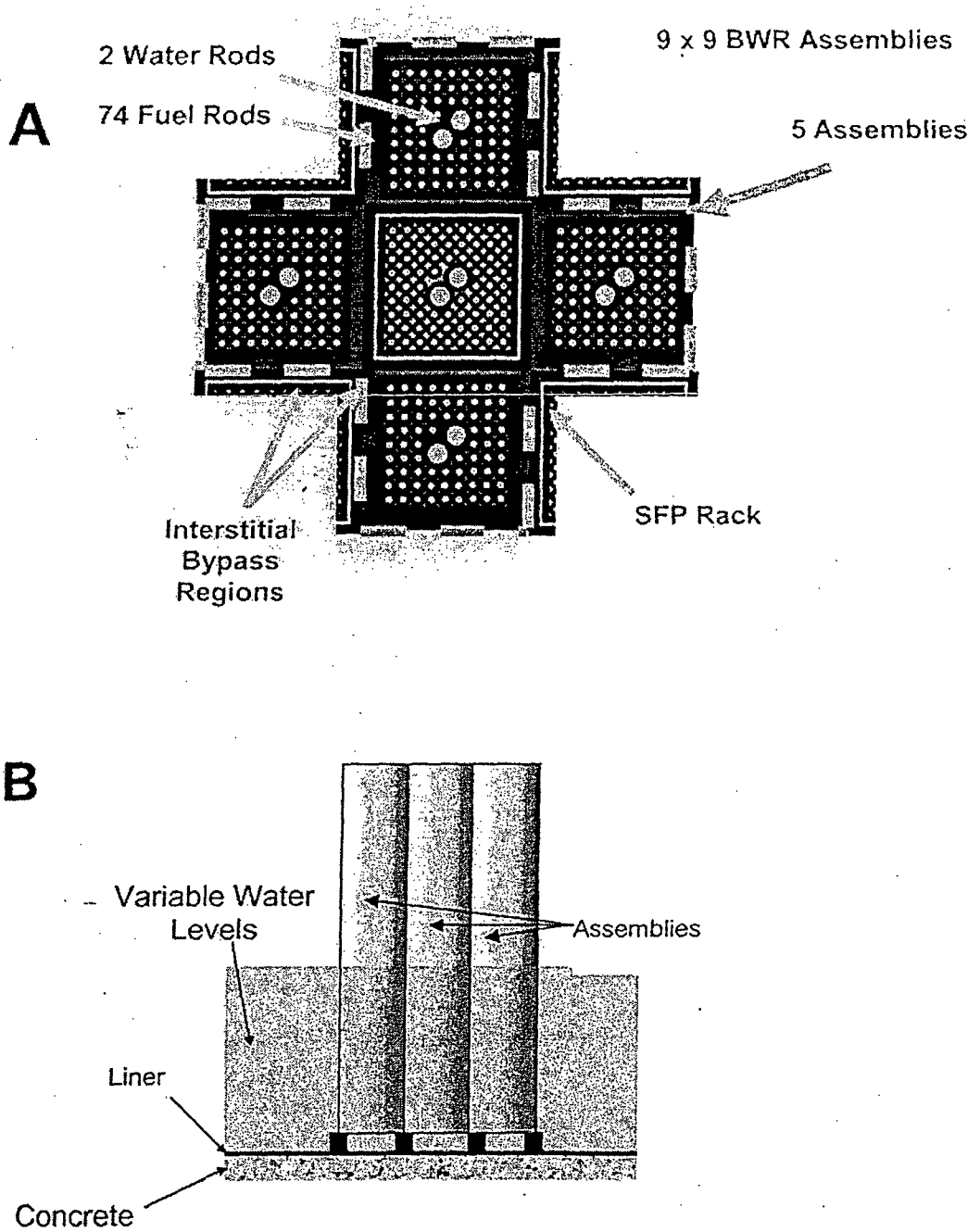


FIGURE 3.4 Configuration of fuel assemblies used for separate effects analysis. (A) Top view of BWR spent fuel assemblies used in the model. (B) Side view showing spent fuel assemblies in the pool. SOURCE: Nuclear Regulatory Commission briefing materials (2004).

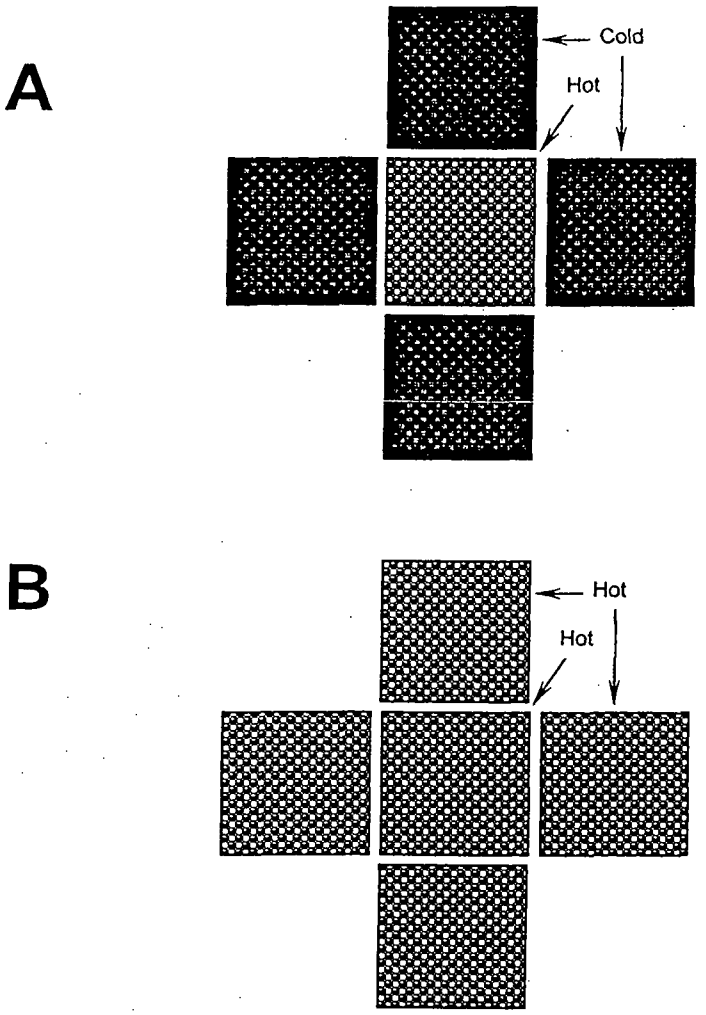


FIGURE 3.5 Two configurations used in the separate effects models shown in FIGURE 3.4: (A) Center hot spent fuel assembly surrounded by four cold assemblies; and (B) center hot spent fuel assembly surrounded by four hot assemblies. SOURCE: Nuclear Regulatory Commission briefing materials (2004).

loss-of-pool-coolant event. This analysis was used to understand how thermal behavior is influenced by factors such as decay heat in the fuel assembly, heat transfer with adjacent assemblies, and heat transfer to circulating air or steam in a drained spent fuel pool. This analysis was used to guide the development of "global response" models to examine the thermal-hydraulic behavior of an entire spent fuel pool.

The separate effects analysis examined the thermal behavior of a high decay-heat BWR spent fuel assembly surrounded either by four low decay-heat assemblies (FIGURE 3.5A) or four high decay-heat assemblies (FIGURE 3.5B). This analysis showed that the potential for heat build-up in a fuel assembly sufficient to initiate a zirconium cladding fire depends on its decay heat (which is related to its age) and on the rate at which heat can be transferred to adjacent assemblies and to circulating air or steam.

In the configuration shown in FIGURE 3.5A, the low decay-heat assemblies act as thermal radiation heat sinks, thereby allowing the more rapid transfer of heat away from the center fuel assembly than would be the case if the center assembly were surrounded by high decay-heat assemblies. The results from this analysis indicate that this configuration can be air cooled sufficiently to prevent the initiation of a zirconium cladding fire within a relatively short time after the center fuel assembly is discharged from the reactor. In the configuration shown in FIGURE 3.5B, heat transfer away from the center assembly is reduced and heat build-up is more rapid. Results indicate that this configuration cannot be air cooled for a significantly longer time after the center fuel assembly is discharged from the reactor.

The global analysis modeled the actual design and fuel loading pattern of the reference BWR spent fuel pool. The pool was divided into seven regions based on fuel age. Within each of those seven regions, the model for the fuel racks was subdivided into 16 zones. The grouping of assemblies into zones reduced the computational requirements compared to modeling every assembly.[18] Two scenarios were examined: (1) a complete loss-of-pool-coolant scenario in which the pool is drained to a level below the bottom of spent fuel assemblies; and (2) a partial-loss-of-pool-coolant scenario in which water levels in the pool drain to a level somewhere between the top and bottom of the fuel assemblies. In the former case, a convective air circulation path can be established along the entire length of the fuel assemblies, which promotes convective air cooling of the fuel. In the latter case, an effective air circulation path cannot form because the bottom of the assembly is blocked by water. Steam is generated by boiling of the pool water, and the zirconium cladding oxidation reaction produces hydrogen gas. This analysis suggests that circulation blockage has a significant impact on thermal behavior of the fuel assemblies. The specific impact depends on the depth to which the pool is drained.

The global analysis examined the thermal behavior of fuel assemblies in the pool at 1, 3, and 12 months after the offloading of one-third of a core of spent fuel from the reactor. Sensitivity studies were carried out to assess the importance of radiation heat transfer between different regions of the pool, the effects of building damage on releases of radioactive material to the environment, and the effects of varying the assumed location and size of the hole in the pool wall.

The results of these analyses are provided in the committee's classified report. For some scenarios, the fuel could be air cooled within a relatively short time after its removal from the reactor. If a loss-of-coolant event took place before the fuel could be air cooled, however, a zirconium cladding fire could be initiated if no mitigative actions were taken. Such fires could release some of the fuel's radioactive material inventory to the environment in the form of aerosols.

For a partial-loss-of-pool-coolant event, the analysis indicates that the potential for zirconium cladding fires would exist for an even greater time (compared to the complete-loss-of-pool-coolant event) after the spent fuel was discharged from the reactor because air circulation can be blocked by water at the bottom of the pool. Thermal coupling between adjacent assemblies will be due primarily to radiative rather than convective heat transfer. However, this heat transfer mode has been modeled simplistically in the MELCOR runs

[18] The global-response model runs took between 10 and 12 days on the personal computers used in the Sandia analyses.

performed by Sandia.[19]

If the water level is above the top of the fuel racks, decay heat in the fuel could cause the pool water to boil. Once water levels fall below a certain level in the fuel assembly, the exposed portion of the fuel cladding might heat up sufficiently to ignite if no mitigative actions were taken. This could result in the release of a substantial fraction of the cesium inventory to the environment in the form of aerosols.

A zirconium cladding fire in the presence of steam could generate hydrogen gas over the course of the event. The generation and transport of hydrogen gas in air was modeled in the Sandia calculations as was the deflagration of a hydrogen-air mixture in the closed building space above the spent fuel pool. The deflagration of hydrogen could enhance the release of radioactive material in some scenarios.

Sandia was just beginning to carry out a similar set of analyses for a "reference" PWR spent fuel pool when the committee completed information gathering for its classified report. There are reasons to believe that the results for a PWR pool could be somewhat different, and possibly more severe, than for a BWR pool: PWR assemblies are larger, have somewhat higher burn-ups, and some assemblies sit directly over the rack feet, which may impede cooling. While PWR fuel assemblies hold more fuel, they also have more open channels within them for water circulation. The committee was told that as part of this work, a sensitivity analysis will be carried out to understand how design differences among U.S. PWRs will influence the model results.

ENTERGY Corp. has carried out independent separate-effects modeling of a PWR spent fuel pool using the MELCOR code. The analyses addressed both partial and complete loss-of-pool-coolant events for its PWR spent fuel assemblies in a region of the pool where there are no water channels in the spent fuel racks. The analyses were made for relatively fresh spent fuel assemblies (i.e., separate models were run for assemblies that had been discharged from the reactor for 4, 30, and 90 days) surrounded by four "cold" assemblies that had been discharged for two years. In general, the ENTERGY results are similar to those from the Sandia separate-effects analyses mentioned above.

Several steps could be taken to mitigate the effects of such loss-of-pool-coolant events short of removal of spent fuel from the pool. Among these are the following:

- The spent fuel assemblies in the pools can be reconfigured in a "checkerboard" pattern so that newer, higher decay-heat fuel elements are surrounded by older, lower decay-heat elements. The older elements will act as radiation heat sinks in the event of a coolant loss so that the fuel is air coolable within a short time of its discharge from the reactor. Alternatively, newly discharged fuel can be placed near the pool wall, which also acts as a heat sink. ENTERGY staff estimates that reconfiguring the fuel in one of its pools into a checkerboard pattern would take only about 10 hours of extra work, but would not extend a refueling outage. Reconfiguring of fuel already in the pool could be done at any time. It does not require a reactor outage.

[19] In a reactor core accident, heat transfer by thermal radiation is not important because all of the fuel assemblies are at approximately the same temperature. Consequently, there is no net heat transfer between them. But spent fuel pools contain assemblies of different ages, burn-ups, and decay-heat production. The hotter assemblies will radiate heat to cooler assemblies.

- If there is sufficient space in the pool, empty slots can also be arranged to promote natural air convection in a complete-loss-of-pool-coolant event. The cask loading area in some pools may serve this purpose if it is in communication with the rest of the pool.
- Preinstalled emergency water makeup systems in spent fuel pools would provide a mechanism to replace pool water in the event of a coolant loss.
- Preinstalled water spray systems above or within the pool could also be used to cool the fuel in a loss-of-pool-coolant event.[20] The committee carried out a simple aggregate calculation suggesting that a water spray of about 50 to 60 gallons (about 190 to 225 liters) per minute for the whole pool would likely be adequate to prevent a zirconium cladding fire in a loss-of-pool-coolant event. A simple, low-pressure spray distribution experiment could verify what distribution of coolant would be sufficient to cool a spent fuel pool. Such a system would have to be designed to function even if the spent fuel pool or building were severely damaged in an attack.[21]
- Limiting full-core offloads to situations when such offloads are required would reduce the decay heat load in the pool during routine refueling outages. Alternatively, delaying the offload of fuel to the pool after a reactor shutdown would reduce the decay-heat load in the pool.
- The walls of spent fuel pools could be reinforced to prevent damage that could lead to a loss-of-pool-coolant event.
- Security levels at the plant could be increased during outages that involve core offloads.

Of course, damage to the pool and high radiation fields could make it difficult to take some of these mitigative measures. Multiple redundant and diverse measures may be required so that more than one remedy is available to mitigate a loss-of-pool-coolant event, especially when access to the pool is limited by damage or high radiation fields. Cost considerations might be significant, particularly for measures such as installing hardened spray systems and lengthening refueling outages, but the committee did not examine the costs of these measures.

3.3.3 Discussion

The Sandia and ENTERGY analyses described in this chapter were still in progress when the committee completed its classified report. As noted previously, draft technical documents describing the work were not available at the time this study was being completed. Consequently, the committee's understanding of these analyses is based on briefing materials (i.e., PowerPoint slides) presented before the committee by Nuclear

[20] There is an extensive analytic and experimental experience base confirming that spray systems are effective in providing emergency core cooling in BWR reactor cores, which generate much more decay heat than spent fuel. Detailed experiments have shown that some minimum amount of water must be delivered on top of each assembly, and if that is provided, the assembly will be cooled adequately even if there is significant blockage of the cooling channels.

[21] ENTERGY staff mentioned the possible use of a specially equipped fire engine to provide spray cooling. The committee does not know whether this would deliver sufficient spray cooling where it is needed or would provide sufficient protection if terrorists are attempting to prevent emergency response, but the strategy is worth further examination.

Regulatory Commission and ENTERGY staff and consultants, discussions with these experts, and the committee's own expert judgment.

The committee judges that these analyses provide a start for understanding the behavior of spent fuel pools in severe environments. The analyses were carried out by qualified experts using well-known analytical methods and engineering codes to model system behaviors. Although this is a start, the analyses have important limitations.

The aircraft attack scenarios consider one type of aircraft. Heavier aircraft could be used in such attacks. These planes are in common use in passenger and/or cargo operations, and some of these planes can be chartered.

Equally limiting assumptions were made in the analyses of spent fuel pool thermal behavior: To make the analysis tractable, it was assumed that the fuel in the pool was in an undamaged condition when the loss-of-pool-coolant event occurred. This is not necessarily a valid assumption. Whether such damage would change the outcome of the analyses described in this chapter is unknown.

Simplistic modeling assumptions were made about the fuel assembly geometry (e.g., individual fuel bundles were not modeled in the global effects calculation), convective cooling flow paths and mechanisms, thermal radiation heat transfer, propagation of cladding fires to low-power bundles, and radioactivity release mechanisms. In addition, flow blockage due to fission-gas-induced clad ballooning[22] was not considered. The thermal analysis experts on the committee judge that these simplistic assumptions could produce results that are more severe (i.e., overconservative) than would be the case had more realistic assumptions been used.

More sophisticated models, which involve clad ballooning and detailed thermal-hydraulics, including radiative heat transfer, have been developed for the analysis of severe in-core accidents. These models can be evaluated using more powerful computers. MELCOR appears to have sufficient capability to evaluate more sophisticated models of the spent fuel pool and Sandia has access to large, sophisticated computers. State-of-the-art calculations of this type are needed for the analysis of spent fuel pools so that more informed regulatory decisions can be made.

The analyses also do not consider the possibility of an attack that ejects spent fuel from the pool. The ejection of freshly discharged spent fuel from the pool might lead to a zirconium cladding fire if immediate mitigative actions could not be taken. The application of such measures could be hindered by the high radiation fields around the fuel.

While the committee judges that some attacks involving aircraft would be feasible to carry out, it can provide no assessment of the probability of such attacks. Nevertheless, analyzing their consequences is useful for informing policy decisions on steps to be taken to protect these facilities from terrorist attack.

---

[22] If a fuel rod reaches relatively high temperatures, the gases inside can cause the cladding to balloon out, restricting and even blocking coolant flow through the spaces between the rods within the assembly.

3.4 FINDINGS AND RECOMMENDATIONS

Based on its review of spent fuel pool risks, the committee offers the following findings and recommendations.

FINDING 3A: Pool storage is required at all operating commercial nuclear power plants to cool newly discharged spent fuel.

Operating nuclear power plants typically discharge about one-third of a reactor core of spent fuel every 18-24 months. Additionally, the entire reactor core may be placed into the spent fuel pool (offloaded) during outage periods for refueling. The analyses of spent fuel thermal behavior described in this chapter demonstrate that freshly discharged spent fuel generates too much decay heat to be passively air cooled. The Nuclear Regulatory Commission requires that this fuel be stored in a pool that has an active heat removal system (i.e., water pumps and heat exchangers) for at least one year as a safety matter. Current design practices for approved dry storage systems require five years' minimum decay in spent fuel pools. Although spent fuel younger than five years could be stored in dry casks, the changes required for shielding and heat removal could be substantial, especially for fuel that has been discharged for less than about three years.

FINDING 3B: The committee finds that, under some conditions, a terrorist attack that partially or completely drained a spent fuel pool could lead to a propagating zirconium cladding fire and the release of large quantities of radioactive materials to the environment. Details are provided in the committee's classified report.

It is not possible to predict the precise magnitude of such releases because the computer models have not been validated for this application.

FINDING 3C: It appears to be feasible to reduce the likelihood of a zirconium cladding fire following a loss-of-pool-coolant event using readily implemented measures.

There appear to be some measures that could be taken to mitigate the risks of spent fuel zirconium cladding fires in a loss-of-pool-coolant event. The following measures appear to have particular merit.

- Reconfiguring of spent fuel in the pools (i.e., redistribution of high decay-heat assemblies so that they are surrounded by low decay-heat assemblies) to more evenly distribute decay-heat loads. The analyses described elsewhere in this chapter suggest that the potential for zirconium cladding fires can be reduced substantially by surrounding freshly discharged spent fuel assemblies with older spent fuel assemblies in "checkerboard" patterns. The analyses suggest that such arrangements might even be more effective for reducing the potential for zirconium cladding fires than removing this older spent fuel from the pools. However, these advantages have not been demonstrated unequivocally by modeling and experiments.
- Limiting the frequency of offloads of full cores into spent fuel pools, requiring longer shutdowns of the reactor before any fuel is offloaded to allow decay-heat levels to be managed, and providing enhanced security when such offloads must

be made. The offloading of the reactor core into the spent fuel pool during reactor outages substantially raises the decay-heat load of the pool and increases the risk of a zirconium cladding fire in a loss-of-pool-coolant event. Of course, any actions that increase the time a power reactor is shut down incur costs, which must be considered in cost-benefit analyses of possible actions to reduce risks.

- Development of a redundant and diverse response system to mitigate loss-of-pool-coolant events. Any mitigation system, such as a spray cooling system, must be capable of operation even when the pool is drained (which would result in high radiation fields and limit worker access to the pool) and the pool or overlying building, including equipment attached to the roof or walls, is severely damaged.

FINDING 3D: The potential vulnerabilities of spent fuel pools to terrorist attacks are plant-design specific. Therefore, specific vulnerabilities can be understood only by examining the characteristics of spent fuel storage at each plant.

As described in the classified report, there are substantial differences in the design of PWR and BWR spent fuel pools. PWR pools tend to be located near or below grade, whereas BWR pools typically are located well above grade but are protected by exterior walls and other structures. In addition, there are plant-specific differences among BWRs and PWRs that could increase or decrease the vulnerabilities of the pools to various kinds of terrorist attacks, making generic conclusions difficult.

FINDING 3E: The Nuclear Regulatory Commission and independent analysts have made progress in understanding some vulnerabilities of spent fuel pools to certain terrorist attacks and the consequences of such attacks for releases of radioactivity to the environment. However, additional work on specific issues listed in the following recommendation is needed urgently.

The analyses carried out to date for the Nuclear Regulatory Commission by Sandia National Laboratories and by other independent organizations such as EPRI and ENTERGY have provided a general understanding of spent fuel behavior in a loss-of-pool-coolant event and the vulnerability of spent fuel pools to certain terrorist attacks that could cause such events to occur. The work to date, however, has not been sufficient to adequately understand the vulnerabilities and consequences. This work has addressed a small number of plant designs that may not be representative of U.S. commercial nuclear power plants as a whole. It has considered only a limited number of threat scenarios that may underestimate the damage that can be inflicted on the pools by determined terrorists. Additional analyses are needed urgently to fill in the knowledge gaps so that well-informed policy decisions can be made.

RECOMMENDATION: The Nuclear Regulatory Commission should undertake additional best-estimate analyses to more fully understand the vulnerabilities and consequences of loss-of-pool-coolant events that could lead to a zirconium cladding fire. Based on these analyses, the Commission should take appropriate actions to address any significant vulnerabilities that are identified. The analyses of the BWR and PWR spent fuel pools should be extended to consider the consequences of loss-of-pool-coolant events that are described in the committee's classified report.

The consequence analyses should address the following questions:

- **To what extent would such attacks damage the spent fuel in the pool, and what would be the thermal consequences of such damage?**
- **Is it feasible to reconfigure the spent fuel within pools to prevent zirconium cladding fires given the actual characteristics (i.e., heat generation) of spent fuel assemblies in the pool, even if the fuel were damaged in an attack? Is there enough space in the pools at all commercial reactor sites to implement such fuel reconfiguration?**
- **In the event of a localized zirconium cladding fire, will such rearrangement prevent its spread to the rest of the pool?**
- **How much spray cooling is needed to prevent zirconium cladding fires and prevent propagation of such fires? Which of the different options for providing spray cooling are effective under attack and accident conditions?**

Sensitivity analyses should also be undertaken to account for the full range of variation in spent fuel pool designs (e.g., rack designs, capacities, spent fuel burn-ups, and ages) at U.S. commercial nuclear power plants.

RECOMMENDATION: While the work described in the previous recommendation under Finding 3E, above, is being carried out, the Nuclear Regulatory Commission should ensure that power plant operators take prompt and effective measures to reduce the consequences of loss-of-pool-coolant events in spent fuel pools that could result in propagating zirconium cladding fires. The committee judges that there are at least two such measures that should be implemented promptly:

- Reconfiguring of fuel in the pools so that high decay-heat fuel assemblies are surrounded by low decay-heat assemblies. This will more evenly distribute decay-heat loads, thus enhancing radiative heat transfer in the event of a loss of pool coolant.
- Provision for water-spray systems that would be able to cool the fuel even if the pool or overlying building were severely damaged.

Reconfiguring of fuel in the pool would be a prudent measure that could probably be implemented at all plants at little cost, time, or exposure of workers to radiation. The second measure would probably be more expensive to implement and may not be needed at all plants, particularly plants in which spent fuel pools are located below grade or are protected from external line-of-sight attacks by exterior walls and other structures.

The committee anticipates that the costs and benefits of options for implementing the second measure would be examined to help decide what requirements would be imposed. Further, the committee does not presume to anticipate the best design of such a system—whether it should be installed on the walls of a pool or deployed from a location where it is unlikely to be compromised by the same attack—but simply notes the demanding requirements such a system must meet.

4

DRY CASK STORAGE AND COMPARATIVE RISKS

This chapter addresses the second and third charges of the committee's statement of task:

- The safety and security advantages, if any, of dry cask storage[1] versus wet pool storage at reactor sites.
- Potential safety and security advantages, if any, of dry cask storage using various single-, dual-, or multi-purpose cask designs.

The second charge calls for a comparative analysis of dry cask storage versus pool storage, whereas the third charge focuses exclusively on dry casks. The committee will address the third charge first to provide the basis for the comparative analysis.

By the late 1970s, the need for alternatives to spent fuel pool storage was becoming obvious to both commercial nuclear power plant operators and the Nuclear Regulatory Commission. The U.S. government made a policy decision at that time not to support commercial reprocessing of spent nuclear fuel (see Appendix D). At the same time, efforts to open an underground repository for permanent disposal of commercial spent fuel were proving to be more difficult and time consuming than originally anticipated.[2] Commercial nuclear power plant operators had no place to ship their growing inventories of spent fuel and were running out of pool storage space.

Dry cask storage was developed to meet the need for expanded onsite storage of spent fuel at commercial nuclear power plants. The first dry cask storage facility in the United States was opened in 1986 at the Surry Nuclear Power Plant in Virginia. Such facilities are now in operation at 28 operating and decommissioned nuclear power plants. In 2000, the nuclear power industry projected that up to three or four plants per year would run out of needed storage space in their pools without additional interim storage capacity.

This chapter is organized into the following sections:

- Background on dry cask storage.
- Evaluation of potential risks of dry cask storage.
- Potential advantages of dry storage over wet storage.
- Findings and recommendations.

---

[1] This storage system is referred to as "dry" because the fuel is stored out of water.

[2] The Nuclear Waste Policy Act of 1982 and the Amendments Act of 1987 laid out a process for identifying a site for a geologic repository. That repository was to be opened and operating by the end of January 1998. The federal government now hopes to open a repository at Yucca Mountain, which is located in southwestern Nevada, by the end of 2010.

4.1 BACKGROUND ON DRY CASK STORAGE

The storage of spent fuel in dry casks has the same three primary objectives as pool storage (Chapter 3):

- Cool the fuel to prevent heat-up to high temperatures from radioactive decay.
- Shield workers and the public from the radiation emitted by radioactive decay in the spent fuel and provide a barrier for any releases of radioactivity.
- Prevent criticality accidents.

Dry casks are designed to achieve the first two of these objectives without the use of water or mechanical systems. Fuel cooling is passive: that is, it relies upon a combination of heat conduction through solid materials and natural convection or thermal radiation through air to move decay heat from the spent fuel into the ambient environment. Radiation shielding is provided by the cask materials: Typically, concrete, lead, and steel are used to shield gamma radiation, and polyethylene, concrete, and boron-impregnated metals or resins are used to shield neutrons. Criticality control is provided by a lattice structure, referred to as a *basket*, which holds the spent fuel assemblies within individual compartments in the cask (FIGURE 4.1). These maintain the fuel in a fixed geometry, and the basket may contain boron-doped metals to absorb neutrons.[3]

Passive cooling and radiation shielding are possible because these casks are designed to store only older spent fuel. This fuel has much lower decay heat than freshly discharged spent fuel as well as smaller inventories of radionuclides.

The industry sometimes refers to these casks using the following terms:

- Single-, dual-, and multi-purpose casks.
- Bare-fuel and canister-based casks.

The terms in the first bullet indicate the application for which the casks are intended to be used. Single-purpose cask systems are licensed[4] only to store spent fuel. Dual-purpose casks are licensed for both storage and transportation. Multi-purpose casks are intended for storage, transportation, and disposal in a geologic repository. No true multi-purpose casks exist in the United States (or in any other country for that matter) because specifications for acceptable containers for geologic disposal have yet to be finalized by the Department of Energy. Current plans for Yucca Mountain do not contemplate the use of multi-purpose casks.

Nevertheless, some cask vendors still refer to their casks as "multi-purpose." These are at best dual-purpose casks, however, because they have been licensed only for storage and transport. **Because true multi-purpose casks do not now exist and are not likely to exist in the future, the committee did not consider them further in this study.**

---

[3] Criticality control is less of an issue in dry casks because there is no water moderator present after the cask is sealed and drained.

[4] Authority for licensing dry cask storage rests with the Nuclear Regulatory Commission.

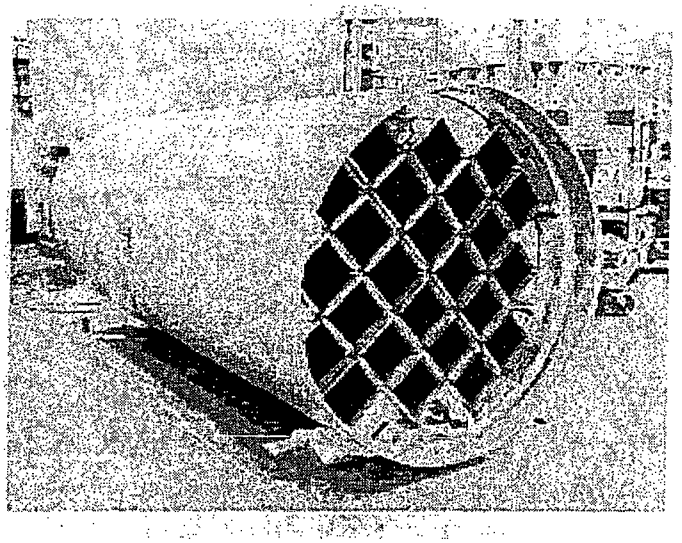


FIGURE 4.1 Photo of NUHOMS canister showing the internal basket for holding the spent fuel assemblies in a fixed geometry. This canister is shown for illustrative purposes only. SOURCE: Courtesy of Transnuclear, Inc., an Areva Company.

The terms in the second bullet indicate how spent fuel is loaded into the casks. In bare-fuel[5] casks, spent fuel assemblies are placed directly into a basket that is integrated into the cask itself (see FIGURE 4.3B). The cask has a bolted lid closure for sealing. In canister-based casks, spent fuel assemblies are loaded into baskets integrated into a thin-wall (typically ½-inch [1.3-centimeter] thick) steel cylinder, referred to as a *canister* (see FIGURE 4.1 and 4.3A). The canister is sealed with a welded lid. The canister can be stored or transported if it is placed within a suitable overpack. This overpack is closed with a bolted lid.

Bare-fuel and canister-based systems are sometimes referred to as "thick-walled" and "thin-walled" casks, respectively, by some cask vendors. This designation is not strictly correct because the overpacks in canister-based systems have thick walls. The only thin-walled component is the canister, which is designed to be stored or transported within the overpack.

The designation of a cask as single- or dual-purpose often has less to do with its design and more to do with licensing decisions. Indeed, bare-fuel and canister-based casks can be licensed for either single or dual purposes. Consequently, one should not expect the performance of a cask in accidents or terrorist attacks to depend on its designation as single- or dual-purpose. Rather, performance will depend on the type of attack and construction of the cask. For the purposes of discussion in this chapter, therefore, the committee uses the designations "bare-fuel" and "canister-based," rather than single- or dual-purpose, when referring to various cask designs.

All bare-fuel casks in use in the United States are designed to be stored vertically. Most canister-based systems also are designed for vertical storage, but one overpack

[5] The term *bare fuel* refers to the entire fuel assembly, including the uranium pellets within the fuel rods.

system is designed as a horizontal concrete module (FIGURE 4.2).[6] The principal characteristics of dry cask storage systems are summarized in TABLE 4.1, which is located at the end of this chapter.

Dry casks are designed to hold up to about 10 to 15 metric tons of spent fuel. This is equivalent to about 32 pressurized water nuclear reactor (PWR) spent fuel assemblies or 68 boiling water nuclear reactor (BWR) spent fuel assemblies. Although the dimensions vary among manufacturers, fuel types (i.e., BWR or PWR fuel), and amounts of fuel stored, the casks are typically about 19 feet (6 meters) in height, 8 feet (2.5 meters) in diameter, and weigh 100 tons or more when loaded.

The casks (for bare-fuel designs) or canisters (for canister-based designs) are placed directly into the spent fuel pool for loading. After they are loaded, the canisters or casks are drained, vacuum dried, and filled with an inert gas (typically helium). The loaded canisters or casks are then removed from the pool, their outer surfaces are decontaminated,[7] and they are moved to the dry storage facility on the property of the reactor site. Loading of a single cask or canister can take up to one week. The vacuum drying process is the longest step in the loading process.

In the United States, dry casks are stored on open concrete pads within a protected area of the plant site.[8,9] This protected area may be contiguous with the protected area of the plant itself or may be located some distance away in its own protected area (see FIGURE 2.1).

According to the information provided to the committee by cask vendors, nuclear power plant operators are currently purchasing mostly dual-purpose casks for spent fuel storage. The horizontal NUHOMS cask design is one of the most-ordered designs at present (TABLE 4.3). The vendors informed the committee that cost is the chief consideration for their customers when making purchasing decisions. Cost considerations are driving the cask industry away from all-metal cask designs and toward concrete designs for storage.

---

[6] In addition, there is one modular concrete vault design in the United States: the Fort St. Vrain, Colorado, Independent Spent Fuel Storage Installation, which stores spent fuel from a high-temperature gas-cooled reactor. This reactor operated until 1989 and is now decommissioned. Because this is a one-of-a-kind facility, and the time available to the committee was short, it was not examined in this study.

[7] Small amounts of radioactive contamination are present in the cooling water in the spent fuel pool. Some of this contamination is transferred to the cask or canister surfaces when it is immersed in the pool for loading.

[8] There may be exceptions in the future. Private Fuel Storage has requested a license from the Nuclear Regulatory Commission to construct a dry cask storage facility in Utah that will store fuel from multiple reactor sites. An underground dry cask storage facility has been proposed at the Humbolt Bay power plant in California to store old, low decay-heat fuel. The underground design is being proposed primarily because the site has very demanding seismic design requirements and is possible only because the fuel to be stored generates little heat.

[9] In Germany, dry casks are stored in reinforced concrete buildings. These buildings were originally designed to provide additional radiation shielding (beyond what is provided by the cask itself) to reduce doses at plant site boundaries to background levels. Some of these buildings are sufficiently robust to provide protection against crashes of large aircraft. A subgroup of the committee visited spent fuel storage sites at Ahaus and Lingen during this study. See Appendix C for details.

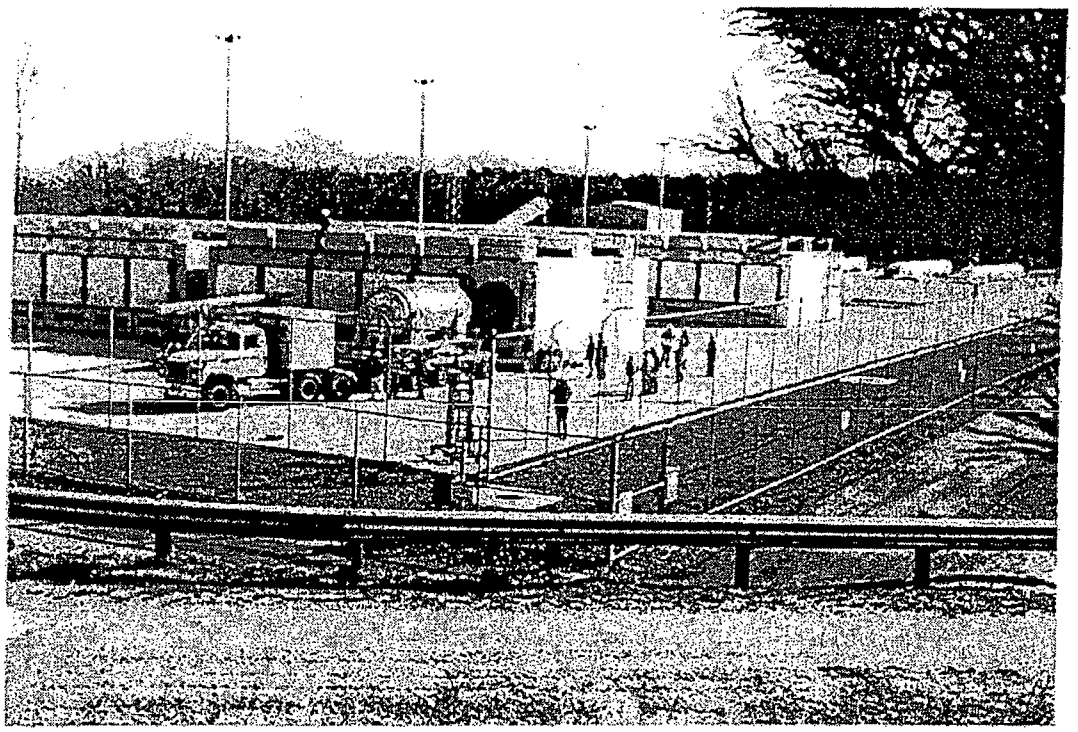


FIGURE 4.2 Photo showing a canister being loaded into a NUHOMS horizontal storage module. SOURCE: Courtesy of Transnuclear, Inc., an Areva Company.

4.2 EVALUATION OF POTENTIAL RISKS OF DRY CASK STORAGE

Dry casks were designed to ensure safe storage of spent fuel,[10] not to resist terrorist attacks. The regulations for these storage systems, which are given in Title 10, Part 72 of the Code of Federal Regulations (i.e., 10 CFR 72), are designed to ensure adequate passive heat removal and radiation shielding during normal operations, off-normal events, and accidents. The latter include, for example, accidental drops or tip-overs during routine cask movements. The robust construction of these casks provides some passive protection against external assaults, but the casks were not explicitly designed with this factor in mind.[11]

The regulations in 10 CFR 72 require that dry cask storage facilities (formally referred to as Independent Spent Fuel Storage Installations, or ISFSIs) be located within a protected area of the plant site (see FIGURE 2.1). However, the protection requirements for these installations are lower than those for reactors and spent fuel pools. The guard force is required to carry side arms, and its main function is surveillance: to detect and assess threats and to summon reinforcements. If the ISFSI is within the protected area of the plant

[10] Dual-purpose casks also were designed for safe transport under the requirements of Title 10, Part 71 of the Code of Federal Regulations. The committee did not examine transport of spent fuel in this study.

[11] A recent study by the German organization GRS (Gesellschaft für Anlagen- und Reaktorsicherheit, MBH) examined the vulnerability of CASTOR-type casks to large-aircraft impacts.

it would come directly under the protection of plant's guard forces. The protected area is surrounded by vehicle barriers to protect against the detonation of a design basis threat vehicle bomb.[12]

A terrorist attack that breached a dry cask could *potentially* result in the release of radioactive material from the spent fuel into the environment through one or both of the following two processes: (1) mechanical dispersion of fuel particles or fragments; and (2) dispersion of radioactive aerosols (e.g., cesium-137). As described in Chapter 3, the latter process would have greater offsite radiological consequences. The committee evaluates the potential for both of these processes later in this chapter.

In the wake of the September 11, 2001, attacks, additional work has been or is being carried out by government and private entities to assess the security risks to dry casks from terrorist attacks. Sandia National Laboratories is currently analyzing the response of dry casks to a number of potential terrorist attack scenarios at the request of the Nuclear Regulatory Commission. The committee was briefed on these analyses at two of its meetings.

Sandia is analyzing the responses of three vertical cask designs and one horizontal design to a variety of terrorist attack scenarios (FIGURE 4.3). These designs are considered to be broadly representative of the dry casks currently licensed for storage in the United States by the Nuclear Regulatory Commission (see TABLE 4.1 at the end of this chapter). The committee received briefings on these studies by Nuclear Regulatory Commission and Sandia staff.

Several attack scenarios are being considered in the Sandia analyses. They include large aircraft impacts and assaults with various types and sizes of explosive charges and other energetic devices. Details on the large aircraft impact scenarios are provided in the classified report.

Most of this work is still in progress and has not yet resulted in reviewable documents. Consequently, the committee had to rely on discussions with the experts who are carrying out these studies and its own expert judgment in assessing the quality and completeness of this work.

4.2.1 Large Aircraft Impacts

Sandia analyzed the impact of an airliner traveling at high speed into the four cask designs shown in FIGURE 4.3. These analyses examined the consequences of impacts of the fuselage and the "hard" components of the aircraft (i.e., the engines and wheel struts) into individual casks and arrays of casks on a storage pad. The latter analysis examined the potential consequences of cask-to-cask interactions resulting from cask sliding or partial tip-over. The objectives of the analyses were first to determine whether the casks would fail (i.e., the containment would be breached) and, if so, to estimate the radioactive material releases and their health consequences.

[12] As noted in Chapter 2, the committee did not examine surveillance requirements or the placement or effectiveness of vehicle barriers and guard stations at commercial nuclear plants.

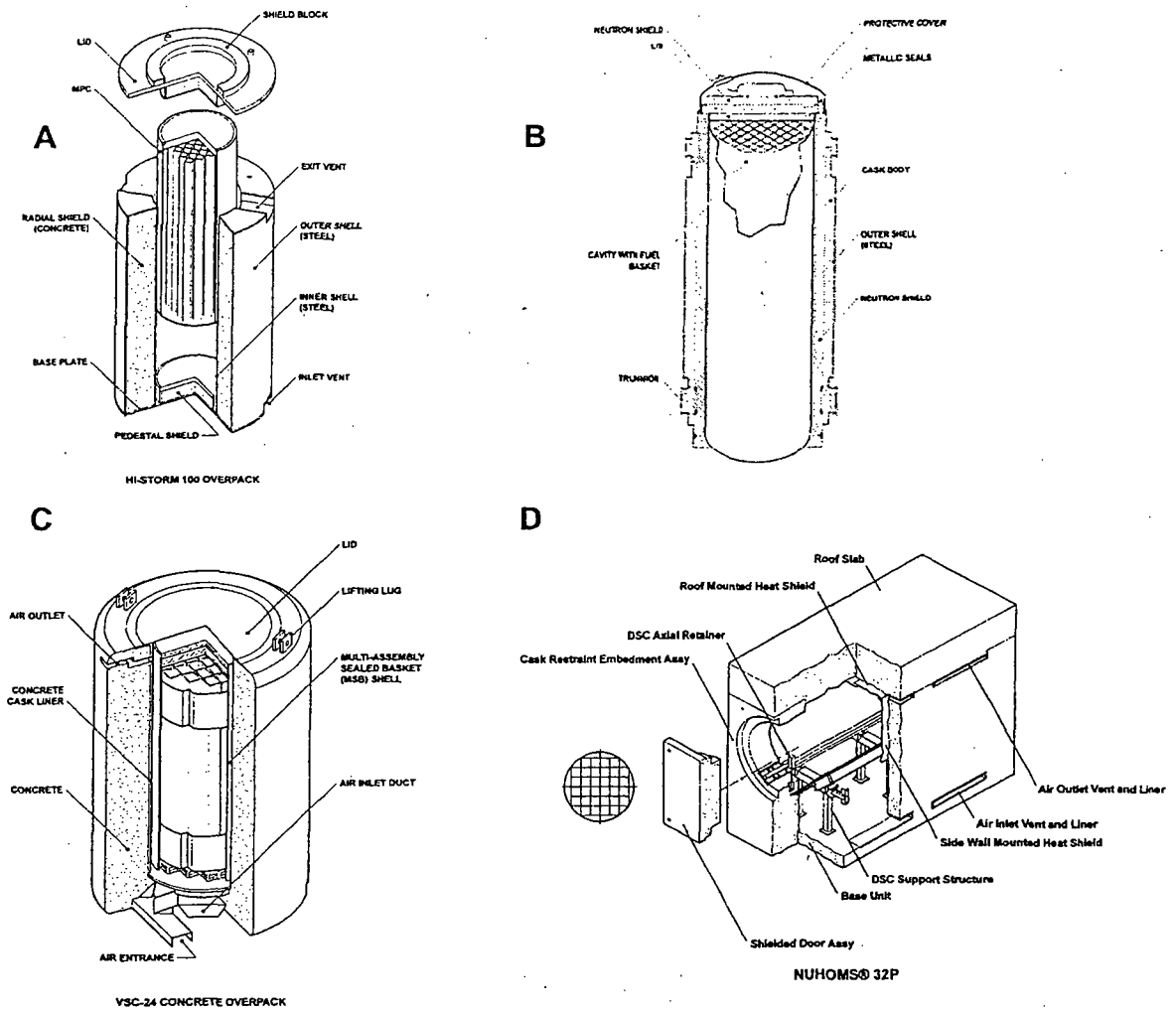


FIGURE 4.3 Four cask systems used in the Sandia analyses described in this chapter: (A) HI-STORM-100, (B) TN-68, (C) VSC-24, (D) NUHOMS-32P. The casks shown in A, C, and D are canister-based casks; the cask shown in B is a bare-fuel cask. SOURCE: Nuclear Regulatory Commission briefing materials (2004).

The aircraft was modeled using Sandia-developed Eulerian CTH code (see footnote 15 in Chapter 3). The aircraft manufacturer (Boeing Corp.) was consulted to ensure that the aircraft model used in the analyses was accurate. The casks were modeled with standard finite element codes using the published characteristics of the casks. The casks were assumed to be filled with high-burn-up, 10-year-old spent fuel. The fuel rods were assumed to fail (rupture) if the strains in the cladding exceeded 1 percent, which is a conservative assumption. Sandia evaluated the release of radioactive materials from the spent fuel pellets inside the fuel rods when such cladding failures occurred. Radiological consequences of such releases were calculated for "representative" (with respect to weather and population) site conditions for each cask based on the actual average conditions at the

site that currently stores the most spent fuel in that cask type.[13] Site conditions differed for each cask.

The effects of jet fuel fires also were not considered in the analyses. Based on an analysis of actual aircraft accidents, Sandia determined that jet fuel would likely be dispersed over a large area in a low-angle impact. Consequently, the resulting petroleum fire would likely be of short duration (generally less than 15 minutes according to Sandia researchers). Long-duration fires that could damage the casks or even ignite the cladding of the spent fuel were not seen to be credible for the aircraft impact scenarios considered by Sandia.[14]

The results of these analyses, which are considered by the Nuclear Regulatory Commission to be classified or safeguards information, are detailed in the classified report. In general, the analyses show that some types of impacts will damage some types of casks. For some scenarios there could be substantial cask-to-cask interactions, including collisions and partial tip-overs.

Nevertheless, predicted releases of radioactive material from the casks, mainly noble gases, were relatively small for all of the scenarios considered by Sandia. The analyses show that the releases were governed by design-specific features of the casks. Sandia noted that the modeling of such releases is difficult and requires expert judgment for several elements of the calculation. Detailed calculations of the consequences were still in progress when the committee was briefed on these analyses.

4.2.2 Other Assaults

Analyses are also being carried out to understand the consequences of other types of assaults on the cask designs shown in FIGURE 4.3. These include assaults using explosives and certain types of high-energy devices. The analyses were still underway when the committee was briefed on these analyses, and the results were characterized by the Nuclear Regulatory Commission as preliminary. Details are provided in the classified report.

4.2.3 Discussion

As noted previously, the dry cask vulnerability analyses were still underway when the committee's classified study was completed. Based on the analyses it did receive, the committee judges that no cask provides complete protection against all types of terrorist attacks. The committee judges that releases of radioactive material from dry casks are low for the scenarios it examined with one possible exception as discussed in the classified report. It is not clear to the committee whether it is credible to assume that this "exceptional" scenario could actually be carried out.

---

[13] As noted in Chapter 1, the committee did not concern itself with how radioactive materials would be transported through the environment once they were released from a dry cask. Rather, the committee confined its examination to whether and how much radioactive material might be released from a dry cask in the event of a terrorist attack.

[14] The committee subgroup that visited Germany was briefed on a fire test on the Castor cask that involved a fully engulfing one-hour petroleum fire. The cask maintained its integrity during and after this test. See Appendix C. The results of this test do not necessarily translate to casks having other designs.

In the committee's opinion, there are several relatively simple steps that could be taken to reduce the likelihood of releases of radioactive material from dry casks in the event of a terrorist attack:

- Additional surveillance could be added to dry cask storage facilities to detect and thwart ground attacks.[15]
- Certain types of cask systems could be protected against aircraft strikes by partial earthen berms. Such berms also would deflect the blasts from vehicle bombs.
- Visual barriers could be placed around storage pads to prevent targeting of individual casks by aircraft or standoff weapons.[16] These would have to be designed so that they would not trap jet fuel in the event of an aircraft attack.
- The spacing of vertical casks on the storage pads can be changed, or spacers (shims) can be placed between the casks, to reduce the likelihood of cask-to-cask interactions in the event of an aircraft attack.
- Relatively minor changes in the design of newly manufactured casks could be made to improve their resistance to certain types of attack scenarios.

4.3 POTENTIAL ADVANTAGES OF DRY STORAGE OVER WET STORAGE

Based on the analyses presented in Chapter 3 and previously in this chapter, the committee judges that dry cask storage has several potential safety and security advantages over pool storage. These differences can best be illustrated using scenarios for both storage systems based on the Sandia analyses reviewed by the committee. **The use of such scenarios should not be taken to imply that the committee believes that these scenarios are likely or even possible at all storage facilities. They are used only for illustrative purposes.**

The following statements can be made about the comparative advantages of dry-cask storage and pool storage based on the Sandia analyses:

Less spent fuel is at risk in an accident or attack on a dry storage cask than on a spent fuel pool. An accident or attack on a dry cask storage facility would likely affect at most a few casks and put a few tens of metric tons of spent fuel at risk. An accident or attack on a spent fuel pool puts the entire inventory of the pool, potentially hundreds of metric tons of spent fuel, at risk.

The potential consequences of an accident or terrorist attack on a dry cask storage facility are lower than those for a spent fuel pool. There are several reasons for this difference:

(1) There is less fuel in a dry cask than in a spent fuel pool and therefore less radioactive material available for release.

(2) *Measured on a per-fuel-assembly basis,* the inventories of radionuclides available

[15] As noted in Chapter 1, the committee did not examine surveillance activities at nuclear power plants and has no basis to judge whether current activities at dry cask storage facilities are adequate.

[16] The ISFSI at the Palo Verde Nuclear Power Plant in Arizona, which was visited by a subgroup of committee members, incorporates a berm into its design to provide a visual barrier.

for release from a dry cask are lower than those from a spent fuel pool because dry casks store older, lower decay-heat fuel.

(3) Radioactive material releases from a breach in a dry cask would occur through mechanical dispersion.[17] Such releases would be relatively small. Certain types of attacks on spent fuel pools could result in a much larger dispersal of spent fuel fragments. Radioactive material releases from a spent fuel pool also could occur as the result of a zirconium cladding fire, which would produce radioactive aerosols. Such fires have the potential to release large quantities of radioactive material to the environment.

The recovery from an attack on a dry cask would be much easier than the recovery from an attack on a spent fuel pool. Breaches in dry casks could be temporarily plugged with radiation-absorbing materials until permanent fixes or replacements could be made. The most significant contamination would likely be confined largely to areas near the cask storage pad and could be detected and decontaminated. The costs of recovery could be high, however, especially if the cask could not be repaired or the spent fuel could not be removed with equipment available at the plant. A special facility might have to be constructed or brought onto the site to transfer the damaged spent fuel to other casks.

Breaches in spent fuel pools could be much harder to plug, especially if high radiation fields or the collapse of the overlying building prevented workers from reaching the pool. Complete cleanup from a zirconium cladding fire would be extraordinarily expensive, and even after cleanup was completed large areas downwind of the site might remain contaminated to levels that prevented reoccupation (see Chapter 3).

It is the potential for zirconium cladding fires in spent fuel pools that gives dry cask storage most of its comparative safety and security advantages. This comparative advantage can be reduced by lowering the potential for zirconium cladding fires in loss-of-pool-coolant events. As discussed in Chapter 3, the committee believes that there are at least two steps that can be implemented immediately to lower the potential for such fires.

4.4 FINDINGS AND RECOMMENDATIONS

With respect to the committee's task to examine potential safety and security advantages of dry cask storage using various single-, dual-, or multi-purpose cask designs, the committee offers the following findings and recommendations:

FINDING 4A: Although there are differences in the robustness of different dry cask designs (e.g., bare-fuel versus canister-based), the differences are not large when measured by the absolute magnitudes of radionuclide releases in the event of a breach.

All storage cask designs are vulnerable to some types of terrorist attacks for which radionuclide releases would be possible. The vulnerabilities are related to the specific

[17] Since the committee's classified report was published, the committee received an additional briefing from the Nuclear Regulatory Commission suggesting that a radioactive aerosol could be released in one type of terrorist attack. However, the scenario in question does not appear to the committee to be credible.

design features of the casks, but the committee judges that the quantity of radioactive material releases predicted from such attacks is still relatively small.

FINDING 4B: Additional steps can be taken to make dry casks less vulnerable to potential terrorist attacks.

Although the vulnerabilities of current cask designs are already small, additional, relatively simple steps can be taken to reduce them. Such steps are listed in Section 4.2.3.

RECOMMENDATION: The Nuclear Regulatory Commission should consider using the results of the vulnerability analyses for possible upgrades of requirements in 10 CFR 72 for dry casks, specifically to improve their resistance to terrorist attacks.

The committee was told by Nuclear Regulatory Commission staff that such a step is already under consideration. Based on the material presented to the committee, there appear to be minor changes that can be made by plant operators and cask vendors to increase the resistance of existing and new casks to terrorist attacks (see Section 4.2.3).

With respect to the committee's task to examine the safety and security advantages of dry cask storage versus wet pool storage at reactor sites, the committee offers the following findings and recommendations:

FINDING 4C: Dry cask storage does not eliminate the need for pool storage at operating commercial reactors.

Newly discharged fuel from the reactor must be stored in the pool for cooling, as discussed in detail in Chapter 3. Under current U.S. practices, dry cask storage can be used only to store fuel that has been out of the reactor long enough (generally greater than five years under current practices) to be air cooled. The fuel in dry cask storage poses less of a risk in the event of a terrorist attack than newly discharged fuel in pools because there is substantially reduced probability of initiating a cladding fire.

FINDING 4D: Dry cask storage for older, cooler spent fuel has two inherent advantages over pool storage: (1) It is a passive system that relies on natural air circulation for cooling; and (2) it divides the inventory of that spent fuel among a large number of discrete, robust containers. These factors make it more difficult to attack a large amount of spent fuel at one time and also reduce the consequences of such attacks.

Each storage cask holds no more than about 10 to 15 metric tons of spent fuel, compared to the several hundred metric tons of spent fuel that is commonly stored in reactor pools. The robust construction of these casks prevents large-scale releases of radionuclides in all of the attack scenarios examined by the committee. Some of the attacks could breach the casks, but many of these breaches would be small and could probably be more easily plugged than a perforated spent fuel pool wall because radiation fields would be lower and there would be no escaping water to contend with. Even large breaches of the cask would

esult only in the mechanical dispersal of some of its radionuclide inventory in the immediate icinity of the cask.

FINDING 4E: Depending on the outcome of plant-specific vulnerability analyses lescribed in the committee's classified report, the Nuclear Regulatory Commission night determine that earlier movements of spent fuel from pools into dry cask torage would be prudent to reduce the potential consequences of terrorist attacks n pools at some commercial nuclear plants.

The statement of task directs the committee to examine the risks of spent fuel torage options and alternatives for decision makers, not to recommend whether any spent uel should be transferred from pool storage to cask storage. In fact, there may be some ommercial plants that, because of pool designs or fuel loadings, may require some removal spent fuel from their pools. If there is a need to remove spent fuel it should become earer once the vulnerability and consequence analyses described in Chapter 3 are ompleted. The committee expects that cost-benefit considerations would be a part of these nalyses.

TABLE 4.1 Dry Casks Used for Spent Fuel Storage in the United States

Cask design used for storage	License holder	Type	Fuel type	Construction	Closure system	Number of casks used to date; sites; and number of casks on order[1]
CASTOR V/21	GNSI (General Nuclear Systems, Inc.)	Bare-fuel, storage-only	BWR	Ductile cast iron	Primary lid (44 bolts), secondary lid (48 bolts)	25 loaded (Surry); 0 purchased
CASTOR X/33	GNS (Gesellschaft für Nuklear-Service mbH)	Bare-fuel, storage-only	PWR	Ductile cast iron	Primary lid (44 bolts), secondary lid (70 cup screws)	1 loaded (Surry); 0 purchased
NAC S/T	NAC International	Bare-fuel, storage-only	PWR	Inner and outer stainless steel shells	Closure lid (24 bolts)	2 loaded (Surry); 0 purchased
MC-10	Westinghouse	Bare-fuel, storage-only	PWR	Stainless and carbon steel	One shield lid and two sealing lids, all bolted (number of bolts not available)	1 loaded (Surry); 0 purchased
TN-32, TN-40	Transnuclear Inc.	Bare-fuel, storage-only	PWR	Carbon steel	One lid (48 bolts)	61 loaded (4 sites); 22 purchased
TN-68	Transnuclear Inc.	Bare-fuel, dual-purpose	BWR	Carbon steel	One lid (48 bolts)	24 loaded (Peach Bottom); 20 purchased
Fuel Solution W-150 Storage Cask	BNFL Fuel Solutions	Canister-based, dual-purpose	PWR, BWR	Reinforced concrete with inner steel shell	Canister lid, welded cask lid (12 bolts)	7 loaded (Big Rock Point); 0 purchased
HI-STORM 100	Holtec International	Canister-based, storage-only module	PWR, BWR	Stainless steel shells with un-reinforced concrete filler	Canister lid, welded cask lid (4 bolts)	58 loaded (7 sites); 177 on order
HI-STAR 100	Holtec International	Canister-based, dual-purpose	PWR, BWR	Carbon steel shells with neutron absorber polymer	Canister lid, welded cask lid (54 bolts)	7 loaded (2 sites[1]); 5 on order

VSC-24 Ventilated Concrete Cask	BNFL Fuel Solutions	Canister-based, storage-only	PWR	Reinforced concrete with inner steel shell	Canister lid, welded cask lid (6 bolts)	58 loaded (3 sites); 4 purchased[2]
NAC-MPC	NAC International	Canister-based, dual-purpose	PWR	Metal canister surrounded by storage overpack. Storage overpack consists of an inner steel liner 3.5 in. thick, two rebar cages, and concrete	Canister lid, welded cask lid over a shield plug (6 high-strength bolts)	21 loaded (Yankee Rowe and CT Yankee); 59 purchased
NAC-UMS	NAC International	Canister-based, dual-purpose	PWR, BWR	Metal canister surrounded by storage overpack. Storage overpack consists of inner steel liner 2.5 in. thick, two rebar cages, and concrete	Canister lid, welded cask lid over a shield plug (6 high-strength bolts)	80 loaded (2 sites); 165 purchased
Holtec MPC 24E/EF	Holtec International	Canister based, dual-purpose	PWR, BWR	Metal canister surrounded by storage overpack. Storage overpack consists of inner and outer steel liners, a double-rebar cage, and concrete	Canister lid, welded cask lid, shield plug plus 48 bolts	34 loaded (Trojan); 0 purchased
NUHOMS 24P, 52B, 61BT, 24PT1, 24PT2, 32PT	Transnuclear Inc.	Canister-based, dual-purpose	PWR, BWR	Horizontal reinforced concrete storage module with shielded canister	Canister lid, welded storage module lid, reinforced concrete	239 loaded (10 sites); >150 purchased

NOTES:
[1]The Humboldt Bay Power Plant is licensing a site-specific variation of the HI-STAR System called HI-STAR HB.
[2] Some licensees have purchased additional casks that have not yet been loaded, nor are they planned for loading.

SOURCES: Data compiled from cask license holders (2004).

5
IMPLEMENTATION ISSUES

Implementation of the recommendations in this report will require actions and cooperation by a large number of parties. This chapter provides a brief discussion of two implementation issues that the committee believes will be of interest to Congress:

(1) Timing Issues: Ensuring that high-quality, expert analyses are completed in a timely manner.

(2) Communication Issues: Ensuring that the results of the analyses are communicated to industry so that appropriate and timely mitigating actions can be taken.

5.1 TIMING ISSUES

The September 11, 2001, terrorist attacks forced the nation to begin a reexamination of the vulnerability of its critical infrastructure to high-impact suicide attacks by terrorists. The Nuclear Regulatory Commission was no exception. The Commission began a top-to-bottom review of security procedures at commercial nuclear power plants. This review resulted in the issuance of numerous directives to power plant operators to upgrade their security practices. The Commission also began a series of vulnerability analyses of spent fuel storage to terrorist attacks. These analyses are described in Chapters 3 and 4.

More than three years have passed since the September 11, 2001, attacks. Vulnerability analyses of spent fuel pool storage to attacks with large aircraft have been performed by EPRI (Chapter 3), and analyses of vulnerabilities of dry cask storage to large aircraft attacks have been completed by the German organization GRS (Gesellschaft für Anlagen- und Reaktorsicherheit, mbH). However, the Nuclear Regulatory Commission's analyses of spent fuel storage vulnerabilities have not yet been completed, and actions to reduce vulnerabilities, such as those described in Chapter 3, on the basis of these analyses have not yet been taken. Moreover, some important additional analyses remain to be done. The slow pace in completing this work is of concern given the enormous potential consequences as described elsewhere in this report.

The committee does not know the reason for this delay, nor was it asked by Congress for an evaluation. It is important to note that the Nuclear Regulatory Commission's analyses are addressing a much broader range of vulnerabilities than just spent fuel storage. The committee nevertheless raises this issue because it appears to be having an impact on the timely completion of critical work and implementation of appropriate mitigative actions for spent fuel storage.

5.2 COMMUNICATION ISSUES

During the course of this study, the committee had the opportunity to interact with representatives of the nuclear power industry to discuss their concerns about safety and

security issues. The committee received numerous comments from industry representatives about the lack of information sharing by the Nuclear Regulatory Commission on the vulnerability analyses described in Chapter 3. These representatives noted that information flow was predominately in one direction: from the industry to the Commission. The Commission was not providing a reciprocal flow of information that could help the industry better understand and take early actions to address identified vulnerabilities.

Restrictions on information sharing by the Commission have resulted in missed opportunities in at least two cases observed by the committee. Analyses of aircraft impacts into power plant structures described in Chapter 3 were being carried out independently by Sandia for the Commission and by EPRI for the nuclear power industry. Because of classification restrictions, EPRI was not provided with information about the Sandia work, including the results of physical tests that would have helped EPRI validate its models. Both Sandia and the industry would have benefited had their analysts been able to talk with each other about their models, assumptions, and results while the analyses were in progress. When the EPRI work was completed the Commission declared it to be safeguards information.[1] As a consequence, some of the EPRI analysts who generated the results no longer had access to them, and the results could not be shared widely within industry.

A similar situation exists with respect to the ENTERGY Corp. spent fuel pool separate effects analyses described in Chapter 3. ENTERGY is using similar approaches and models as Sandia but has received little or no guidance from Commission staff about whether the results are realistic or consistent. The ENTERGY analysts told the committee that they would have benefited had they been able to compare and discuss their approaches and results with Sandia analysts. Sandia analysts were prevented from doing so because of classification issues. Sharing of ENTERGY's results within the company or across industry may be problematical if they are determined to be classified or safeguards information by the Commission.

Several Nuclear Regulatory Commission staff also privately expressed to the committee their frustration at the difficulty in sharing information that they know would be useful to industry. In fact, from the contacts the committee had, there does not appear to be a lack of willingness to share information at the working staff level within the Commission. Rather, it seems to be an issue of getting permission from upper management and addressing the classification restrictions.

Much of the difficulty in sharing this information appears to arise because the information is considered by the Nuclear Regulatory Commission to be safeguards information or in some cases even classified national security information. Industry analysts and decision makers generally do not have the appropriate personal security clearances[2] to access this information. The committee learned that the Commission is making efforts to share more of this information with some industry representatives. The industry will be responsible for implementing any changes to spent fuel storage to make it less vulnerable to terrorist attack. Clearly, therefore, the industry needs to understand the results of the

---

[1] Safeguards information is defined in section 147 of the Atomic Energy Act and in the Code of Federal Regulations, Title 10, Part 73.2. See the glossary for a definition. Authority for designation of safeguards resides with the Nuclear Regulatory Commission.

[2] In fact, a personnel security clearance is not required to access safeguards information. One only needs to be of "good character" and have a "need to know" as determined by the Nuclear Regulatory Commission.

Commission's vulnerability analyses to ensure that effective implementation strategies are adopted.

The committee also received complaints during this study from members of the public about the lack of information sharing. Commission staff have responded to these complaints by stating that such sharing could reveal sensitive information to terrorists and that the public does not have a "need to know" this information.

The committee fully agrees that information that could prove useful to terrorists should not be released. On the other hand, the committee believes that there is information that could be shared without compromising national security. For example, general information about the kinds of threats being considered and general steps being taken to reduce vulnerabilities could be shared with the public. Information about specific vulnerabilities of spent fuel pools and dry storage casks to terrorist attacks as well as potential mitigative actions could be shared with industry without revealing the details about how such attacks might be carried out. Sharing information with industry is essential for ensuring that mitigative actions to reduce vulnerabilities are carried out. Sharing information with the public is essential in a nation with strong democratic traditions for sustaining public confidence in the Commission as an effective regulator of the nuclear industry, and for reducing the potential for severe environmental, health, economic, and psychological consequences from terrorist attacks should they occur.

5.3 FINDING AND RECOMMENDATION

FINDING 5A: Security restrictions on sharing of information and analyses are hindering progress in addressing potential vulnerabilities of spent fuel storage to terrorist attacks.

Current classification and security practices appear to discourage information sharing between the Nuclear Regulatory Commission and industry. During the course of the study the committee received comments from power plant operators, their contractors, and Nuclear Regulatory Commission staff about the difficulties of sharing the information on the vulnerability of spent fuel storage. Indeed, even the committee found it difficult and in some cases impossible to obtain needed information (e.g., information on the design basis threat). Such restrictions have several negative consequences: They impede the review and feedback processes that can enhance the technical soundness of the analyses being carried out; they make it difficult to build support within the industry for potential mitigative measures; and they may undermine the confidence that the industry, expert panels such as this one, and the public place in the adequacy of such measures.

RECOMMENDATION: The Nuclear Regulatory Commission should improve the sharing of pertinent information on vulnerability and consequence analyses of spent fuel storage with nuclear power plant operators and dry cask storage system vendors on a timely basis.

Implementation of this recommendation will allow timely mitigation actions. Certain current security practices may have to be modified to carry out this recommendation.

The committee also believes that the public is an important audience for the work being carried out to assess and mitigate vulnerabilities of spent fuel storage facilities. While it would be inappropriate to share all information publicly, more constructive interaction with the public and independent analysts could improve the work being carried out and also increase public confidence in Nuclear Regulatory Commission and industry decisions and actions to reduce the vulnerability of spent fuel storage to terrorist threats.

REFERENCES

Alvarez, R., J. Beyea, K. Janberg, J. Kang, E. Lyman, A. Macfarlane, G. Thompson, and F. N. von Hippel. 2003a. Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States. Science and Global Security, Vol. 11, pp. 1-51.

Alvarez, R., J. Beyea, K. Janberg, J. Kang, E. Lyman, A. Macfarlane, G. Thompson, and F. N. von Hippel. 2003b. Response by the authors to the NRC review of "Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States." Science and Global Security, Vol.11, pp. 213-223.

American Nuclear Society. 1988. Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type): An American National Standard. ANSI/ANS-57.7-1988. American Nuclear Society. LaGrange Park, Illinois.

ASCE (American Society of Civil Engineers). 2003. The Pentagon Building Performance Report. By P. F. Mlakar, D. O. Dusenberry, J. R. Harris, G. Haynes. L. T. Phan, and M. A. Sozen. January. Structural Engineering Institute. Reston, Virginia. Available at *http://fire.nist.gov/bfrlpubs/build03/art017.html.*

Baker, L., and L. C. Just. 1962. Studies of Metal Water Reactions at High Temperatures III. Experiments and Theoretical Studies of the Zirconium-Water Reaction. ANL-548. May. Argonne National Laboratory, Argonne, Illinois.

Benjamin, A. S., D. J. McCloskey, D. A. Powers, and S. A. Dupree. 1979. Spent Fuel Heatup Following Loss of Water During Storage. NUREG/CR-0649, SAND77-1371. Rev.3. Sandia National Laboratories, New Mexico.

Benjamin, A. S. 2003. Comments on "Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States." Science and Global Security, Vol. 11, pp. 53-58.

Beyea, J., E. Lyman, and F. von Hippel. 2004. Damages from a Major Release of ^{137}Cs into the Atmosphere of the U.S. (addendum to "Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States" by R. Alvarez, J. Beyea, K. Janberg. E. Lyman, A. Macfarlane, G. Thompson, and F. von Hippel, 2003. Science and Global Security, Vol. 11, pp. 1-51). Science and Global Security, Vol. 12, pp. 125-136.

Borenstein, S. 2002. Security Upgrades at Nuclear Plants Are Behind Schedule. Knight Ridder Newspapers. April 11. Available at *http://www.nci.org/02/04f/12-01.htm.*

BNL (Brookhayen National Laboratory). 1987. Severe Accidents in Spent Fuel Pools in Support of Generic Safety Issue 82. NUREG/CR-4982 and BNL-NUREG-52093. V. L. Sailer, K.R. Perkins, J.R. Weeks, and H. R. Connell. July. Upton, N.Y.: Brookhaven National Laboratory.

BNL. 1997. A Safety and Regulatory Assessment of Generic BWR and PWR Permanently Shutdown Nuclear Power Plants. R. J. Travis, R. E. Davis, E. J. Grove, and M. A. Azarm. NUREG/CR-6451. August. Upton, N.Y.: Brookhaven National Laboratory.

Chapin, D. M., K. P. Cohen, W. K. Davis, E. E. Kintner, L. J. Koch, J. W. Landis, M. Levenson, I. H. Mandil, Z. T. Pate, T. Rockwell, A. Schriesheim, J. W. Simpson, A. Squire, C. Starr, H. E. Stone, J. J. Taylor, N. E. Todreas, B. Wolfe, and E. L. Zebroski. 2002. Nuclear Power Plants and Their Fuel as Terrorist Targets. Science, Vol. 297, pp. 1997-1999.

Droste, B., H. Völzke, G. Wieser, and L. Quiao. 2002. Safety Margins of Spent Fuel Transport and Storage Casks Considering Aircraft Crash Impacts. RAMTRANS, Vol. 13(3-4), pp. 313-316.

Duderstadt, J. J., and L. J. Hamilton. 1976. Nuclear Reactor Analysis. John Wiley & Sons. New York.

EPRI. 2002. Deterring Terrorism: Aircraft Crash Impact Analyses Demonstrate Nuclear Power Plant's Structural Strength. Palo Alto, California [SAFEGUARDS INFORMATION].

FEMA (Federal Emergency Management Agency). 2002. World Trade Center Building Performance Study: Data Collection, Preliminary Observations, and Recommendations. FEMA 403. May. FEMA Region II, New York. Available at *http://www.fema.gov/library/wtcstudy.shtm.*

Ferguson, C. D., W. C. Potter, A. Sands, L. S. Spector, and F. L. Wehling. 2004. The Four Faces of Nuclear Terrorism. Center for Nonproliferation Studies. Monterey Institute of International Studies. Nuclear Threat Initiative. Monterey, California. Available at *http://cns.miis.edu/pubs/books/pdfs/4faces.pdf.*

GAO (U.S. Government Accountability Office). 2003. Spent Nuclear Fuel: Options Exist to Further Enhance Security. GAO-03-426. July. Available at *http://www.gao.gov/new.items/d03426.pdf.*

HSK (Die Hauptabteilung für die Sicherheit der Kernanlagen). 2003. Position of the Swiss Federal Nuclear Safety Inspectorate Regarding the Safety of the Swiss Nuclear Power Plants in the Event of an Intentional Aircraft Crash. HSK-AN-4626. March. Würenlingen, Switzerland.

Jenkins, B. M. 1975. Will Terrorists Go Nuclear? RAND Corporation. RAND P-5541. Santa Monica, California.

Jenkins, B. M. 1985. Will Terrorists Go Nuclear? Orbis, Vol. 29(3), pp. 507-516.

Kaplan, S., and B.J. Garrick. 1981. On the quantitative definition of risk. Risk Analysis, Vol. 1(1), pp. 11-27.

Lamarsh, J. R. 1975. Introduction to Nuclear Engineering. Addison-Wesley Publishing Company. Reading, Massachusetts.

Lange, F., G. Pretzsch, J. Dohler, E. Horman, H. Busch, and W. Koch. 1994. Experimental Determination of UO_2-Release from Spent Fuel Transport Cask after Shaped Charge Attack. INMM Annual Meeting. Naples, Florida, Vol. XXIII, pp. 408-413.

Lange, F., G. Pretzsch, E. Hörmann, and W. Koch. 2001. Experiments to Quantify Potential Releases and Consequences from Sabotage Attack on Spent Fuel Casks. Thirteenth International Symposium on Packaging and Transportation of Radioactive Materials PATRAM. Chicago, Illinois.

Lange, F., H. J. Fett, E. Hormann, E. Schrodl, G. Schwarz, B. Droste, H. Volzke, G. Wieser, and L. Qiao. 2002. Safety Margins of Transport and Storage Casks for Spent Fuel Assemblies and HAW Canisters under Extreme Accident Loads and Effects from External Events. Report within framework of Project SR 2415. April. Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH, Koln; Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin, Germany.

Luna, R. E. 2000. Comparison of Results from Two Spent Fuel Sabotage Source Term Experiments. RAMTRANS. Vol. 11(3), pp. 261-265.

Marsh, G. E. and G. S. Stanford. 2001. National Policy Analysis #374: Terrorism and Nuclear Power: What are the Risks? National Center for Policy Research. November. Available at *http://www.nationalcenter.org/NPA374.html.*

NRC (National Research Council). 2002. Making the Nation Safer: The Role of Science and Technology in Countering Terrorism. National Academy Press. Washington, D.C.

RBR Consultants, Inc.. 2003. Terrorist Aircraft Strikes at Indian Point Spent Fuel Pools. February. Herschel Specter's testimony to the New York City Council's Committee on Environmental Protection. February. New York.

Thomauske, B. 2003. Realization of the German Concept for Interim Storage of Spent Nuclear Fuel—Current Situation and Prospects. Waste Management '03 Conference. February 23-27, 2003. Tucson, Arizona.

Thompson, G. 2003. Robust Storage of Spent Nuclear Fuel: A Neglected Issue of Homeland Security. Institute for Resource and Security Studies. Report commissioned by Citizens Awareness Network. January. Cambridge, Massachusetts.

Tong, L. S., and J. Weisman. 1996. Thermal Analysis of Pressurized Water Reactors. Third Edition. American Nuclear Society. LaGrange Park, Illinois.

U.S. Atomic Energy Commission. 1975. Reactor Safety Study. An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants. WASH-1400. August. Washington, D.C.

USNRC (U.S. Nuclear Regulatory Commission). 1976. Final Generic Environmental Statement on the Use of Recycled Plutonium in Mixed Oxide Fuel in Light-Water Cooled Reactors (GESMO). NUREG-0002. Washington, DC.

USNRC. 1983. A Prioritization of Generic Safety Issues. NUREG-0933. December. Vol. 3.82, pp. 1-6. Washington, D.C.

USNRC. 1984. Spent Fuel Heat Generation in an Independent Spent Fuel Storage Installation. Regulatory Guide 3.54 (Task CE 034-4). Office of Nuclear Regulatory Research. September. Washington, D.C.

USNRC. 1987. Case Histories of West Valley Spent Fuel Shipments. NUREG/CR-4847. January, Washington, D.C.

USNRC. 1996. Refueling Practice Survey: Final Report. May. Washington, DC. Available at *http://www.nrc.gov/reading-rm/doc-collections/news/1996/96-074.html.*

USNRC. 1997. Operating Experience Feedback Report. Assessment of Spent Fuel Cooling. NUREG-1275. Vol. 12. J. G. Ibarra, W. R. Jones, G. F. Lanik, H. L. Ornstein, S. V. Pullani. Office for Analysis and Evaluation of Operational Data. Washington, D.C.

USNRC. 2001a. Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants. NUREG-1738. Division of Systems Safety and Analysis. January. Washington, D.C.

USNRC. 2001b. Review of NRC's Dry Cask Storage Program. Audit Report. OIG-01-A-11. Office of the Inspector General. June 20. Washington, D.C.

USNRC. 2003a. Nuclear Regulatory Commission (NRC) review of "Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States." Science and Global Security, Vol. 11, pp. 203-211.

USNRC. 2003b. A Prioritization of Generic Safety Issues. NUREG-0933. R. Emrit, R. Riggs, W. Milstead, J. Pittman, and H. Vendermolen. Office of Nuclear Regulatory Research. October. Washington, DC. Available at *http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0933.*

Walker, J.S. 2004. Three Mile Island: A Nuclear Crisis in Historical Perspective. University of California Press. Berkeley, California.

Zimmerman, P. D., and C. Loeb. 2004. Dirty Bombs: The Threat Revisited. Defense Horizons. Vol. 38 (January), pp. 1-11.

A
INFORMATION-GATHERING SESSIONS

The committee organized several meetings and tours to obtain information about the safety and security of spent fuel storage. A list of these meetings and tours is provided below. The committee held several *data-gathering sessions not open to the public* to obtain classified and safeguards information about the safety and security of spent fuel storage. The committee also held several *data-gathering sessions open to the public* to receive unclassified briefings from industry, independent analysts, and other interested parties including members of the public. The written materials (e.g., PowerPoint presentations and written statements) obtained by the committee at these open sessions are posted on the web site for this project: *http://dels.nas.edu/sfs*.

A.1 FIRST MEETING, FEBRUARY 12-13, 2004, WASHINGTON, D.C.

The objective of this meeting was to obtain background information on the study request from staff of the House Committee on Appropriations, Energy and Water Development Subcommittee. The committee also was briefed by one of the sponsors of the study and by two independent experts. The following is the list of topics and speakers for the open session:

- Background on the congressional request for this study. Speaker: Kevin Cook, Professional Staff, House Committee on Appropriations, Energy and Water Development Subcommittee.
- Reducing the hazard from stored spent power-reactor fuel in the United States. Speakers: Frank von Hippel, Princeton University, and Klaus Janberg, independent consultant, co-authors of the paper entitled "Reducing the Hazard from Stored Spent Power-Reactor Fuel in the United States" (Alvarez et al., 2003).
- Nuclear power plants and their fuel as terrorist targets. Speaker: Ted Rockwell, MPR Associates, Inc., co-author of the paper entitled "Nuclear Power Plants and Their Fuel as Terrorist Targets" (Chapin et al., 2002).
- Nuclear Regulatory Commission analyses of spent fuel safety and security. Speaker: Farouk Eltawila, director, Division of Systems Analysis and Regulatory Effectiveness, Office of Research, Nuclear Regulatory Commission.

On the second day of the meeting, the committee held a data-gathering session not open to the public to obtain classified briefings from the U.S. Nuclear Regulatory Commission about its ongoing analyses of spent fuel storage security.

A.2 SECOND MEETING, MARCH 4-6, 2004, ARGONNE, ILLINOIS

During the second meeting, the committee held a data-gathering session not open to the public to receive classified briefings on spent fuel storage security from the U.S. Nuclear Regulatory Commission. The committee also toured the Dresden and Braidwood Nuclear

Generating Stations to see first-hand how spent fuel is managed and stored. The two plants were chosen because of the differences in their spent fuel storage facilities.

A.3 THIRD MEETING, APRIL 15-17, 2004, ALBUQUERQUE, NEW MEXICO

During the third meeting, the committee held a data-gathering session not open to the public to receive a briefing from EPRI on spent fuel storage vulnerabilities. The committee also held a data-gathering session open to the public to receive briefings on dry cask storage systems and radioactive releases from damaged spent fuel storage casks.

- Speakers on dry cask storage systems: William McConaghy (GNB-GNSI); Steven Sisley (BNFL); Alan Hanson (Transnuclear Inc.); Charles Pennington (NAC International); and Brian Gutherman (Holtec International, via telephone).
- Radionuclide releases from damaged spent fuel. Speaker: Robert Luna, Sandia National Laboratories (retired).

A.4 TOUR OF SELECTED SPENT FUEL STORAGE INSTALLATIONS IN GERMANY

On April 25-28, 2004, a group of committee members traveled to Germany to meet with German officials and to visit selected spent fuel storage installations. The agenda of the tour was as follows:

- Meeting with Michael Sailer, chairman of the German reactors safety commission (RSK, Reaktorsicherheitskommission).
- Visit to the dry cask manufacturer GNB (Gesellschaft für Nuklear-Behälter mbH) headquarters in Essen and the cask assembly facility and test museum in Mülheim.
- Tour of the Ahaus intermediate dry storage facility.
- Meeting with Florentin Lange, GRS (Gesellschaft für Anlagen- und Reaktorsicheheit mbH), co-author of the study entitled "Safety Margins of Transport and Storage Casks for Spent Fuel Assemblies and HAW Canisters Under Extreme Accident Loads and Effects from External Events" (Lange et al., 2002).
- Tour of the Lingen nuclear power plant and its spent fuel storage facilities.

A summary of information gathered during the tour is provided in Appendix C.

A.5 FOURTH MEETING, MAY 10-12, 2004, WASHINGTON, D.C.

During the fourth meeting, the committee held a data-gathering session not open to the public to hold in-depth technical discussions with Sandia National Laboratories staff and contractors on their spent fuel storage vulnerability analyses. The committee also received an intelligence briefing from Department of Homeland Security staff on terrorist capabilities and from the U.S. Nuclear Regulatory Commission staff on terrorist scenarios.

The meeting also included a data-gathering session open to the public that included the following briefings:

- Summary of the field trip to Germany. Speaker: Louis Lanzerotti (committee chair).
- Vulnerabilities of spent nuclear fuel pools to terrorist attacks: Issues with the design basis threat. Speaker: Peter Stockton, Project on Government Oversight.
- Consequences of a major release of ^{137}Cs into the atmosphere. Speaker: Jan Beyea, Consulting in the Public Interest.

A.6 FIFTH MEETING, MAY 26-28, 2004, WASHINGTON, D.C.

The objective of this closed meeting (i.e., open only to committee members and staff) was to finalize the classified report for National Research Council review.

A.7 TOURS OF SELECTED SPENT FUEL STORAGE FACILITIES AT U.S. NUCLEAR POWER PLANTS

On June 11 and June 14, 2004, respectively, committee subgroups visited the Palo Verde Nuclear Generating Station in Arizona and the Indian Point Nuclear Generating Station in New York.

A.8 SIXTH MEETING, JUNE 28-29, 2004

The objective of this closed meeting was to complete work on the classified report.

A.9 SEVENTH MEETING, AUGUST 12-13, 2004

The objective of this closed meeting was to develop a public version of the committee's report. The committee also held a data-gathering session not open to the public to receive a briefing from the Department of Homeland Security on steps being taken to address the findings and recommendations in the classified report.

A.10 EIGHTH MEETING, OCTOBER 28-29, 2004

The objective of this closed meeting was to continue work to develop a public version of the committee's report. The committee also held a data-gathering session not open to the public to receive a briefing from the Nuclear Regulatory Commission on steps being taken to address the findings and recommendations in the classified report.

A.11 NINTH MEETING, NOVEMBER 29-30, 2004

The objective of this closed meeting was to continue work to develop a public version of the committee's report.

A.12 TENTH MEETING, January 24-25, 2005

The objective of this closed meeting was to continue work to develop a public version of the committee's report. The committee also held a data-gathering session not open to the public to meet with three commissioners from the Nuclear Regulatory Commission (Chairman Nils Diaz and members Edward McGaffigan and Jeffrey Merrifield) to discuss what additional information the commission might be willing to make available to the committee on human-factors-related issues.

REFERENCES

Alvarez, R., J. Beyea, K. Janberg, J. Kang, E. Lyman, A. Macfarlane, G. Thompson, and F. N. von Hippel. 2003a. Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States. Science and Global Security, Vol. 11, pp. 1-51

Chapin, D. M., K. P. Cohen, W. K. Davis, E. E. Kintner, L. J. Koch, J. W. Landis, M. Levenson, I. H. Mandil, Z. T. Pate, T. Rockwell, A. Schriesheim, J. W. Simpson, A. Squire, C. Starr, H. E. Stone, J. J. Taylor, N. E. Todreas, B. Wolfe, and E. L. Zebroski. 2002. Nuclear Power Plants and Their Fuel as Terrorist Targets. Science, Vol. 297, pp. 1997-1999.

Lange, F., H. J. Fett, E. Hormann, E. Schrodl, G. Schwarz, B. Droste, H. Volzke, G. Wieser, and L. Qiao. 2002. Safety Margins of Transport and Storage Casks for Spent Fuel Assemblies and HAW Canisters under Extreme Accident Loads and Effects from External Events. Report within framework of Project SR 2415. April. Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH, Koln; Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin, Germany.

B

BIOGRAPHICAL SKETCHES OF COMMITTEE MEMBERS

LOUIS J. LANZEROTTI, *Chair*, is an expert in geophysics and electromagnetic waves and a veteran of over 40 National Research Council (NRC) studies. He currently consults for Bell Laboratories, Lucent Technologies, and is a distinguished professor for solar-terrestrial research at the New Jersey Institute of Technology. Previously, he was a distinguished member of the technical staff at Bell Labs. His research interests include space plasmas and engineering problems related to the impacts of atmospheric and space processes on telecommunications on commercial satellites and transoceanic cables. He has been associated with numerous National Aeronautics and Space Administration (NASA) space missions as well, including Voyager, Ulysses, Galileo, and Cassini, and with commercial space satellite missions to research design and operational problems associated with spacecraft and cable operations. In 1988, he was elected to the National Academy of Engineering for his work on energetic particles and electromagnetic waves in the earth's magnetosphere, including their impact on space and terrestrial communication systems. He has twice received the NASA Distinguished Public Service Medal and has a geographic feature in Antarctica named in his honor. He was appointed to the National Science Board by President George W. Bush in 2004. Dr. Lanzerotti holds a Ph.D. in physics from Harvard University.

CARL A. ALEXANDER is an expert in the behavior of nuclear material at high temperatures and also in biological and chemical weapons. He is chief scientist and senior research leader at the Battelle Memorial Institute in Columbus, Ohio. Dr. Alexander worked on fuel design and behavior for the aircraft nuclear propulsion program and several space nuclear power projects, including the Viking, Voyager, and Cassini missions. He helped analyze the evolution of the Three Mile Island accident and is involved in the French Phebus fission product experiments, which are to reproduce all of the phenomena involved during a nuclear power reactor core meltdown accident. He has served as a consultant to the Nuclear Regulatory Commission and, in the 1970s, worked on the first experiments on the effects of an attack on spent fuel shipping containers using shaped charges. He currently leads research projects on agent neutralization and collateral effects for weapons of mass destruction for the Defense Threat Reduction Agency and the Navy, and on lethality of missile defense technologies for the Missile Defense Agency. Dr. Alexander has taught materials science and engineering at the Ohio State University and has served as graduate advisor and adjunct professor at the Massachusetts Institute of Technology, University of Southampton in the United Kingdom, and the University of Maryland. He has authored over 100 peer-reviewed articles and technical reports, many of which are classified. He holds a Ph.D. in materials science from Ohio State University.

ROBERT M. BERNERO is a nuclear engineering and regulatory expert. He is now an independent consultant after retiring from the U.S. Nuclear Regulatory Commission (USNRC) in 1995. In 23 years of service for the USNRC Mr. Bernero held numerous positions in reactor licensing, fuel cycle facility licensing, engineering standards development, risk assessment research, and waste management. His final position at USNRC was as director of the Office of Nuclear Materials Safety and Safeguards. Prior to joining the USNRC he worked for the General Electric Company in nuclear technology for 13 years. He has served as a member of the Commission of Inquiry for an International

Review of Swedish Nuclear Regulatory Activities, and he currently consults on nuclear safety-related matters, particularly regarding nuclear materials licensing and radioactive waste management. Mr. Bernero received his B.A. degree from St. Mary of the Lake (Illinois), a B.S. degree from the University of Illinois, and an M.S. degree from Rensselaer Polytechnic Institute.

M. QUINN BREWSTER is an expert in energetic solids and heat transfer. He is currently the Hermia G. Soo Professor of Mechanical Engineering at the University of Illinois at Urbana-Champaign. He is involved in the Academic Strategic Alliance Program, whose objective is to develop integrated software simulation capability for coupled, system simulation of solid rocket motors including internal ballistics (multi-phase, reacting flow) and structural response (propellant grain and motor case). Dr. Brewster has authored one book on thermal radiative transfer and chapters in four other books as well as several publications on combustion science. He is a fellow of the American Society of Mechanical Engineers and associate fellow of the American Institute of Aeronautics and Astronautics. Dr. Brewster holds a Ph.D. in mechanical engineering from the University of California at Berkeley.

GREGORY R. CHOPPIN is an actinide elements and radiochemistry expert. He is currently the R.O. Lawton Distinguished Professor Emeritus of Chemistry at Florida State University. His research interests involve the chemistry and separation of the f-elements and the physical chemistry of concentrated electrolyte solutions. During a postdoctoral period at the Lawrence Radiation Laboratory, University of California, Berkeley, he participated in the discovery of mendelevium, element 101. His research and educational activities have been recognized by the American Chemical Society's Award in Nuclear Chemistry, the Southern Chemist Award of the American Chemical Society, the Manufacturing Chemist Award in Chemical Education, the Chemical Pioneer Award of the American Institute of Chemistry, a Presidential Citation Award of the American Nuclear Society, the Becquerel Medal, British Royal Society, and honorary D.Sc. degrees from Loyola University and the Chalmers University of Technology (Sweden). Dr. Choppin previously served on the NRC's Board on Chemical Sciences and Technology and Board on Radioactive Waste Management. He holds a Ph.D. in inorganic chemistry from the University of Texas, Austin.

NANCY J. COOKE is an expert in the development, application, and evaluation of methodologies to elicit and assess individual and team knowledge. She is currently a professor in the applied psychology program at Arizona State University East. She also holds a National Research Council Associateship position with Air Force Research Laboratory and serves on the board of directors of the Cognitive Engineering Research Institute in Mesa, Arizona. Her current research areas are the following: cognitive engineering, knowledge elicitation, cognitive task analysis, team cognition, team situation awareness, mental models, expertise, and human-computer interaction. Her most recent work includes the development and validation of methods to measure shared knowledge and team situation awareness and research on the impact of cross- training, distributed mission environments, and workload on team knowledge, process, and performance. This work has been applied to team cognition in unmanned aerial vehicle and emergency operation center command-and-control. She contributed to the creation of the Cognitive Engineering Research on Team Tasks Laboratory to develop, apply, and evaluate measures of team cognition. She has authored or co-authored over 70 articles, chapters, and technical reports on measuring team cognition, knowledge elicitation, and human-computer interaction. Dr. Cooke holds a Ph.D. in cognitive psychology from New Mexico State University, Las Cruces.

GORDON R. JOHNSON is an expert in penetration mechanics and computational mechanics. He is currently a senior scientist and manager of the solid mechanics group at Network Computing Services. His recent work has included the development of computational mechanics codes that include finite elements and meshless particles. He has also developed computational material models to determine the strength and failure characteristics of a variety of materials subjected to large strains, strain rates, temperatures, and pressures. His work for the U.S. Departments of Energy and Defense has included a wide range of intense impulsive loading computations for high-velocity impact and explosive detonation. He was a chief engineering fellow during his 35 years at Alliant Techsystems (formerly Honeywell). He has served as a technical advisor for university contracts with the Army Research Office, and an industry representative for its strategic planning, and was a member of the founding board of directors for the Hypervelocity Impact Society. Dr. Johnson holds a Ph.D. in structures from the University of Minnesota, Minneapolis.

ROBERT P. KENNEDY has expertise in structural dynamics and earthquake engineering. He is currently an independent consultant in structural mechanics and engineering. Dr. Kennedy has worked on static and dynamic analysis and the design of special-purpose civil and mechanical-type structures, particularly for the nuclear, petroleum, and defense industries. He has designed structures to resist extreme loadings, including seismic loadings, missile impacts, extreme winds, impulsive loads, and nuclear environmental effects, and he has developed computerized structural analysis methods. He also served as a peer reviewer for an EPRI study on aircraft impacts on nuclear power plants. In 1991, he was elected to the National Academy of Engineering for developing design procedures for civil and mechanical structures to resist seismic and other extreme loading conditions. Dr. Kennedy holds a Ph.D. in structural engineering from Stanford University.

KENNETH K. KUO is an expert in combustion, rocket propulsion, ballistics, and fluid mechanics. He is a Distinguished Professor of Mechanical Engineering at the Pennsylvania State University. He is also the leader and director of the university's High Pressure Combustion Laboratory, a laboratory with advanced instrumentation and data acquisition devices. Dr. Kuo has directed team research projects in propulsion and combustion studies for 32 years. He has edited eight books and authored one book on combustion, published over 300 technical articles, and served as principal investigator for more than 70 projects, including a Multidisciplinary University Research Initiative (MURI) grant from the U.S. Army on "Ignition and Combustion of High Energy Materials." He is now serving as principal investigator and co-principal investigator for two MURI programs on rocket and energetic materials. In 1991, he was elected fellow of American Institute of Aeronautics and Astronautics and has received several awards for his work on solid propellants combustion processes. Dr. Kuo holds a Ph.D. in aerospace and mechanical sciences from Princeton University.

RICHARD T. LAHEY, JR., is an expert in multiphase flow and heat transfer technology, nuclear reactor safety, and the use of advanced technology for industrial applications. He is currently the Edward E. Hood Professor of Engineering at Rensselaer Polytechnic Institute (RPI) and was previously chair of the Department of Nuclear Engineering and Science, director of the Center for Multiphase Research, and the dean of engineering at RPI. Previously, Dr. Lahey held several technical and managerial positions with the General Electric Company, including overall responsibility for all domestic and foreign R&D programs associated with boiling water nuclear reactor thermal-hydraulic and safety technology. He has chaired several committees for the American Society of Mechanical Engineering, American Nuclear Society, American Institute for Chemical Engineering, American Society

for Engineering Education, and NASA. His current research is funded by the Department of Energy's Naval Reactors Program, the Office of Naval Research, the National Science Foundation, the New York State Energy Research and Development Authority, Oak Ridge National Laboratory, and the Defense Advanced Research Projects Agency. He currently consults on nuclear reactor safety problems and the chemical processing of non-nuclear materials and is a member of the Board of Managers of PJM Interconnection, LLC. In 1994, he was elected to the National Academy of Engineering for his contributions to the fields of multiphase flow and heat transfer and nuclear reactor safety technology. In 1995, he became a member of the Russian Academy of Sciences-Baskortostan and he is a fellow of the American Nuclear Society and of the American Society of Mechanical Engineers. He has authored or co-authored over 300 technical publications, including 10 books or handbooks and 160 journal articles. Dr. Lahey holds a Ph.D. in mechanical engineering from Stanford University.

KATHLEEN R. MEYER has expertise in health physics and radiologic risk assessment. She is a principal of Keystone Scientific, Inc., and is currently involved in risk assessments for public health and the environment from radionuclides and chemicals at several U.S. Department of Energy sites. Other work includes an assessment of the interim radionuclide soil action levels adopted by the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency, and the Colorado Department of Health and Environment for cleanup at the Rocky Flats Environmental Technology Site. She has been a member of the National Council on Radiation Protection and Measurements Historical Dose Evaluation Committee. Dr. Meyer has authored or co-authored several peer-reviewed articles, including papers on cancer research, historical evaluation of past radionuclide and chemical releases, and risk assessment of radionuclides and chemicals. She holds a Ph.D. in radiological health sciences from Colorado State University.

FREDRICK J. MOODY is an expert thermal hydraulics and two-phase flow in nuclear power reactors. In 1999, he retired after 41 years of service at General Electric Company and 28 years as an adjunct professor of mechanical engineering at San Jose State University. Dr. Moody was the recipient of several prestigious career awards, including the General Electric Power Sector Award for Contributions to the State-of-the-Art for Two-Phase Flow and Reactor Accident Analysis. He has served as a consultant to the Nuclear Regulatory Commission's Advisory Committee on Reactor Safeguards, teaches thermal hydraulics for General Electric's Nuclear Energy Division, and continues to review thermal analyses for General Electric. Dr. Moody is a fellow of the American Society of Mechanical Engineers, which awarded him the George Westinghouse Gold Medal in 1980, and the Pressure Vessels and Piping Medal in 1999. He has also received prestigious career awards from General Electric and was elected to the Silicon Valley Engineering Hall of Fame. Dr. Moody was elected to the National Academy of Engineering in 2001 for pioneering and vital contributions to the safety design of boiling water reactors and for his role as educator. He has published three books and more than 50 papers. Dr. Moody holds a Ph.D in mechanical engineering from Stanford University.

TIMOTHY R. NEAL is an expert in weapons technology and explosives. He began his career at Los Alamos National Laboratory in 1967 and has led programs addressing weapon hydrodynamics, explosions inside structures and above ground, image analysis, and dynamic testing. He also has held several management positions within the Laboratory's nuclear weapons arena, including leadership of the Explosives Technology and Applications Division and of the Advanced Design and Production Technologies Initiative. He spearheaded Los Alamos' Stockpile Stewardship and Management Programmatic

Environmental Impact Statement and helped establish the U.S. Department of Energy's new Stockpile Stewardship Program. More recently, he has served as a senior technical advisor to the U.S. Department of Energy on nuclear explosive safety, and he has worked closely with the Pantex Plant for nuclear weapons production in Amarillo, Texas, in establishing a new formal basis for operational safety. Dr. Neal has received four DOE excellence awards, including one for hydrodynamics, and authored various technical papers and reports as well as one book on explosive phenomena. He holds a Ph.D. in physics from Carnegie-Mellon University.

LORING A. WYLLIE, JR. is an expert in structural engineering and senior principal of Degenkolb Engineers. His work has included seismic evaluations, analysis, and design of strengthening measures to improve seismic performance. He has performed seismic assessments and proposed strengthening solutions for several buildings within the U.S. Department of Energy weapons complex and for civilian buildings, some of which have historical significance. Mr. Wyllie's expertise is also recognized in several countries, including the former Soviet Union where he worked on an Exxon facility. Mr. Wyllie is a past president of the Earthquake Engineering Research Institute. His contributions to the profession of structural engineering were recognized by his election to the National Academy of Engineering in 1990 and his honorary membership in the Structural Engineers Association of Northern California. In recognition of Mr. Wyllie's expertise in concrete design and performance, the American Concrete Institute named him an honorary member in 2000. Mr. Wyllie also was elected an honorary member of the American Society of Civil Engineers in 2001. He holds a M.S. degree from the University of California, Berkeley.

PETER D. ZIMMERMAN is an expert in nuclear physics and terrorism. He is currently the chair of science and security and director of the Centre for Science & Security Studies at King's College in London. He previously served as the chief scientist of the Senate Foreign Relations Committee, where his responsibilities included nuclear testing, nuclear arms control, cooperative threat reduction, and bioterrorism. Previously, he served as science advisor for arms control in the U.S. State Department, where he provided advice directly to Assistant Secretary for Arms Control and the Undersecretary for Arms Control and International Security. His responsibilities included technical aspects of the Comprehensive Test Ban Treaty, biological arms control, missile defense, and strategic arms control. Dr. Zimmerman spent many years in academia as professor of physics at Louisiana State University. He is the author of more than 100 articles on basic physics as well as arms control and national security. His most recent publication is the monograph "Dirty Bombs: The Threat Revisited," which was published by the National Defense University in the Defense Horizons series. Dr. Zimmerman holds a Ph.D. in experimental nuclear and elementary particle physics from Stanford University and a Fil. Lic. degree from the University of Lund, Sweden. He is a fellow of the American Physical Society and a member of its governing council. He is a recipient of the 2004 Joseph A. Burton/Forum award for physics in the public interest.

C

TOUR OF SELECTED SPENT FUEL STORAGE-RELATED INSTALLATIONS IN GERMANY

On April 25-28, 2004, six committee members visited spent fuel storage-related installations in Germany. The following is a summary of some of the pertinent information obtained from that trip.

Several organizations and individuals worked with committee staff to make this trip possible. The committee would especially like to acknowledge Alfons Lührmann and William McConaghy of GNB/GNSI (Gesellschaft für Nuklear-Behälter, mbH/General Nuclear Systems, Inc.), who organized site visits; Klaus Janberg (STP engineering); Michael Sailer, chairman of RSK (Reaktorsicherheitskommission—reactor safety commission); Holger Broeskamp manager of GNS (Gesellchaft für Nuklear-Service, mbH—Germany's nuclear industry consortium) and his staff; Wolfgang Sowa, managing director of GNB (Gesellschaft für Nuklear-Behälter, mbH) and his staff; Florentin Lange of GRS (Gesellschaft für Anlagen- und Reaktorsicherheit, mbH); and Hubertus Flügge, vice-president of the RWE Power AG plants in Lingen and his staff, who allowed the committee to visit the reactor building and the site's spent fuel storage facility.

C.1 GERMAN COMMERCIAL NUCLEAR POWER PLANTS

Germany currently has 18 operating commercial nuclear power reactors at 12 sites. Approximately one-third of the reactors are boiling water reactors (BWRs) and two-thirds are pressurized water reactors (PWRs).

The design for PWR plants is illustrated schematically in FIGURE C.1. It consists of a dome-shaped reactor building constructed of reinforced concrete and a spherical inner containment structure constructed of steel. The reactor core, spent fuel pool, and steam generators are located within the inner containment. The emergency core-cooling systems are located outside the inner containment but within the reactor building.

The German BWR reactor building design is generally similar to a PWR. However, the spent fuel pool is outside the inner containment structure but within the reactor building. The reactor building is also a different shape (rectangular or cylindrical).

There are three generations of commercial nuclear power plants in Germany, each having increasingly thick walls:

- First-generation plants have reactor building walls that are less than 1 meter thick. There are four plants of this type.
- Second-generation plants have reactor building walls that are slightly more than 1 meter thick. There are five plants of this type.
- Third-generation plants have reactor building walls that are about 2 meters thick. There are nine plants of this type.[1]

[1] The committee subgroup visited one of these plants (the Lingen power plant) during its tour.

Some first- and second-generation plants have independent emergency systems in a bunkered building that contains some safety trains and a control room. These systems are capable of delivering water to the reactor after an accident or attack if the pipe systems within the reactor building survive.

Second- and third-generation plants were designed to withstand the crash of military fighter jets. Second-generation plants were designed to withstand the crash of a Starfighter jet at the typical landing speed. Third-generation plants were designed to withstand the crash of a Phantom jet at the typical cruising speed. This is considered to be part of the "design basis threat" for nuclear power plants in Germany. This information on the design basis threat has been made available to the public by the German government.

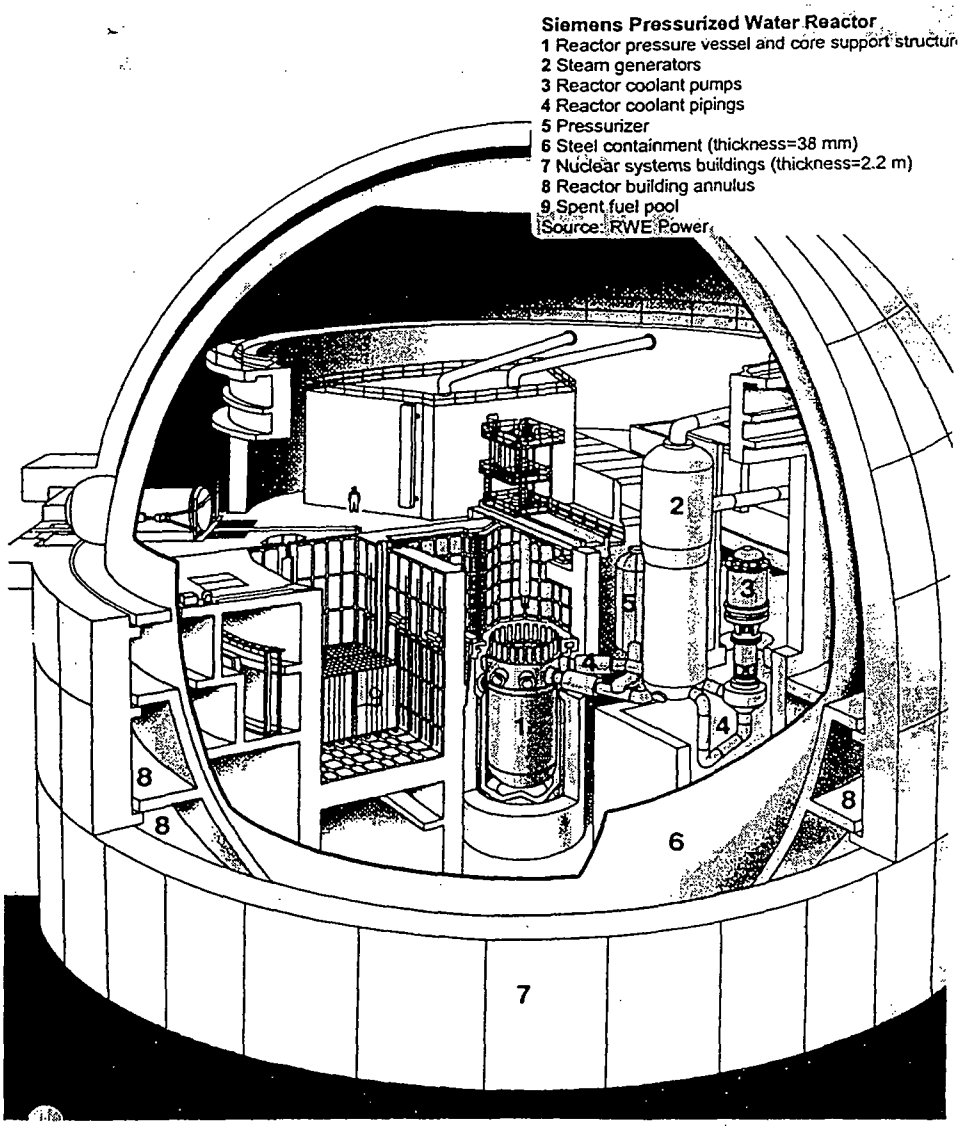


FIGURE C.1 Schematic illustration of the Lingen PWR power plant, a third-generation power plant design. SOURCE: RWE Power.

Plant operators must show that of the four safety trains (each train contains 50 percent of the safety system) at the plant, at least two will survive such a crash. The crash parameters (e.g., aircraft type, speed, and angle) have been established by RSK. The crash parameters have been published and the public knows about them. Each plant must perform an independent analysis of each reactor building. Sometimes two separate analyses have to be provided for the same site if there are two or more reactors with different designs.

In 1998, the German government decided to phase out nuclear energy. Commercial nuclear plants will be allowed to generate an agreed-to amount of electricity before shutdown. Currently, the Lingen and the Neckarwestheim-2 plants have the highest remaining electricity production allowance and will be shut down in 2021 or 2022, should no revision of this political decision be implemented.

C.2 SPENT FUEL STORAGE

Until recently, all spent fuel at German plants was stored in the reactor pools until it could be sent to Sellafield (U.K.) or La Hague (France) for reprocessing. In the 1980s, plants began to re-rack their spent fuel pools to increase storage capacities (the older German nuclear plants were designed to contain one full reactor core plus one third of a core). Regulators became concerned that the emergency cooling systems were not sufficient to handle the increased heat loads in spent fuel pools from this re-racking. Some plants added additional cooling circuits to address this concern. Only one power plant (an older plant at Obrigheim) has wet interim pool storage in a bunkered building.

A discussion of alternative spent fuel storage options began in 1979. A reprocessing plant had been proposed at Gorleben that would have had several thousand metric tons of pool storage. The German government concluded that while there were no major technical issues for reprocessing, wet fuel storage was a potential problem because cooling systems could be disrupted in a war. GNS decided to shift from wet to dry storage for centralized storage facilities.

There are two centralized storage facilities in Germany: Gorleben and Ahaus. Gorleben is designed to store vitrified high-level waste from spent fuel reprocessing and spent fuel from commercial power reactors. Ahaus is designed to store spent fuel from test reactors and other special types of fuel. Ahaus currently stores 305 casks of reactor fuel from the decommissioned Thorium High Temperature Reactor, three casks of PWR spent fuel from the Neckarwestheim site, and three casks of BWR spent fuel from the Gundremmingen site. The latter shipment produced large public demonstrations and required the deployment of 35,000 police officers to maintain security.

At the end of 2001, the German utility companies and the German federal government agreed to avoid all transport of spent fuel in Germany because of intense public opposition. The German government recently passed a law making it illegal to transport spent nuclear fuel to reprocessing plants in France and the United Kingdom after June 30, 2005. However, there is no legal restriction concerning the transport of spent fuel from power reactors to other destinations (e.g., to dry storage facilities). The government and power plant operators have negotiated an agreement to develop dry cask storage facilities at each of the 12 nuclear power plant sites to avoid the need for offsite spent fuel transport.

These dry cask storage facilities are to be constructed by 2006. They are licensed to store fuel for 40 years.

There are three dry cask storage facility designs in Germany:

1. WTI design: The walls and roof are constructed of 80 and 50 centimeters, respectively, of reinforced concrete.
2. STEAG design: The walls and roof are constructed of 1.2 and 1.3 meters, respectively, of reinforced concrete. This design is used at the Lingen Nuclear Power Plant dry storage facility visited by the committee (FIGURE C.2).
3. GNK design: This is a tunnel design and is under construction at the Neckarwestheim nuclear power plant.

The use of reinforced concrete in these facilities was originally intended for radiation protection and structural support, not for terrorist attacks.

In 1999, RSK issued guidelines for dry storage, which were released in 2001 (RSK, 2001). Licensing a dry storage facility in Germany requires several safety demonstrations and analyses. As part of the licensing procedures for a storage facility, the license applicant must do independent calculations that demonstrate how the building features meet the safety standards and the design basis threat. This threat includes an armed group of intruders and the impact of a Phantom 2 military jet. It also includes a shaped charge. The scenario of a deliberate crash of a large civilian airplane has been considered and analyzed as part of the recent licensing of onsite dry storage facilities but is not established as part of the design basis threat. There are public hearings during which the license applicant explains the safety features of the storage facility. The public is aware of the design basis threat, and it is provided with the results of the analysis but not with the details.

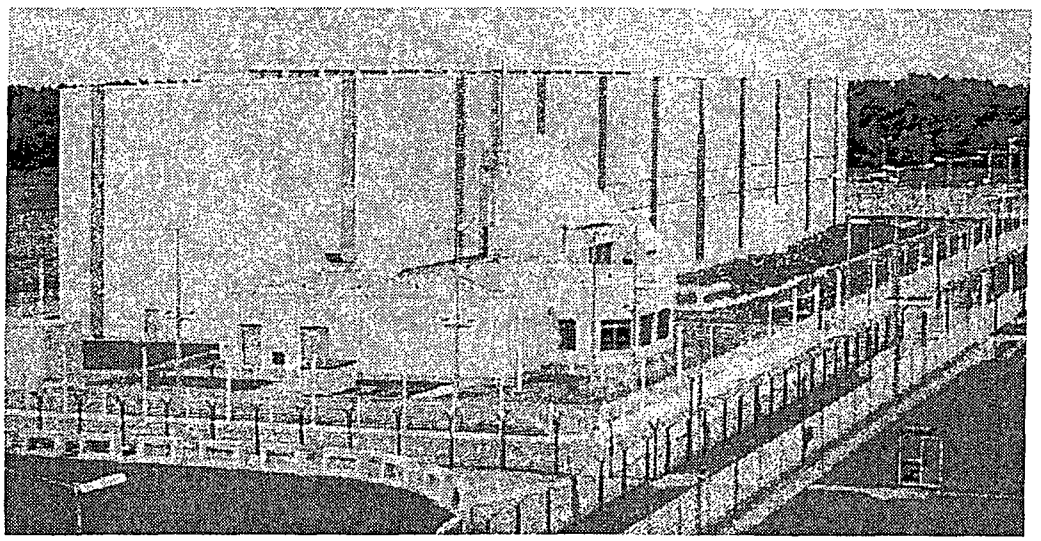


FIGURE C.2 Dry cask spent fuel storage building at the Lingen Nuclear Power Plant. SOURCE: RWE Power.

There are six temporary (i.e., five- to seven-year) storage facilities in use at reactor sites until these dry cask storage facilities become available. The casks in these temporary storage facilities are stored horizontally and are protected by concrete "garages" designed to withstand the impact of a Phantom military jet.

Spent commercial fuel is stored in CASTOR® casks (FIGURE C.3) that were originally designed and developed by the German utility-owned company GNB.[2] These casks can store either PWR or BWR spent fuel assemblies. The design consists of a ductile cast iron cylindrical cask body with integral circumferential fins machined into the outer surface to maximize heat transfer; inside, the spent fuel assemblies are inserted in a borated stainless steel basket. The cask has a double-lid system that is protected by a third steel plate. The cask complies with the international regulations of the International Atomic Energy Agency (IAEA) as a type B(U) package.

Spent fuel is typically cooled for five years in a pool before it is put in dry cask storage; some other custom-made cask designs can hold fuel that has been cooled for shorter (minimum two years) or longer times depending on the fuel characteristics and fuel burn-up. Current fuel burn-ups in Germany (52 to 55 gigawatt-days per metric ton) are similar to those in the United States.

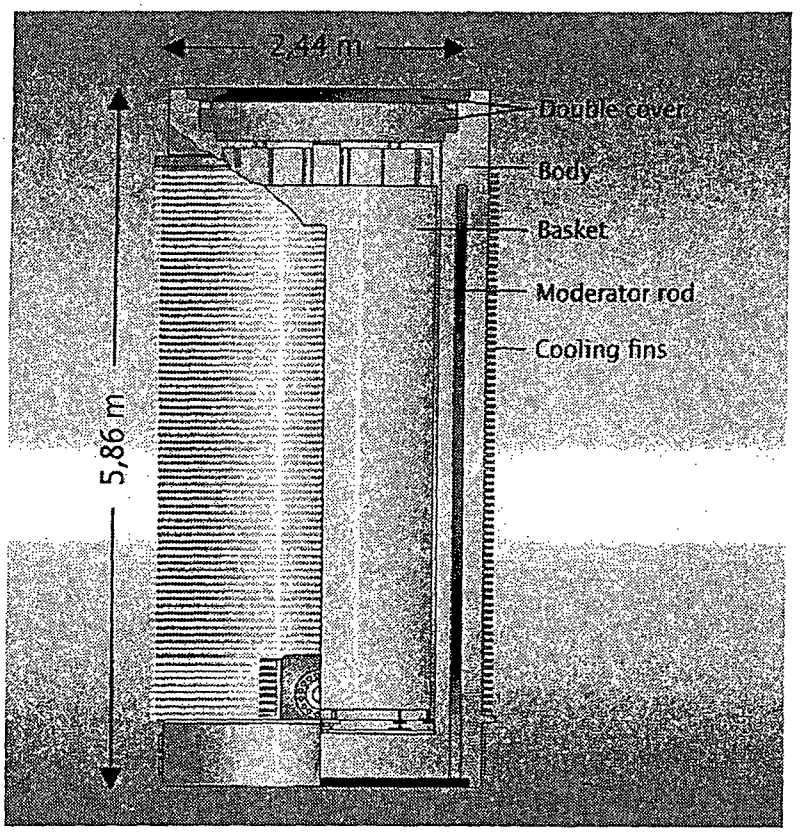


FIGURE C.3 Typical features of a CASTOR cask used at the Lingen Nuclear Power Plant. SOURCE: RWE Power AG Lingen Nuclear Power Plant.

[2] Gesellschaft für Nuklear-Behälter, mbH.

C.3 RESPONSE TO THE SEPTEMBER 11, 2001, TERRORIST ATTACKS IN THE UNITED STATES

The September 11, 2001, terrorist attacks on the United States caused the German government to reassess the security of its nuclear power plants and spent fuel storage facilities. RSK held meetings starting in October 2001 to discuss the implications of the September 11 attacks for German commercial nuclear power plants. It issued a short statement recommending that an analysis be carried out on each plant to assess its vulnerability to September 11-type attacks. These analyses have not yet been undertaken. Plant operators assert that terrorist attacks are a general risk of society and should be treated like attacks on other infrastructure (e.g., chemical facilities). The Länder (state) governments, which are responsible for licensing commercial power plants in Germany, do not require these analyses. RSK recommended that the federal government develop a checklist for such an analysis, but this also has not been done.

A general analysis of the impact of the different civilian aircraft on commercial nuclear plants was requested by BMU[3] and has been carried out by GRS.[4] The result of the discussions between RSK and BMU on the basis of this report was that plant specific sensitivity analyses are needed. GRS was also involved in the framing of the recent German licensing process in the analysis of the consequences of civilian aircraft attacks on STEAG- and WTI-design spent fuel storage facilities using three sizes of aircraft (ranging from Airbus A320- to Boeing 747-size aircraft).

C.4 TESTS ON GERMAN CASKS

The casks that are used in German dry cask storage facilities have been subjected to several tests that simulate accidents and terrorist attacks. The following types of tests were performed on these casks or cask materials.

Airplane crash test simulations with military aircraft (Phantom type) are part of the licensing requirements for both casks and storage facilities. Between 1970 and 1980 a number of tests on storage casks were carried out at the Meppen military facility in Germany. A one-third scale model of a GNB cask was used to simulate the impact of a turbine shaft of a military aircraft using a hollow-tube projectile. Two different impact orientations were used: perpendicular to upright cask body (lateral impact) and perpendicular to center of lid system. The projectile completely disintegrated in the test, but the cask sustained only minor damage.

The jet aircraft tests were carried out because of safety concerns, but after September 11, 2001, intentional crashes of aircraft also were considered. Investigations by BAM (Bundesanstalt für Materialforschung und -prüfung) and GRS concluded that CASTOR-type casks would maintain their integrity when intentionally hit by a commercial aircraft.

---

[3] Bundesministerium für Umwelt, Naturschutz and Reaktorsicherheit (Federal Ministry for Environment, Nature Protection, and Nuclear Safety and Security).

[4] Gesellschaft für Anlagen- und Reaktorsicherheit (GRS), mbH (Company for Installation and Reactor Safety). GRS is Germany's main research institution on nuclear safety. It is an independent, nonprofit organization, founded in 1977, and has about 450 employees. GRS funds its work through research contracts. Some have compared GRS to Sandia National Laboratories in the United States.

Other types of terrorist attacks have been a long-standing concern to the German government because of terrorism activities in Europe in the 1970s and 1980s. A series of tests simulating terrorist attacks on casks were done in Germany, France, the United States (for the German government), and Switzerland (for the Swiss government). Additional tests may have been done that are not publicly acknowledged.

In 1979-1980 at the German Army facility in Meppen, a "hollow charge" (i.e., shaped charge) weapon was fired at a ductile cast iron plate and fuel assembly dummy to simulate a CASTOR cask. The cask plate was perforated but release fractions from the fuel assembly were not examined. From this experiment, the German government concluded that the wall thickness of the cask should not be less than 300 millimeters.

Other tests were carried out at the Centre d'Etude de Gramat in France in 1992 on behalf of the Germany Federal Ministry of Environment, Nature Protection and Nuclear Safety (BMU) (Lange et al., 1994). These tests involved shaped charges directed at a CASTOR cask (type CASTOR IIa, the cask was one third of the regular length) filled with nine fuel element dummies with depleted uranium. The fuel rods were pressurized to 40 bars to simulate fuel burn-up, but the cask interior was at atmospheric pressure or at reduced pressure of 0.8 bar. The shaped charge perforated the cask and penetrated fuel elements. This damaged the fuel and resulted in the release of fuel particles from the cask.

These particles were collected, and their particle size distribution was measured. About 1 gram of uranium was released in particles of less than 12.5-microns aerodynamic diameter, and 2.6 grams of uranium were released in particles with a size range between 12.5 and 100 microns. If the pressure inside the cask was reduced to 0.8 bar (to simulate the conditions during interim storage of spent fuel in Germany), the releases were reduced by two-thirds: 0.4 gram for particle sizes less than 12.5 microns and about 0.3 gram for particles between 12.5 and 100 microns.

In 1998, a demonstration was carried out at the Aberdeen Proving Ground in the United States using an anti-tank weapon on a CASTOR cask. The purpose of this demonstration was to show that a concrete jacket on the exterior of the cask could prevent perforation. The weapon was first fired at the cask without the jacket. It perforated the front wall of the cask. The concrete jacket was effective in preventing perforation of the cask. Committee members saw a specimen of this cask at the GNB workshop (see FIGURE C.4).

Also in 1999, explosion of a liquid gas tank next to a cask was performed by the German BAM (Federal Office of Material Research and Testing) to study the effect of accidents involving fire or explosions in the vicinity of the cask during transportation or storage. The gas tank and the CASTOR cask were initially about 8 feet (2.5 meters) apart. Explosion of the tank generated a fire ball 330 to 500 feet (100 to 150 meters) in diameter. The explosion projected the cask 23 feet (7 meters) away and tilted it by 180 degrees, causing it to hit the ground on the lid side. Examination after the explosion showed no change in the containment properties of the lid system.

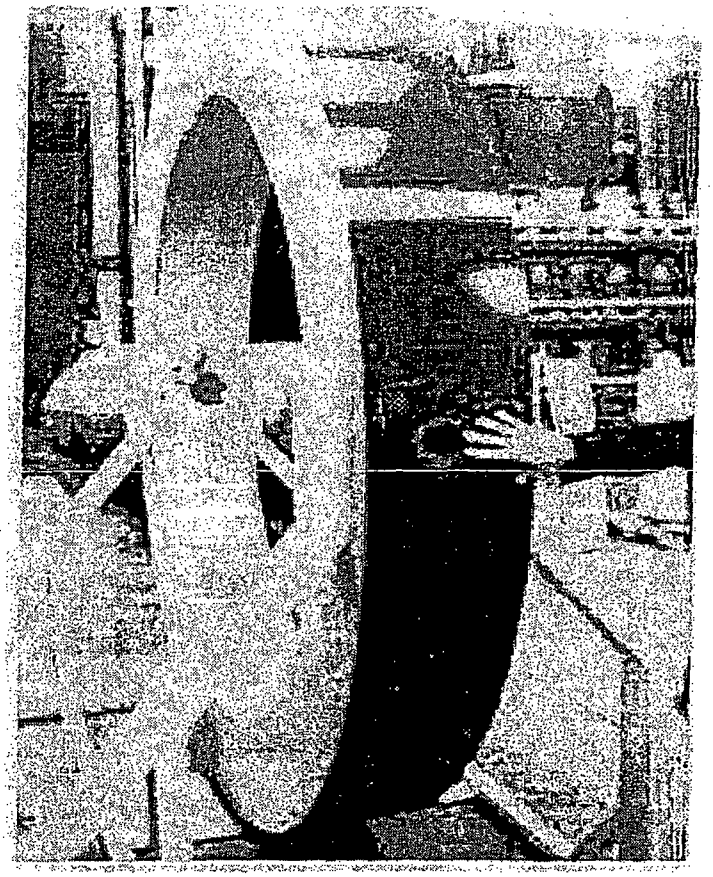


FIGURE C.4 Section of a CASTOR cask showing the perforation made by a shaped charge at the Aberdeen Proving Ground. SOURCE: Courtesy of GNB/GNSI.

REFERENCE

Lange, F., G. Pretzsch, J. Döhler, E. Hörmann, H. Busch, and W. Koch. 1994. Experimental Determination of UO_2-Release from a Spent Fuel Transport Cask after Shaped Charge Attack. 35th INMM Annual Meeting Proceedings (Naples, Florida). Vol. 23, pp. 408-413.

RSK (Reaktorsicherheitskommission). 2001. Safety-Related Guidelines for the Dry Interim Storage of Spent Fuel Elements in Storage Casks. Recommendation of the Commission on Reactor Safety. April 5. Available at *http://www.rskonline.de/Download/Leitlinien/English/RSK-GUIDELINES-DRY-INTERIM-STORAGE.pdf.*

D

HISTORICAL DEVELOPMENT OF CURRENT COMMERCIAL POWER REACTOR FUEL OPERATIONS

There are 103 commercial power reactors operating in the United States at this time. Almost all of them are operating with spent fuel pools that are too small to accommodate cumulative spent fuel discharges. This short appendix was prepared to provide a historical background for power reactor fuel operations and pool and dry-cask storage of spent fuel.

D.1 DESIGN FOR A CLOSED FUEL CYCLE

The first large generation of commercial reactors in the United States were almost all light water reactors (LWRs), that is, nuclear reactors that use ordinary water to cool the core and to moderate the neutrons emitted by fission. The hydrogen atoms in the water coolant moderate, or slow down the fission-emitted neutrons to an energy level that is more likely to cause fission when the neutron strikes a fissile atom. These reactors were designed, developed, and licensed in the 1960s and 1970s, although many were not completed until the 1980s. Their design power output increased rapidly, as it did for non-nuclear power plants, in order to achieve economies of scale. Thus, the earlier plants in this generation were designed to produce 500-900 megawatts of electrical power (MWe) while later units increased to 1000-1200 MWe. The number of LWRs built and ordered by the U.S. industry began to approach 200. All of these plants were being designed for a closed fuel cycle, that is, for the uranium oxide fuel, enriched to 2-5 percent uranium-235, to be loaded and "burned" to a level of 20-30 gigawatt-days per metric ton of uranium (GWd/MTU), then reprocessed in commercial plants to separate the still usable fissionable, or fissile, materials in the spent fuel from the radioactive waste. The reprocessing plants would recover the fissile plutonium-239 formed from uranium-238 during reactor operations and residual fissile uranium-235 for use as fuel in LWRs and later in breeder reactors (USNRC, 1976).

By the mid-1970s commercial reprocessing plants were built, under construction, or planned in New York, Illinois, South Carolina, and Tennessee, with a combined projected capacity to reprocess more than 6000 MTU of spent fuel per year. For comparison, a large LWR discharges about 20 MTU of spent fuel at a refueling. By this time the price of fresh uranium was dropping and the cost of fuel reprocessing made it difficult for recycle fuel to compete with fresh fuel. Also, there was controversy about the risk of fissile material diversion if recycled plutonium was moved in commercial traffic. Both existing fuel reprocessing plants withdrew from licensing for technical reasons and then, on April 7, 1977, President Carter issued a policy statement that "we will defer indefinitely the commercial reprocessing and recycling of the plutonium produced in the U.S. nuclear power programs." The statement went on to say: "The plant at Barnwell, South Carolina, will receive neither federal encouragement nor funding for its completion as a reprocessing facility." After consultation with the White House, the U.S. Nuclear Regulatory Commission (USNRC) terminated its Final Generic Environmental Statement on the Use of Recycled Plutonium in Mixed Oxide Fuel in Light-Water Cooled Reactors (GESMO) proceedings.

Thus, the U.S. nuclear industry was immediately changed from a closed fuel cycle, with recycle, to an open or once-through fuel cycle with the fuel loaded into the reactor in

several consecutive locations to obtain maximum economic use of the fuel before it was finally removed as waste. The USNRC changed the legal definition of high-level radioactive waste to include the high-level waste from both nuclear fuel reprocessing and spent nuclear fuel.

For this study, the significance of this closed fuel cycle design is that this entire generation of more than 100 reactors was designed with small spent fuel pools, relying on prompt shipment away from the reactor to the reprocessing plant to make room for later discharges of spent fuel. Early spent fuel shipping casks were being designed with active cooling systems to support shipment of fuel less than a year out of the reactor to a reprocessing plant. BOX D.1 discusses the spent nuclear fuel at reprocessing plants. Supplementary wet and dry storage systems had to be developed to receive the older spent fuel to make room for fresh spent fuel from the reactor. Many plants had to remove and modify the storage racks in their spent fuel pools to accommodate more spent fuel in the pool itself until licensed supplementary systems were available.

D.2 RETRENCHMENT OF U.S. REACTOR PLANS

As noted in Section D.1, in the 1970s the United States was building reactors at a high rate. Then, in the late 1970s, three factors produced a retrenchment in power reactor plans: rising interest rates, reversal of the U.S. fuel reprocessing policy, and the Three Mile Island-2 accident.

D.2.1 Effect of Interest Rates

Commercial power reactors have characteristically high initial capital costs. The regulated public utilities have had to raise the capital with various debt instruments; to build, license, and operate the finished plant for a time before it can be declared commercial; and to change the electricity rates charged consumers to retire the debt on the capital cost. The soaring interest rates in the United States during the late 1970s drove the costs of new nuclear plants that were under construction to extreme heights. This, combined with slackening demand for electricity, led to the cancellation of many plants, some even in advanced stages of construction.

D.2.2 Effect of Reversal of U.S. Fuel Reprocessing Policy

President Carter enunciated a change in U.S. policy for reprocessing of spent nuclear fuel in early 1977. Those reactors then operating and those under construction had to begin modifying their reactor fuel cycle design to go from the closed (reprocessing) cycle to a "once-through" fuel cycle. This induced the designers to go to higher levels of uranium-235 enrichment in the new fuel, but still within the 5 percent licensing limit. It also induced the designers to revise the core loading and operating plans in order to burn or use the fissile content of the fuel to the greatest extent economically possible since the fissile residue could not be retrieved by reprocessing. As a result, spent fuel burnup levels rose to levels that are now almost double the 20-30 GWd/MTU characteristic of the original closed fuel cycle. This results in an increase in the decay-heat power of the spent fuel assembly by the time it is put into the spent fuel pool.

BOX D.1 Spent Fuel at Nuclear Fuel Reprocessing Plants

Up until the mid-1970s the commercial nuclear industry was expected to operate several nuclear fuel reprocessing plants to recover fissile plutonium from virtually all of the commercial spent fuel from U.S. reactors. These plants would use aqueous reprocessing methods developed by the Atomic Energy Commission (AEC). The recovered plutonium was to be used as mixed oxide fuel (PuO_2 and UO_2) in water reactors and, later, as fuel in breeder reactors. Each reprocessing plant had one or two storage pools to receive and store the fuel temporarily until it was reprocessed. No long-term storage of the spent fuel from commercial reactors was planned. Only two commercial reprocessing sites have received spent fuel, West Valley, New York, and G.E.-Morris, Illinois.

The first commercial reprocessing plant began operations by the Nuclear Fuel Services Company on a site in West Valley, New York, owned by the State of New York. The State of New York licensed a low-level radioactive waste disposal site adjacent to the reprocessing plant. The West Valley plant had a reprocessing capacity of about 1 metric ton of uranium (MTU) per day. It operated at reduced capacity because there was not yet much commercial spent fuel to reprocess. In fact, about half of the spent fuel reprocessed there was from the last in the series of plutonium production reactors, the N-Reactor, at the AEC site in Hanford, Washington. This spent fuel was provided to the West Valley plant to keep it working in the early days when little commercial spent fuel was available. The West Valley plant suspended operations in 1972 in order to expand its capacity to about 3 MTU per day. The work and the re-licensing effort went on until 1976 when the company withdrew its application for the new license and terminated reprocessing operations. The U.S. Department of Energy (DOE) took over the task of high-level radioactive waste retrieval and decommissioning under the West Valley Demonstration Project Act of 1980. About 137 MTU of commercial spent fuel remaining in the cooling pool was returned to its owners (USNRC, 1987). In 2003 the last of this spent fuel, about 25 MTU in two shipping casks, was shipped to the DOE-Idaho National Lab where it remains in dry storage in those casks.

The General Electric Company built a nuclear fuel reprocessing plant at Morris, Illinois, near the Dresden Nuclear Power Station. The plant was expected to reprocess 3 MTU per day. When the G.E.-Morris plant was in its final testing in 1975, the company determined that its performance would not be acceptable without extensive modifications. The request for a reprocessing plant operating license was withdrawn and the plant was licensed only to possess the spent nuclear fuel that it was under contract to reprocess. After modifying the storage system in its below-grade pool to hold more spent fuel, G.E.-Morris has received and stores 700 MTU of spent fuel for various owners.

Power reactors are refueled, and spent fuel is discharged to the storage pool, every one to two years. The decay-heat power of recently discharged spent fuel dominates the heat load of all the spent fuel in the pool, both freshly discharged and old, since the decay heat from a spent fuel assembly decreases by one to two orders of magnitude in the first year after it is removed from the reactor. Increasing the capacity of the spent fuel pool by re-racking, that is, modifying the storage racks to provide for closer spacing of the fuel assemblies,[1] allows older fuel to be accumulated in the pool rather than being removed for

[1]The capacity of spent fuel pools has typically been increased by replacing the original storage racks with racks that hold the spent fuel assemblies closer together. The fuel assembly channels in these

shipment or dry storage. Re-racking can make it more difficult to cool the freshly discharged fuel if there is catastrophic loss of the fuel pool water.

D.2.3 Effect of the Three Mile Island Accident

The final factor driving the retrenchment of the nuclear power industry was the Three Mile Island-2 (TMI-2) accident that occurred on March 28, 1979, in Pennsylvania (Walker, 2004). In that accident a small failure in the reactor coolant system was compounded by operator errors to result in catastrophic damage; a partial core melt occurred. The inability of the operators to understand and control the events, and the confusion among the state, the USNRC, and other responsible agencies about public protection had a devastating effect on public trust in the safety of nuclear power. The USNRC escalated safety requirements after the TMI-2 accident. These new requirements substantially modified the operation of licensed plants, delayed completion of new plants, and further increased their construction costs. The accident also resulted in the retrenchment of nuclear power in the 1980s and led to the cancellation of many plants, decommissioning of some plants, and the sale of some plants to other owners. The fleet of operating U.S. reactors was reduced to the presently operating 103 described here.

D.3 COMMERCIAL POWER REACTORS CURRENTLY OPERATING IN THE UNITED STATES

All of the commercial power reactors operating in the United States are light water reactors. BOX D.2 describes the LWRs that are currently operating in the United States.

D.3.1 Pressurized Water Reactors

About two-thirds of the U.S. reactors are pressurized-water reactors (PWRs), dual-cycle plants in which the primary cooling water is kept under a pressure of about 2000 pounds per square inch absolute (psia) as it circulates to remove fission and decay heat from the reactor fuel in the core and carry that energy to the steam generators, to generate steam in the lower-pressure secondary loop. The reactor, primary loop piping, and steam generators are all located in the containment structure; the steam lines penetrate the containment carrying the steam to the turbine to generate electrical power.

About one-third of the U.S. reactors are boiling-water reactors (BWRs), single-cycle plants in which the primary coolant of the reactor core is operated at about 1000 psia as it recirculates within the reactor core. The fission and decay heat generated in the core cause a substantial amount of the reactor coolant water to boil into steam that passes out directly from the reactor pressure vessel to the turbine-generator system. Plant differences stem initially from the different designs of the nuclear steam system supplier, the different designs of the architect-engineers that built the plants, and the owners that often specified additional modifications.

---

replacement racks typically have solid metal walls with neutron-absorbing material for nuclear safety reasons. This configuration inhibits water or air circulation more than the earlier configuration.

BOX D.2 U.S. Nuclear Power Plants

In the United States, 32 utility companies are licensed to manage the 103 operating reactors. There are also 27 shutdown reactors in storage or decommissioning. These reactors are situated at 65 nuclear power plant sites across the United States; a plant site may have 1, 2, or 3 reactors.

The fleet of 103 operating reactors in the United States is composed of the following:

- 69 pressurized water reactors (PWRs) and
- 34 boiling water reactors (BWRs).

The containment design for PWRs is divided into dry (56 reactors), ice condenser (9 reactors), and sub-atmospheric (4 reactors) containments. Among the BWR containment designs, 22 reactors are of design type Mark I, 8 of Mark II, and 4 of Mark III.

The PWRS operating in the United States were designed by three different nuclear steam system suppliers; Westinghouse Electric, Combustion Engineering, and Babcock & Wilcox. Most PWRs have what are called large dry containments, that is, containment structures of about 2 million cubic feet volume that can absorb the rapid release of steam and hot water from a postulated rupture of the primary coolant system without exceeding an internal pressure of about 4 atmospheres. FIGURE D.1 illustrates a PWR in a large dry containment. Some PWR containments are essentially as large but use ventilation fans to maintain the initial containment pressure mildly sub-atmospheric to provide an additional pressure margin. Finally, one set of nine Westinghouse PWRs uses ice-condenser containment structures, in which the containment has about the same pressure capability but is smaller, relying on massive baskets of ice maintained in the containment to condense steam releases and mitigate the pressure surge.

D.3.2 Boiling Water Reactors

The BWRs in operation today were designed by the General Electric Company. They all use pressure suppression containments, two-chamber systems with the reactor located in a dry well that is connected to a wet well containing a large pool of water.

In the event of a rupture of the reactor system in the dry well, the steam and hot water released are channeled into the water in the wet well, condensing and cooling the steam to mitigate the pressure surge. BOX D.2 lists the three successive generations of BWR containment design, and the number of each still operating. FIGURE D.2 illustrates three types of BWR containments: Mark I, Mark II, and Mark III. The Mark I containment is the most common type with 22 in operation. The reactor pressure vessel, containing the reactor core is located in a dry well of the containment in the shape of an inverted incandescent light bulb.

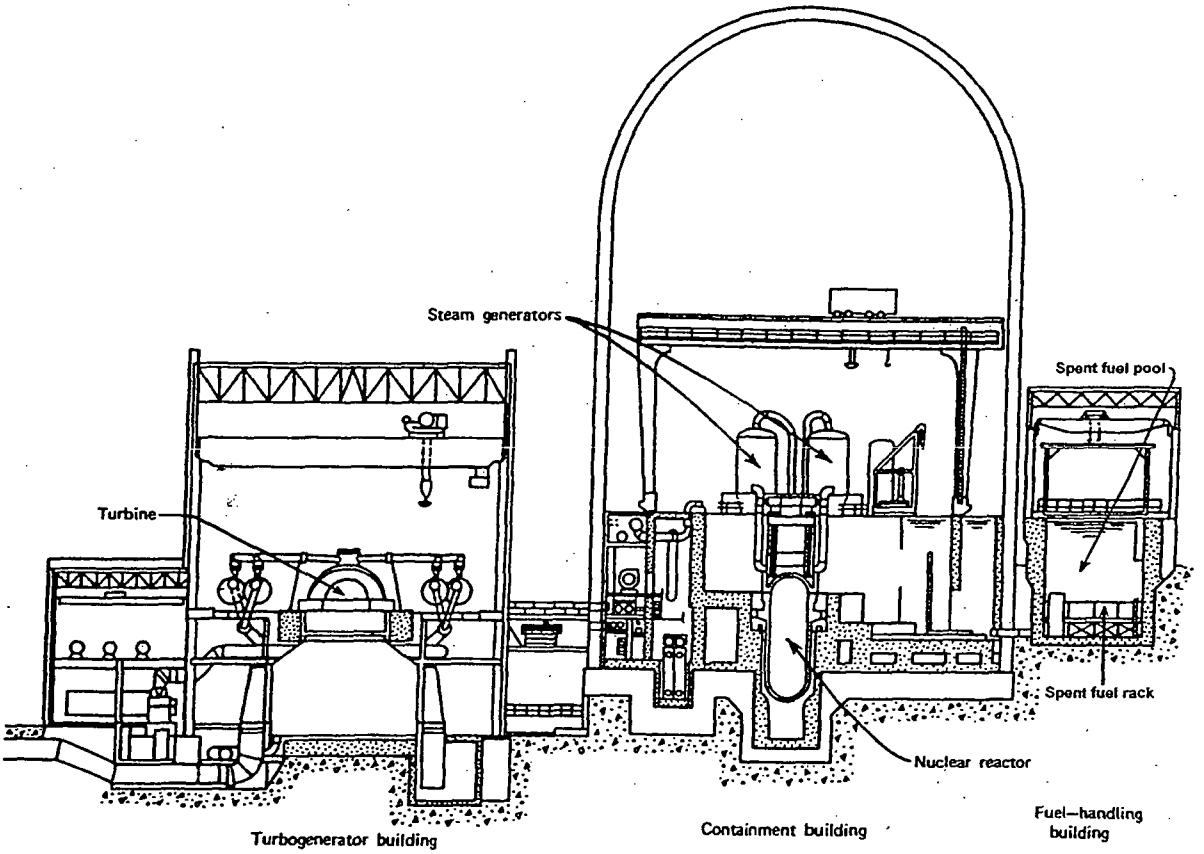


FIGURE D.1 A PWR in a large dry containment. SOURCE: Modified from Duderstadt and Hamilton (1976, Figure 3-4).

The dry well is connected by large ducts to the wet well, a large toroidal (i.e., doughnut-shaped) part of the containment that is partially filled with water. Gas and steam releases from an accident in the dry well would be passed through the connecting ducts into the water in the wet well, cooling the gas and condensing the steam to mitigate the accident pressure rise in the containment. The containment building Mark II BWR is similar to the Mark I except that in the Mark II containment the conical dry well is directly above the cylindrical wet well. Nine Mark II reactors are still operating in the United States. In the Mark III, the dry well around the reactor vessel is vented to the top of a cylindrical wet well that surrounds it.

Four Mark III BWRs are currently operating. The entire dry well-wet well system is contained within a large steel containment shell and a concrete shield building.

D.3.3 Reactor Fuel and Reactor Control

TABLE D.1 presents the range of dimensions and weights for a wide variety of the LWR fuel assemblies used in the operating reactors. The spent fuel pools and the dry storage systems used at a reactor must be tailored to the specific fuel design for that reactor.

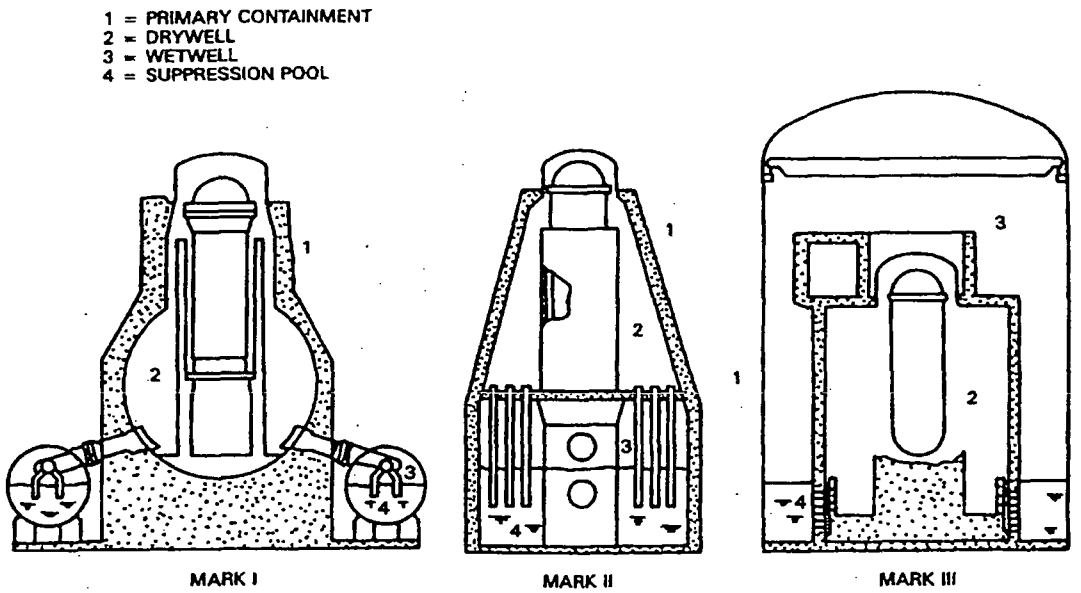


FIGURE D.2 Three types of BWR containment system: Mark I, Mark II, and Mark III. SOURCE: Modified from Lahey and Moody (1993, Figure 1-9).

The fission process is controlled by the reactor operators through the use of neutron-absorbing materials. The primary control is an array of control rods or blades that can be withdrawn from the core to the degree needed. In the PWRs, the control rods are moved within selected empty tubes within the assembly. In the BWRs, cruciform (cross-shaped) control blades are moved across the faces of the fuel assembly, typically narrower than those in a PWR fuel assembly. Reactor fuel designers also use burnable poisons within the fuel assembly to control the fission process. These poisons are placed in appropriate amounts within the fuel assembly so that they burn away, making the fuel assembly more reactive, as the continued fission process is making it less reactive. PWRs also use neutron control by dissolving neutron-absorbing sodium borate in the reactor coolant, gradually lowering the concentration from the peak after refueling to the minimum before the next refueling.

REFERENCES

American Nuclear Society. 1988. Design Criteria for an Iindependent Spent Fuel Storage Installation (Water Pool Type): An American National Standard. ANSI/ANS-57.7-1988. American Nuclear Society. LaGrange Park, Illinois.

Duderstadt, J. J. and L. J. Hamilton. 1976. Nuclear Reactor Analysis. John Wiley & Sons. New York.

Lahey, R. T. and F. J. Moody. 1997. The Thermal Hydraulics of a Boiling Water Nuclear Reactor. Second Edition. American Nuclear Society. La Grange Park, Illinois.

USNRC (U.S. Nuclear Regulatory Commission). 1976. Final Generic Environmental Statement on the Use of Recycled Plutonium in Mixed Oxide Fuel in Light-Water Cooled Reactors (GESMO). NUREG-0002. Washington, DC.

USNRC. 1987. Case Histories of West Valley Spent Fuel Shipments. NUREG/CR-4847. January. Washington, D.C.

Walker, J. S. 2004. Three Mile Island: A Nuclear Crisis in Historical Perspective. University of California Press. Berkeley, California.

TABLE D.1 Range of Dimensions and Weights for Light Water Reactor Fuel Assemblies Used in Operating Reactors in the United States.

Physical Characteristics of Typical LWR Fuel Assemblies

Reactor Type	BWR	BWR	PWR	PWR	PWR	PWR	PWR	PWR	PWR	PWR	PWR	PWR
Fuel Designer	GE	GE	B&W	B&W	GE	GE	W	W	W	W	W	W
Fuel Rod Array	7x7	8x8	15x15	17x17	14x14	16x16	14x14	14x14	15x15	15x15	17x17	17x17
Active Fuel Length (in.)	144	144	144	143	137	150	120	144	121	144	144	168
Nominal Envelope (in.)[2]	5.438	5.47	8.536	8.536	8.25	8.25	7.763	7.763	8.449	8.426	8.426	8.426
Fuel Assembly Length (in.)	176	176	166	166	157	177	137	161	137	160	160	–
Weight (lbs.)	600	600	1,516	1,502	581 kg	–	501 kg	573 kg	594 kg	654 kg	665 kg	–
Fuel Rod												
Number	49	63	208	264	164	224-236	180	179	204	204	264	264
Length (in.)	163	–	153	–	147	161	127	152	127	152	152	–
Pitch, Square (in.)	0.738	0.640	0.568	0.501	0.580	0.506	0.556	0.556	0.563	0.563	0.496	0.496
O.D. (in.)	0.570	0.493	0.430	0.379	0.440	0.382	0.422	0.422	0.422	0.422	0.374	0.360
Clad Thickness (mils.)	35.5	34	26.5	23.5	26	25	16.5	24.3	16.5	24.3	22.5	22.5
Clad Material	Zr 2	Zr 2	Zr 4	Zr 4	Zr 4	Zr 4	sst	Zr 4	sst	Zr 4	Zr 4	Zr 4
Pellet O.D. (in.)	0.488	0.416	0.370	0.3232	0.3795	0.325	0.3835	0.3659	0.3835	0.3659	0.3225	0.3088
Pellet Length (in.)	–	–	–	0.375	0.650	0.390	0.600	0.600	0.600	0.600	0.530	0.530
Gap, Radial (mils.)	5.5	4.5	3.5	3.1	4.3	3.5	2.8	3.8	2.8	3.8	3.3	3.3
Density (STD)	–	–	92.5-95.0	93.5-95.0	93.0-95.0	94.75	93.0-94.0	92.0	93.0-94.0	92.0	95.0	95.0
Poison	Gd_2O_3	Gd_2O_3	None	None	B_4C/Al_2O_3	B_4C/Al_2O_3	–	–	–	–	–	–
Nonfueled Rods												
Number	0	1	17	25	6	6	16	17	21	21	25	25
Material	–	Zr 2	Zr 4	Zr 4	Zr 4	Zr 4	304 sst	Zr 4	304 sst	Zr 4	Zr 4	Zr 4
Spacer Grids												
Number	7	7	8	8	8	12	–	–	–	–	–	–
Material	Inconel X	Inconel X	Inconel 718	Inconel 718	Zr 4	Zr 4	–	–	–	–	–	–

SOURCE: American Nuclear Society (1988).

E

GLOSSARY

Actinide: Any of a series of chemically similar radioactive elements with atomic numbers ranging from 89 (actinium) through 103 (lawrencium). This group includes uranium and plutonium.

Alpha particle: Two neutrons and two protons bound as a single particle (a helium nucleus) emitted from certain radioactive isotopes when they undergo radioactive decay.

Bare-fuel cask: See *Cask*.

Beta particle: A charged particle consisting of a positron or electron emitted from certain radioactive isotopes when they undergo radioactive decay.

Beyond-design-basis accidents: Technical expression describing accident sequences outside of those used as design criteria for a facility. Beyond-design-basis accidents are generally more severe but are judged to be too unlikely to be a basis for design.

Boiling water reactor (BWR): A type of nuclear reactor in which the reactor's water coolant is allowed to boil to produce steam. The steam is used to drive a turbine and electrical generator to produce electricity.

Burn-up: Measure of the number of fission reactions that have occurred in a given mass of nuclear fuel, expressed as thermal energy released multiplied by the period of operation and divided by the mass of the fuel. Typical units are megawatt-days per metric ton of uranium (MWd/MTU) or gigawatt-days per metric ton of uranium (GWd/MTU).

Canister-based cask: See *Cask*.

Cask: Large, typically cylindrical containers constructed of steel and/or reinforced concrete that are used to store and/or transport spent nuclear fuel. Casks designed for storage of spent nuclear fuel can be of two types: "bare-fuel" or "canister-based." In bare-fuel casks, spent fuel is stored in a fuel basket surrounded by a heavily shielded and leak-tight container. In canister-based casks, the fuel is enclosed in a leak-tight steel cylinder, called a canister, which has a welded lid. The canister is placed in a heavily shielded cask overpack. Casks can be single-, dual-, or multiple-purpose, indicating that they can be used, respectively, for storage (also called storage-only casks), for storage and transportation, and for storage, transportation, and geologic disposal. There are no true multi-purpose casks for spent fuel currently available on the market.

Cesium-137: Radioactive isotope that is one of the products of nuclear fission.

Chain reaction: A series of fission reactions wherein the neutrons released in one fission event stimulate the next fission event or events.

Cladding: Thin-walled metal tube that forms the outer jacket of a nuclear fuel rod. It prevents corrosion of the nuclear fuel and the release of fission products into the coolant. Zirconium alloys (also called *zircaloy*, see below) are common cladding materials in commercial nuclear fuel.

Conduction: In the context of heat transfer, the transfer of heat within a medium through a diffusive process (i.e., molecular or atomic collisions).

Containment structure: A robust, airtight shell or other enclosure around a nuclear reactor core to prevent the release of radioactive material to the environment in the event of an accident.

Convection: Heat transfer by the physical movement of material within a fluid medium.

Cooling time: The amount of time elapsed since spent fuel was discharged from a nuclear reactor.

Core: That portion of a nuclear reactor containing the fuel elements.

Criticality: Term used in reactor physics to describe the state in which the number of neutrons released by the fission process is exactly balanced by the neutrons being absorbed and escaping the reactor core. At criticality, the nuclear fission chain reaction is self-sustaining.

Decay heat: Heat produced by the decay of radioactive isotopes contained in nuclear fuel.

Decay, radioactive: Disintegration of the nucleus of an unstable element by the spontaneous emission of charged particles (alpha, beta, positron) or photons of energy (gamma radiation) from the nucleus, spontaneous fission, or electron capture.

Depleted uranium: Uranium enriched in the element uranium-238 relative to uranium-235 compared to that usually found in nature. Also, uranium in which the uranium-235 content has been reduced through a physical process.

Design basis phenomena: Earthquakes, tornadoes, hurricanes, floods, and other events that a nuclear facility must be designed and built to withstand without loss of systems, structures, and components necessary to ensure public health and safety.

Design basis threat: In the context of this study, hypothetical ground assault threat against a commercial nuclear power plant. Some generic elements of the design basis threat are described in Title 10, Section 73.1(a) of the Code of Federal Regulations (10 CFR 73.1(a)).

Dirty bomb: See *Radiological Dispersal Device*.

Dry storage: Out-of-water storage of spent nuclear fuel in heavily shielded casks.

Drywell: The containment structure enclosing a boiling water nuclear reactor vessel. The drywell is connected to a pressure suppression system and provides a barrier to the release of radioactive material to the environment under accident conditions.

Dual-purpose cask: See *Cask*.

Fissile material: Material that undergoes fission from thermal (slow) neutrons. Although sometimes used as a synonym for fissionable material, the term "fissile" has acquired this more restricted meaning in nuclear reactor technology. The three primary fissile materials are uranium-233, uranium-235, and plutonium-239.

Fission: Splitting of a nucleus into at least two nuclei accompanied by the release of neutrons and a relatively large amount of energy.

Fissionable: Material that is capable of undergoing fission from fast neutrons.

Fission products: Nuclei resulting from the fission of elements such as uranium.

Fuel assembly: A square array of fuel rods.

Fuel pellet: A small cylinder of uranium usually in a ceramic form (uranium dioxide, UO_2), typically measuring about 0.4 to 0.65 inches (1.0 to 1.65 centimeters) tall and about 0.3 to 0.5 inch (0.8 to 1.25 centimeters) in diameter.

Fuel reprocessing: Chemical processing of reactor fuel to separate the unused fissionable material (uranium and plutonium) from waste material.

Fuel rod: Sometimes referred to as a *fuel element* or *fuel pin*. A long, slender tube that holds the uranium fuel pellets. Fuel rods are assembled into bundles called *fuel assemblies*.

Gamma ray: Electromagnetic radiation (high-energy photons) emitted from certain radioactive isotopes when they undergo radioactive decay.

Half-life (radioactive): Time required for half the atoms of a radioactive substance to undergo radioactive decay. Each radioactive isotope has a unique half-life. For example, cesium-137 decays with a half-life of 30.2 years, and plutonium-239 decays with a half-life of 24,065 years.

Independent Spent Fuel Storage Installation (ISFSI): A facility for storing spent fuel in wet pools or dry casks as defined in Title 10, Part 72 of the Code of Federal Regulations.

Irradiation: Process of exposing material to radiation, for example, the exposure of nuclear fuel in the reactor core to neutrons.

Isotope: Elements that have the same number of protons but different numbers of neutrons. For example, uranium-235 and uranium-238 are different isotopes of the element uranium.

Loss-of-pool-coolant event: A postulated accidental or malevolent event that results in a loss of the water coolant from a spent fuel pool at a rate in excess of the capability of the water makeup system to restore it.

Megawatt: One million watts.

MELCOR: A computer code developed by Sandia National Laboratories for use in analyzing severe reactor core accidents. The code has been adapted to model fluid flow, heat transfer, fuel cladding oxidation kinetics, and fission product release phenomena associated with spent fuel assemblies in spent fuel pools in loss-of-pool-coolant events.

Metric ton: Weight unit corresponding to 1000 kg or approximately 2200 pounds.

Metric tons of uranium: See *MTU*.

Moderator: Material, such as ordinary water, heavy water, or graphite, used in a reactor to slow down high-energy neutrons.

MTU (metric tons of uranium): Unit of measurement of the mass for spent nuclear fuel, also expressed in metric tons of heavy metal (MTHM). It refers to the initial mass of uranium that is contained in a fuel assembly. It does not include the mass of fuel cladding (zirconium alloy) or the oxygen in the fuel compound.

Multi-purpose cask: See *Cask*.

MWe: Megawatts of electrical energy output from a power plant.

MWt: Megawatts of thermal energy output from a power plant.

Neutron: Uncharged subatomic particle contained in the nucleus of an atom. Neutrons are emitted from the nucleus during the fission process.

Open rack: A storage rack in a spent fuel pool that has open space and lateral channels between the cells for storing spent fuel assemblies to permit water circulation.

Overpack: Metal or concrete cask used for storage or transportation of a canister containing spent nuclear fuel. See Cask.

Owner-controlled area: That part of the power plant site over which the plant operator exercises control. This usually corresponds to the boundary of the site.

Pellet: See *Fuel pellet*.

Penetrate: To pass into, but not completely through, a solid object.

Perforate: To produce a hole that goes completely through a solid object.

Plutonium-239: A fissile isotope of plutonium that contains 94 protons and 145 neutrons.

Pressurized water reactor (PWR): A type of nuclear reactor in which the reactor's water coolant is kept at high pressure to prevent it from boiling. The coolant transfers its heat to a secondary water system that boils into steam to drive the turbine and generator to produce electricity.

Probabilistic risk assessment: A systematic, quantitative method to assess risk (see below) as it relates to the performance of a complex system.

Protected area: A zone located within the owner-controlled area of a commercial nuclear power plant site in which access is restricted using guards, fences, and other barriers.

psia: Unit of pressure, pounds per square inch absolute, that is the total pressure including the pressure of the atmosphere.

Radioactivity: Spontaneous transformation of an unstable atom, often resulting in the emission of particles (alpha and beta) or gamma radiation. The process is referred to as radioactive decay.

Radiological Dispersal Device (RDD): A terrorist device in which sources of radioactive material are dispersed by explosives or other means. Also referred to as a *dirty bomb*.

Radiological sabotage: Any deliberate act directed against a nuclear power plant or spent fuel in storage or transport that could directly or indirectly endanger the public health and safety by exposure to radiation.

Radionuclide: Any form of an isotope of an element that is radioactive.

Re-racking: Replacement of the existing racks in a spent fuel pool with new racks that increase the number of spent fuel assemblies that can be stored.

Risk: The potential for an adverse effect from an accident or terrorist attack. This potential can be estimated quantitatively if answers to the following three questions can be obtained: (1) What can go wrong? (2) How likely is it? (3) What are the consequences?

Safety: In the context of spent fuel storage, measures that protect storage facilities against failure, damage, human error, or other accidents that would disperse radioactivity in the environment.

Safeguards: As used in the regulation of domestic nuclear facilities and materials, the use of material control and accounting programs to verify that all nuclear material is properly controlled and accounted for, and also the use of physical protection equipment and security forces to protect such material.

Safeguards information: Information not otherwise classified as National Security Information or Restricted Data that specifically identifies a U.S. Nuclear Regulatory Commission licensee's or applicant's detailed (1) security measures for the physical

protection of special nuclear material or (2) security measures for the physical protection and location of certain plant equipment vital to the safety of production or utilization facilities (10 CFR 73.2). The U.S. Nuclear Regulatory Commission has the authority to determine whether information is "safeguards information."

Security: In the context of spent fuel storage, measures to protect storage facilities against sabotage, attacks, or theft.

Shaped charge: A demolition and wall penetration or perforation device that uses high explosive to create a high-velocity jet of material.

Single-purpose cask: See *Cask.*

Special nuclear material: Fissile elements such as uranium and plutonium.

Spent fuel: See *Spent nuclear fuel.*

Spent fuel pool: A water-filled pool that is used at all commercial nuclear reactors for storage of spent (used) fuel elements after their removal from a nuclear reactor. Spent fuel pools are constructed of reinforced concrete and lined with stainless steel. The inside of the pool has storage racks to hold the spent fuel assemblies and may contain a gated compartment to hold a spent fuel cask while it is being loaded and sealed.

Spent (or used or irradiated fuel) nuclear fuel: Fuel that has been "burned" in the core of a nuclear reactor and is no longer efficient for producing electricity. After discharge from a reactor, spent fuel is stored in water-filled pools (see *Wet storage*) for shielding and cooling.

Storage-only cask: See *Cask.*

Thermal power: Total heat output from the core of a nuclear reactor.

Uranium-235: A fissile isotope of uranium that contains 92 protons and 143 neutrons. It is the principal nuclear fuel in nuclear power reactors.

Uranium-238: An isotope of uranium that contains 92 protons and 146 neutrons.

Vital area: A zone located within the protected area of a commercial nuclear power plant site that contains the reactor control room, the reactor core, support buildings, and the spent fuel pool. It is the most carefully controlled and guarded part of the plant site.

Watt: Unit of power.

Watt-hour: Energy unit of measure equal to one watt of power supplied for one hour.

Wet storage: Storage of spent nuclear fuel in spent fuel pools.

Zircaloy: Zirconium alloy used as cladding for uranium oxide fuel pellets in reactor fuel assemblies.

Zirconium cladding fire: A self-sustaining, exothermic reaction caused by rapid oxidation of zirconium fuel cladding (zircaloy) at high temperatures.

F
ACRONYMS

ACRS: Advisory Committee on Reactor Safeguards

BAM: Bundesanstalt für Materialforschung und -prüfung

BMU: Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit

BNL: Brookhaven National Laboratory

BWR: Boiling Water Nuclear Reactor (see Appendix E)

CFD: Computational Fluid Dynamics

DBT: Design Basis Threat (see Appendix E)

DHS: United States Department of Homeland Security

DOE: United States Department of Energy

EPRI: Formerly referred to as the Electric Power Research Institute

GAO: United States Government Accountability Office (formerly the General Accounting Office)

GESMO: Final Generic Environmental Statement on the Use of Recycled Plutonium in Mixed Oxide Fuel in Light-Water Cooled Reactors

GNB: Gesellschaft für Nuklear-Behälter, mbH

GNS: Gesellschaft für Nuklear-Service, mbH

GNSI: General Nuclear Systems, Inc.

GRS: Gesellschaft für Anlagen- und Reaktorsicherheit, mbH

GWd/MTU: Gigawatt-Days per Metric Ton of Uranium (see *Burn-up* in Appendix E)

INL: Idaho National Laboratory (formerly Idaho National Engineering and Environmental Laboratory)

ISFSI: Independent Spent Fuel Storage Installation

HSK: Die Hauptabteilung für die Sicherheit der Kernanlagen

MTU: Metric Tons of Uranium (see Appendix E)

MWd/MTU: Megawatt-Days per Metric Ton of Uranium (see *Burn-up* in Appendix E)

NPP: Nuclear Power Plant

NRC: National Research Council

PFS: Private Fuel Storage

PWR: Pressurized Water Nuclear Reactor (see Appendix E)

RDD: Radiological Dispersal Device (see Appendix E)

RPG: Rocket-Propelled Grenade

RSK: Reaktorsicherheitskommission

TOW: Tube-Launched, Optically Tracked, Wire Guided [Missile] (see Appendix E)

USNRC: United States Nuclear Regulatory Commission

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE COMMISSION

In the Matter of	)	
	)	
Entergy Nuclear Operations, Inc.	)	Docket No. 50-293
	)	
(Vermont Yankee Nuclear Power Station)	)	
	)	

MASSACHUSETTS ATTORNEY GENERAL'S REQUEST FOR A HEARING AND PETITION FOR LEAVE TO INTERVENE WITH RESPECT TO ENTERGY NUCLEAR OPERATIONS INC.'S APPLICATION FOR RENEWAL OF THE VERMONT YANKEE NUCLEAR POWER PLANT OPERATING LICENSE
AND
PETITION FOR BACKFIT ORDER REQUIRING NEW DESIGN FEATURES TO PROTECT AGAINST SPENT FUEL POOL ACCIDENTS

By Massachusetts Attorney General Thomas F. Reilly
Through his Attorneys,

Diane Curran
Harmon Curran, Spielberg & Eisenberg, L.L.P.
1726 M Street N.W., Suite 600
Washington, D.C. 20036
202/328-3500
dcurran@harmoncurran.com

Matthew Brock, Assistant Attorney General
Environmental Protection Division
Office of the Attorney General
One Ashburton Place
Boston, MA 02108
617/727-2200
matthew.brock@ago.state.ma.us

May 26, 2006

TABLE OF CONTENTS

TABLE OF AUTHORITIES

Judicial Decisions

NRC Decisions

Statutes

Atomic Energy Act

Nuclear Waste Policy Act

Regulations

Federal Register Notices

NRC Documents

Miscellaneous

I. INTRODUCTION AND EXECUTIVE SUMMARY

On behalf of the Commonwealth of Massachusetts, Attorney General Thomas F. Reilly ("Massachusetts Attorney General" or "Petitioner") petitions to intervene and requests the U.S. Nuclear Regulatory Commission ("NRC" or "Commission") to grant an adjudicatory hearing on Entergy Nuclear Operations, Inc.'s ("Entergy's") application for renewal of its license to operate the Vermont Yankee nuclear power plant. He files this petition pursuant to the notice of opportunity for a hearing published at 71 Fed. Reg. 15,222 (March 27, 2006), Section 189a of the Atomic Energy Act ("AEA") [42 U.S.C. § 2239(a)], and 10 C.F.R. § 2.309.

Through its application, Entergy seeks approval to operate the Vermont Yankee plant an additional 20 years past its expiration date of 2012. As a general matter the Attorney General does not oppose Entergy's renewal application, and he acknowledges that nuclear power provides an important component of the New England energy supply. At the same time, however, he wants to ensure that the NRC does not grant the license renewal before Entergy and the NRC address the risk of a severe accident in the Vermont Yankee spent fuel pool and comply with federal laws for the protection of public health, safety, and the environment.

As detailed below in the Petitioner's contention (*see* Section V below), Entergy's license renewal application fails to comply with the National Environmental Policy Act's ("NEPA's") requirement that it address significant new information bearing on the environmental impacts of operating the Vermont Yankee nuclear power plant during a license renewal term. That new information, not addressed in any previous Environmental Impact Statement ("EIS") for the Vermont Yankee nuclear plant or any

other nuclear power plant, demonstrates that continued storage of spent fuel in high-density storage racks in the Vermont Yankee pool poses a significant and reasonably foreseeable environmental risk of a severe fire and offsite release of a large amount of radioactivity. Entergy's failure to take account of this new information is inconsistent with NEPA's major requirement that environmental decisions must take new information into account if the information shows that a proposed action will affect the quality of the human environment "in a significant manner or to a significant extent not already considered." *Marsh v. Oregon Natural Resources Council,* 490 U.S. 360, 374 (1989) ("*Marsh*").

Entergy's application also fails to satisfy the AEA's fundamental requirement to ensure safe operation of the Vermont Yankee plant during the license renewal term because it does not include adequate design measures to prevent the occurrence of a pool fire or to reduce its consequences. Therefore, pursuant to 10 C.F.R. § 50.109(a)(5), the Attorney General petitions the Commission to require that Entergy backfit the Vermont Yankee design to eliminate or substantially mitigate the risk of a pool fire. The choice of design measure for the backfit should be informed by the consideration of backfit design alternatives in an EIS.

The Attorney General's hearing request and backfit petition arise from the safety and environmental risks posed by Entergy's plan to continue to use "high-density" racks for storage of spent fuel in the Vermont Yankee fuel pool. When the Vermont Yankee plant was originally licensed in 1972, "low-density" racks were used to store spent fuel in the pool. The open construction of these racks allowed cooling fluid to flow freely all around and over the spent fuel assemblies stored in the pool. Under several license

amendments granted between 1972 and 1994, the NRC has allowed Entergy to pack fuel more and more densely into the pool, using "high-density" storage racks. By the time the current license term expires in 2012, Entergy will have accumulated some three thousand fuel assemblies in the Vermont Yankee fuel pool, amounting to approximately forty million curies of radioactive isotopes. If the fuel pool were to suffer a loss of water sufficient to uncover the tops of the fuel assemblies, the dense configuration of the high-density racks would inhibit the flow of water, air or steam over the fuel assemblies, causing some of the fuel to ignite within hours. The fire could then propagate within the pool, and the burning of fuel assemblies could lead to a large atmospheric release of radioactive isotopes, contaminating a large land area for decades and at a heavy cost to public health and the economy.

While such a catastrophic accident is unlikely, its probability falls within the range that NRC considers reasonably foreseeable. Therefore it is not a speculative or worst-case event. Pool water could also be lost if the pool were the subject of an intentional attack, a risk that can no longer be ignored after the attacks of September 11, 2001. Yet, neither Entergy nor the NRC has addressed the safety and environmental impacts of a pool fire in any EIS, nor is the Vermont Yankee plant designed to avoid a pool fire accident.

Although it has long been known that high-density pool storage of spent fuel could potentially lead to a serious accident, the scientific information on such risks has continued to develop in recent years, including through technical studies by the Commission's own staff, independent expert analyses, and a study by the National Academies of Sciences. Increased appreciation for the potential for an intentional attack

on nuclear facilities has also changed our consideration of that risk. Despite the NRC's acknowledgment of concern about such a risk, and despite the known vulnerability of fuel pools to fire if they are intentionally drained, the agency has not addressed the potential safety and environmental impacts of attacks involving fuel pools. *Marsh* and NRC regulations require that prior to licensing Vermont Yankee, the NRC must prepare an EIS that addresses significant new information regarding the safety and environmental impacts of a pool fire. This information was not available to the NRC when earlier EISs relevant to license renewal were prepared. Under NEPA, the EIS must also weigh reasonably available alternatives for avoiding or mitigating a pool fire, such as combined low-density pool storage and dry storage of spent fuel.

The AEA also requires the NRC to protect against the unreasonable risk of a pool fire in its license renewal decision for Vermont Yankee. *Petition for Emergency and Remedial Action,* CLI-78-6, 7 NRC 400, 404 (1978) ("*Petition for Emergency and Remedial Action*"). Therefore, the NRC must not only assess the impacts of pool fires in an EIS, it must require Entergy to change the design or operations of the plant to prevent a pool fire from occurring.

II. THE MASSACHUSETTS ATTORNEY GENERAL HAS STANDING TO INTERVENE IN THIS PROCEEDING AND REQUEST A BACKFIT ORDER.

Section 189a of the AEA, 42 U.S.C. § 2239(a)(1), provides that:

> In any proceeding under this Act, for the granting, suspending, revoking, or amending of any license . . . the Commission shall grant a hearing upon the request of any person whose interest may be affected by the proceeding, and shall admit any person as a party to such a proceeding.

As previously established, the Attorney General has standing to intervene in a proceeding involving the safety of pool storage of spent fuel at Vermont Yankee.

Vermont Yankee Nuclear Power Corporation (Vermont Yankee Nuclear Power Station), LBP-87-7, 25 NRC 116, 118 (1987) ("*Vermont Yankee*").[1]

The Attorney General is concerned that Entergy and the NRC have not adequately informed the public regarding the risks of a severe accident in the Vermont Yankee spent fuel pool during the license renewal term, nor have they implemented adequate design measures to avoid such an accident. Therefore, the Attorney General seeks enforcement of federal laws requiring the preparation of an EIS regarding the risks of storing spent fuel in the Vermont Yankee pool, as well as the imposition of design measures for avoiding those accidents. If granted, this relief would improve the level of protection of the environment and public health and safety of the residents of Massachusetts.[2]

III. STATUTORY AND REGULATORY FRAMEWORK

The two statutes that govern this hearing request and backfit petition are NEPA and the AEA. The AEA sets minimum standards for safe and secure operation of nuclear facilities, while NEPA requires NRC to consider and attempt to avoid or mitigate significant adverse environmental impacts of licensing those facilities. Although the statutes have some overlapping concerns, they establish independent requirements. *Limerick Ecology Action v. NRC,* 869 F.2d 719, 729-30 (3rd Cir. 1989). NEPA goes

---

1 The Attorney General satisfies the requirements of 10 C.F.R. § 2.309(d) for demonstrating standing. The Attorney General has an interest in this proceeding because the Vermont Yankee nuclear power plant lies within ten miles of the Commonwealth of Massachusetts. An accidental offsite release of radioactivity from the Vermont Yankee fuel pool during the proposed license renewal term could affect the health and well-being of Massachusetts residents, the integrity of the environment, and the economic welfare of the Commonwealth.

2 As an elected representative of the citizens of the Commonwealth of Massachusetts, the Attorney General also has the right to participate in this proceeding as a representative of an interested State. 10 C.F.R. § 2.315(c). *See also Vermont Yankee,* 25 NRC at 118.

beyond the AEA, requiring the consideration of alternatives to reduce or avoid adverse environmental impacts of NRC licensing actions. *Id.,* citing 10 C.F.R. § 51.71(d).[3]

A. Atomic Energy Act Safety Requirements

1. AEA requirements for protection of public safety

The AEA prohibits the NRC from issuing a license to operate a nuclear power plant if it would be "inimical to the common defense and security or to the health and safety of the public." 42 U.S.C. § 2133(d). Public safety is "the first, last, and a permanent consideration in any decision on the issuance of a construction permit or a license to operate a nuclear facility." *Petition for Emergency and Remedial Action,* 7 NRC at 404, citing *Power Reactor Development Corp. v. International Union of Electrical Radio and Machine Workers,* 367 U.S. 396, 402 (1961) ("*Power Reactor Development Corp.*").

2. NRC requirements for protection against design-basis accidents

NRC regulations for implementation of the AEA provide that a nuclear power plant must be designed against accidents that are "anticipated during the life of the facility." *See* 10 C.F.R. § 50.34(a)(4), which provides that a construction permit application for a nuclear power plant must include:

> a preliminary analysis and evaluation of the design and performance of structures, systems, and components of the facility with the objective of assessing the risk to public health and safety resulting from operation of the facility and including determination of the margins of safety during normal operations and transient conditions anticipated during the life of the facility, and the adequacy of

---

3 As the Court observed in *Limerick,* it is "unreasonable to suppose that [environmental] risks are automatically acceptable, and may be imposed upon the public by virtue of the AEA, merely because operation of a facility will conform to the Commission's basic health and safety standards." *Id.* quoting *Citizens for Safe Power v. NRC,* 524 F.2d 1291, 1299 (D.C. Cir. 1975).

structures, systems, and components provided for the prevention of accidents and the mitigation of the consequences of accidents.

These "anticipated" accidents, against which nuclear power plants must be designed, are called "design-basis accidents." *See* NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants at 5-1 (1996) ("License Renewal GEIS"). Design-basis accidents include low-frequency but credible events. *Id.* at 5-2.

In determining which types of accidents constitute design-basis accidents and therefore must be protected against in a nuclear plant's design, the NRC sets a "threshold" based on probability of the accident. The NRC has held that reactor core accidents with a "realistic probability" (*i.e.*, a non-conservative probability) of at least one in ten million per year (10^{-7}) must be included in the design-basis.[4]

The NRC designates accidents that are more complex and less likely than design-basis accidents as "severe accidents." License Renewal GEIS at 5-1 (severe accidents are "those involving multiple failures of equipment or function and, therefore, whose likelihood is generally lower than design-basis accidents but whose consequences may be higher"). Although severe accidents are "beyond the substantial coverage of design-basis events," they constitute "the major risk to the public associated with radioactive releases from nuclear power plant accidents." Policy Statement on Severe Accidents Regarding

---

4 *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), CLI-01-22, 54 NRC 255, 259-60 (2001) ("*PFS I*"), citing *Metropolitan Edison Co.* (Three Mile Island Nuclear Station, Unit 2), ALAB-692, 16 NRC 921 (1982); *Consumers Power Co.* (Big Rock Point Plant), LBP-84-32, 20 NRC 601, 639-52 (1984).

But see Vermont Yankee Nuclear Power Corp. (Vermont Yankee Nuclear Power Station), CLI-90-4, 31 NRC 333, 334 (1990), in which the Commission refused to rule out NEPA consideration of an accident probability of 10^{-4} per year as remote and speculative. Under the *PFS I* ruling, an accident with a probability of 10^{-4} would be well within the range of a design-basis accident. Therefore, not only should it have been considered credible for purposes of preparing an EIS, but it should have been included in the design-basis for the facility.

Future Designs and Existing Plants, 50 Fed. Reg. 32,138, 32,139 (August 8, 1985) ("Severe Accident Policy Statement").

The Commission has made a generic determination that nuclear plants can be operated safely, despite the potential for severe accidents. Severe Accident Policy Statement, 50 Fed. Reg. at 32,139-40. *See also* Final Rule, Nuclear Power Plant License Renewal, 56 Fed. Reg. 64,943, 64,948-49 (December 13, 1991). Nevertheless, the Commission has an ongoing program to address severe accidents in the context of its regulatory program for protection of public health and safety under the Atomic Energy Act, and pledges to act upon any new information that calls the safety finding into question. *Id.* As provided by the Severe Accident Policy Statement:

> Should significant new safety information become available, from whatever source, to question the conclusion of 'no undue risk,' then the technical issues thus identified would be resolved by the NRC under its backfit policy and other existing procedures, including the possibility of generic rulemaking where this is justified.

50 Fed. Reg. at 32,139.

3. Standard for license renewal

Section 2133(c) of the Atomic Energy Act allows the NRC to renew nuclear power licenses. Although the AEA does not set a safety standard for license renewal, the Commission generally interprets the AEA to require that it "must have 'reasonable assurance' that public health and safety are not endangered by its licensing actions." *Petition for Emergency and Remedial Action,* 7 NRC at 404, citing *Power Reactor Development Corp.*, 367 U.S. at 402.

In the license renewal rulemaking, the Commission made a determination that:

> With the exception of age-related degradation unique to license renewal and possibly some few other issues related to safety only during extended operation,

> the regulatory process is adequate to ensure that the licensing bases of all currently operating plants provide and maintain an acceptable level of safety for operation so that operation will not be inimical to public health and safety or common defense and security.

56 Fed. Reg. at 64,946. Thus, other than with respect to aging issues, the NRC does not inquire into safety issues in the license renewal process.

If significant new information becomes available with respect to a safety issue unrelated to the aging of the plant, the NRC does not permit it to be raised in the license renewal hearing. Preamble to Final License Renewal Rule, 56 Fed. Reg. at 64,946. Instead, the NRC requires that the issue must be addressed under the NRC policy for backfitting the design of operating reactors in 10 C.F.R. § 50.109, or under "other existing procedures, including the possibility of generic rulemaking." *Id.*[5]

B. NEPA Statutory and Regulatory Requirements

1. General NEPA requirements

a. NEPA requirement to prepare an EIS

NEPA is the "basic charter for protection of the environment." 40 C.F.R. § 1500.1. Its fundamental purpose is to "help public officials make decisions that are based on understanding of environmental consequences, and take decisions that protect, restore and enhance the environment." *Id.* NEPA requires federal agencies to examine the environmental consequences of their actions *before* taking those actions, in order to ensure "that important effects will not be overlooked or underestimated only to be discovered after resources have been committed or the die otherwise cast." *Robertson v. Methow Valley Citizens Council* (*Robertson*), 490 U.S. 332, 349 (1989).

---

5 Among these options the Massachusetts Attorney General has elected to request a backfit to design the Vermont Yankee plant against pool fires. *See* Section VI. below.

The primary method by which NEPA ensures that its mandate is met is the "action-forcing" requirement for preparation of an EIS, which assesses the environmental impacts of the proposed action and weighs the costs and benefits of alternative actions. *Id.*, 490 U.S. at 350-51. An EIS must be rigorous, providing a "hard look" at the environmental consequences of the proposed action. *Id.* at 349; *Marsh,* 490 U.S. at 374.

b. NEPA requirement to supplement an EIS

The completion of an EIS for a proposed action does not end an agency's responsibility to weigh the environmental impacts of a proposed action. *Marsh,* 490 U.S. at 371-72. As the Supreme Court recognized in *Marsh,* it would be incongruous with NEPA's "action-forcing" purpose to allow an agency to put on "blinders to adverse environmental effects," just because the EIS has been completed. *Id.* Accordingly, up until the point when the agency is ready to take the proposed action, it must supplement the EIS if there is new information showing that the remaining federal action will affect the quality of the human environment "in a significant manner or to a significant extent not already considered." 490 U.S. at 374.

c. NEPA requirement that an EIS must consider reasonably foreseeable impacts of nuclear accidents.

The environmental impacts that must be considered in an EIS include "reasonably foreseeable" impacts which have "catastrophic consequences, even if their probability of occurrence is low." 40 C.F.R. § 1502.22(b)(1). The Commission has held that probability is the "key" to determine whether an accident is "reasonably foreseeable" or whether it is "remote and speculative" and therefore need not be considered in an EIS.[6]

---

6 Vermont Yankee Nuclear Power Corp. (Vermont Yankee Nuclear Power Station), CLI-90-7, 32 NRC 129, 131 (1990). See also Limerick Ecology Action v. NRC,

In the spectrum of accidents that might be considered in an EIS for a nuclear power plant license, there is no dispute that "design-basis accidents," *i.e.*, accidents against which a nuclear plant must be designed under the AEA's requirement to protect public health and safety against "undue risk," are reasonably foreseeable and therefore must be considered. Thus, almost since the passage of NEPA the NRC has included consideration of the environmental impacts of design-basis accidents in its EISs. *Limerick Ecology Action v. NRC,* 869 F.2d 719, 726 (3rd Cir. 1989), citing 36 Fed. Reg. 22,851 (1971).

In 1980, following the Three Mile Island accident, the Commission also began to consider the environmental impacts of severe or "beyond design-basis" accidents in its EISs. *Id.,* citing Statement of Interim Policy, Nuclear Power Plant Accident Considerations Under the National Environmental Policy Act of 1969, 45 Fed. Reg. 40,101 (1980). In contested cases the Commission has required intervenors to address the quantitative probability of severe accidents for which they seek consideration in an EIS. *See, e.g., Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), CLI-01-11, 53 NRC 370, 387 (2001) ("Harris"). While the Commission has not established a threshold for the level of accident probability considered "reasonably foreseeable," in *Harris* the Commission affirmed a decision by the ASLB approving the NRC Staff's probability estimate of 10^{-7} for a particular accident scenario and ruling that the accident was "remote and speculative." *Id.* at 388 n.8. (*But see* Section III.A.2 above.)

2. NRC's procedures for preparation of ER and EIS

NRC's NEPA procedures require the NRC to prepare an EIS for any major licensing action significantly affecting the quality of the human environment. 10 C.F.R.

---

869 F.2d at 745, citing Vermont Yankee Nuclear Power Corp. v. Natural Resources Defense Council, Inc., 435 U.S. 519, 551 (1978).

§§ 51.71, 51.91. Before the EIS is prepared, however, the NRC's regulations require that the license applicant must prepare what amounts to a first draft of the EIS, *i.e.,* the environmental report ("ER"). 10 C.F.R. § 51.53(c)(2), *Duke Power Co.* (Catawba Nuclear Station, Units 1 and 2), CLI-83-19, 17 NRC 1041, 1049 (1983) (noting that "as a practical matter, much of the information in an Applicant's ER is used in the [Draft EIS]"). The ER generally must address all the same impacts, alternatives, and other environmental issues that will be addressed later in the NRC's EIS. *Compare* 10 C.F.R. § 51.53(c)(2) with 10 C.F.R. § 51.71.

3. NRC's NEPA procedures for license renewal

a. NRC reliance on License Renewal GEIS in individual license renewal proceedings

NRC regulations for the implementation of NEPA do not require the preparation of a complete ER and EIS for every nuclear power plant license renewal application. Instead, the NRC relies on the License Renewal GEIS, prepared in 1996, to evaluate most of the environmental impacts of license renewal. *See* 10 C.F.R. §§ 51.53(c)(3)(i), 51.71(d).

The License Renewal GEIS and NRC's environmental regulations for license renewal-related NEPA issues separate environmental impacts, including accidents, into two major categories: Category 1 or "generic" impacts, and Category 2 or "plant-specific" impacts. *Duke Energy Corporation* (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-14, 55 NRC 278, 290 (2002) ("*McGuire/Catawba*"). Environmental impacts are listed according to their category in Table B-1 of Appendix B to Subpart A of 10 C.F.R. Part 51.

For Category 1 impacts, the NRC considers the License Renewal GEIS analysis

sufficient, and no further analysis is required in the Environmental Report and EIS that are prepared at the time of the license renewal application. 10 C.F.R. §§ 51.53(c)(3)(i), 51.71, 51.95(c). For Category 2 impacts, the NRC has determined that impacts and alternatives cannot be fully addressed in the Generic EIS and therefore must be addressed in the site-specific ER and EIS. *McGuire/Catawba,* 55 NRC at 290; *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 NRC 3, 12 (2001).

b. NRC discussion of accident impacts in License Renewal GEIS

The License Renewal GEIS purports to address both design-basis accidents and severe accidents. With respect to design-basis accidents, the GEIS provides a brief statement that the impacts of design-basis accidents were considered in the original EIS for each nuclear power plant, and that the design was found adequate to "accommodate" those accidents. License Renewal GEIS at 5-11. Moreover, the GEIS asserts that the consequences of design-basis accidents are not expected to change significantly as a result of aging of the plant. *Id.* Therefore, the GEIS does not provide a further discussion of design-basis accidents. *Id.* These impacts are also classified as "Category 1 in Table B-1 of Appendix B to Subpart A of 10 C.F.R. Part 51.

With respect to severe or beyond design-basis accidents, the License Renewal GEIS discusses the potential consequences of an array of severe accidents identified in various studies, primarily the NRC's most recent and comprehensive probabilistic analysis of nuclear power plant accidents, NUREG-1150, Severe Accident Risks for Five U.S. Nuclear Power Plants (1990). While recognizing the possibility that the likelihood of some severe accidents may be so low as to be "remote and speculative" and therefore

not necessary to discuss in an EIS, the License Renewal GEIS does not exclude any severe accidents on the ground of their estimated probability. Severe accidents are classified as "Category 2" impacts in Table B-1 of Appendix B to Subpart A of 10 C.F.R. Part 51.

The License Renewal GEIS does not include any discussion of how deliberate and malicious attacks on nuclear power plants may increase the likelihood or consequences of severe accidents. The NRC declines to address the topic on the grounds that (a) NRC security regulations provide reasonable assurance that the risk from sabotage is small; (b) although their probability is not quantifiable, acts of sabotage are "not reasonably expected"; and (c) even if such an event were to occur, resultant core damage and radiological releases would be "no worse than those expected from internally initiated events." License Renewal GEIS at 5-18.[7]

The License Renewal GEIS is consistent with the NRC's long-established policy of refusing to examine the environmental impacts of deliberate malicious acts on the ground that it could not make a "meaningful assessment of the risks of sabotage." *Philadelphia Electric Co.* (Limerick Generating Station, Units1 and 2), ALAB-819, 22 NRC 681, 697-701 (1985) ("*Limerick Appeal Board Decision*"), *aff'd on this ground and rev'd on other grounds, Limerick Ecology Action v. NRC,* 869 F.2d 719, 743-44 (3rd Cir. 1989). Even the attacks of September 11, 2001, did not cause the NRC to change this policy, which it reiterated in *Private Fuel Storage, L.L.C.* (Independent Spent Fuel

---

7 The NRC's failure to discuss impacts of deliberate and malicious acts in the License Renewal GEIS is a departure from the 1979 GEIS, in which the NRC examined the impacts of attacks on spent fuel pools, albeit not in light of significant new information about the risks of pool fires, NUREG-0575, Handling and Storage of Spent Light Water Power Reactor Fuel (1979) ("1979 GEIS"). *See* discussion in Section V.B.1.c, below.

Storage Installation, CLI-02-25, 56 NRC 340 (2002) ("*PFS II*") and *Pacific Gas & Electric Company* (Diablo Canyon ISFSI), CLI-03-12, 58 NRC 185 (2003) ("*Diablo Canyon*").[8] *Diablo Canyon* has been appealed to the U.S. Court of Appeals for the 9th Circuit, where a decision is pending. Moreover, to the extent that *PFS II* and *Diablo Canyon* are based on factual determinations that should be re-evaluated in a new EIS in light of significant new information, the policy is subject to challenge in this proceeding. 10 C.F.R. § 51.53(c)(3)(iv). *See* discussion below in Section III.B.3.c.

c. NRC requirement to supplement License Renewal GEIS

Consistent with *Marsh,* 490 U.S. at 374, NRC regulation 10 C.F.R. § 51.53(c)(3)(iv) requires that an environmental report "must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware." Thus, the conclusions of the License Renewal GEIS are subject to modification in individual license renewal proceedings if new and significant information, not evaluated in the License Renewal GEIS, shows that the environmental impacts of license renewal are greater than concluded in the License Renewal GEIS.

d. NRC requirement to consider alternatives in site-specific ER and EIS

For any environmental impacts that do not fall into Category 1, a license renewal applicant must consider "alternatives for reducing adverse impacts," including severe accidents. 10 C.F.R. § 51.53(c)(3)(iii), citing 10 C.F.R. § 51.45(c). This requirement

---

8 For other decisions applying the NRC's policy against considering the environmental impacts of terrorism and sabotage, *see Duke Cogema Stone & Webster* (Savannah River Mixed Oxide Fuel Fabrication Facility), CLI-02-24, 56 NRC 335 (2002); *Dominion Nuclear Connecticut, Inc.* (Millstone Nuclear Power Station, Unit 1), CLI-02-27, 56 NRC 367 (2002); *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2), Catawba Nuclear Station, Units 1 and 2), CLI-02-26, 56 NRC 358 (2002).

also applies to the draft and final EIS for each individual license renewal application. 10 C.F.R. § 51.71(d), 51.91.

As the Commission explained in the preamble to the final rule for environmental review of license renewal applications, the alternatives that must be considered include severe accident mitigation alternatives ("SAMAs"). Final Rule, Environmental Review for Renewal of Nuclear Power Plant Operating Licenses, 61 Fed. Reg. 28,467, 28,480-81 (June 5, 1996). This requirement is:

> based on the Commission's NEPA regulations that require a review of severe [accident] mitigation alternatives in its environmental impact statements (EISs) and supplements to EISs, as well as a previous court decision that required review of severe mitigation alternatives (referred to as SAMDAs) at the operating license stage. See, Limerick Ecology Action v. NRC, 869 F.2d 719 (3d Cir. 1989).

61 Fed. Reg. at 28,481. In addition, the Commission noted that while each licensee was in the process of performing an individual plant examination ("IPE") to "look for plant vulnerabilities to internally initiated events" and a separate IPE "for externally initiated events (IPEEE)," the program had not been completed in time to include the results in an EIS or supplemental EIS. *Id.* Thus, the ER and EIS for each individual license renewal application must include consideration of SAMAs. *Id.*

C. Atomic Energy Act Public Hearing Requirements for License Renewal Decisions.

Section 189a of the AEA requires the NRC to provide interested members of the public with a prior opportunity for a hearing on any decision regarding the issuance or amendment of a nuclear facility license. 42 U.S.C. § 2239(a)(1)(A). While the AEA does not establish a specific right to a hearing for license renewal proceedings, the Commission has determined that a hearing should be granted because renewal of an

operating license "is essentially the granting of a license." Proposed Rule, Nuclear Power Plant License Renewal, 55 Fed. Reg. 29,043, 29,052 (July 17, 1990).

In order to be admitted as an intervenor to an NRC adjudicatory licensing proceeding, including a license renewal proceeding, a petitioner must file "contentions" that provide "sufficient information to show that a genuine dispute exists with the applicant/licensee on a material issue of law or fact." 10 C.F.R. § 2.309(f)(vi). Contentions raising questions of compliance with NRC safety requirements must be based on the application, and contentions raising questions of compliance with NEPA must be based on the applicant's ER. 10 C.F.R. § 2.309(f).

Pursuant to 10 C.F.R. § 2.335, contentions may not challenge NRC regulations. However, factual determinations codified in NRC NEPA regulations may be challenged under regulations and judicial precedents requiring the consideration of significant new information that undermines those determinations. *See* discussion above in Sections III.B.1.b and III.B.3.c. In addition, contentions may challenge fact-based statements of NRC policy that were established without notice or opportunity for public comment. *Limerick Ecology Action v. NRC,* 869 F.2d at 733-39.[9]

---

9 In the *Limerick* proceeding, which took place in the 1980s, the Intervenor submitted a contention challenging the NRC's pronouncement in an EIS that it would not consider the environmental impacts of sabotage against a proposed nuclear plant because it lacked any meaningful method of assessing the likelihood of sabotage events at a proposed nuclear power plant. 849 F.2d at 743. The Court upheld the NRC's holding that the Intervenor "failed to produce any credible evidence or theory that would 'cast any serious doubt' on the Commission's conclusion that sabotage risk analysis is beyond current probabilistic risk assessment methods and that there is no current basis by which to measure such risk." *Id.* Thus, the court recognized the Intervenor's right to challenge the NRC's policy pronouncement regarding consideration of intentional attacks on a nuclear facility in the specific licensing proceeding in which it had intervened. While the Third Circuit upheld the Commission's ruling that the *Limerick* Intervenor failed to present enough evidence to challenge the factual basis for the policy, that is not the case here. In its contention below, the Attorney General presents a significant body of evidence

IV. FACTUAL AND PROCEDURAL BACKGROUND

A. Vermont Yankee Nuclear Power Plant

1. Pool Storage of Spent Fuel at Vermont Yankee

At the Vermont Yankee nuclear power plant, electricity is generated by fission reactions in radioactive "fuel rods" in the plant's reactor. Fuel rods are grouped together in "assemblies." After a fuel assembly is "spent" in the sense that it no longer can be used to generate power, it is discharged from the reactor. However, at this point in its life the assembly is much more dangerous than when it entered the reactor. It emits heat and intense radiation, and contains a large inventory of radioactive material. Gordon Thompson, Risks and Risk-Reducing Options Associated with Pool Storage of Spent Nuclear Fuel at the Pilgrim and Vermont Yankee Nuclear Power Plants, § 2 (May 25, 2006) ("Thompson Report").[10]

The Vermont Yankee plant has a fuel storage pool through which fresh fuel assemblies pass during their placement in the reactor, and where spent fuel is stored after it is removed from the reactor core. When Vermont Yankee and other plants in the present generation of nuclear power plants first began operation in the 1970s, their spent fuel pools were equipped with low-density, open-frame racks. These racks allowed free circulation of water around the fuel assemblies. If water were lost from a pool equipped with open-frame racks, air or steam could circulate freely through the fuel assemblies, cooling the assemblies. As a result, the fuel cladding would ignite, if at all, only in rare conditions. Thompson Report, § 8.

---

showing that the NRC's policy is unfounded.

10 A copy of Dr. Thompson's report is attached to the Declaration of Dr. Gordon Thompson in Support of Massachusetts Attorney General's Contention and Petition for Backfit Order (May 25, 2006, which is included as Exhibit 1 to this pleading.

Over the past three decades, spent fuel inventories have mounted because of the lack of other means of spent fuel management. Plant licensees have responded to this problem by substantially increasing the density at which fuel is stored in the existing spent fuel pools. In order to increase the density of storage, licensees have been obliged to use racks in which each fuel assembly is surrounded by solid, neutron-absorbing panels, which are needed to suppress criticality or a runaway chain reaction. The panels limit the flow of coolant (water, air or steam) to a mode of circulation in which the coolant enters each rack cell from below, rises vertically through the cell, and leaves the cell at its top.

The Vermont Yankee license has been amended several times to permit storage of an ever-increasing volume of spent fuel in high-density storage racks. Currently, all racks in the Vermont Yankee pool are high-density. During the requested period of license extension, the Vermont Yankee fuel pool will contain about 2,600 fuel assemblies with a radioactive inventory of about 39 million curies of cesium-137. Thompson Report, Table 3-4.

If water is lost from a pool equipped with high-density racks, the circulation of coolant over the fuel assemblies will be inhibited, and the fuel will ignite over a wide range of conditions. Thompson Report, § 2. *See also* discussion below in Section V.B.3. A pool fire at Vermont Yankee could release between 3.9 and 39 million curies of radioactive cesium, contaminating a large land area with radioactive cesium-137 for decades, at a cost of many billions of dollars. Thompson Report, § 5; Jan Beyea, Report to the Massachusetts Attorney General on the Potential Consequences of a Spent-fuel Pool Fire at the Pilgrim or Vermont Yankee Nuclear Plant at 21-24 (May 25, 2006)

("Beyea Report").[11]

2. Availability of dry storage as an alternative to pool storage

Dry storage is an alternative to wet storage that involves placement of the spent fuel in containers (casks or canisters) that are filled with a noncorrosive gas such as helium. Cooling is achieved by convective (*i.e.,* passive) circulation of air over the fuel containers. In comparison with high-density pool storage, dry storage is more expensive because it requires the purchase and installation of new equipment. However, dry storage eliminates the potential for a pool fire and, if properly executed, dramatically reduces the potential for other modes of release of the radioactive material in spent fuel. Thompson Report, § 8. Thus, the expense is well-justified. *Id.,* § 9; Beyea Report, Tables 4 and 5.

To this date, Entergy has not implemented dry storage at the Vermont Yankee nuclear power plant.

B. Vermont Yankee license renewal application

Entergy's license for the Vermont Yankee nuclear power plant is due to expire in 2012. On January 25, 2006, Entergy submitted an application to the NRC for renewal of its operating license for an addition 20-year term, or until 2032. Entergy License Renewal Application, Vermont Yankee Nuclear Power Station ("License Renewal Application"). As required by 10 C.F.R. § 51.53(c), the license renewal application included an ER, which purported to address the site-specific environmental impacts of the proposed operation during the renewal term and other related issues. Vermont Yankee License Renewal Application, Appendix E, Applicant's Environmental Report ("Vermont Yankee ER"). The Vermont Yankee ER addresses the environmental impacts

11 A copy of Dr. Beyea's report is attached to the Declaration of Dr. Jan Beyea in Support of Massachusetts Attorney General's Contention and Petition for Backfit Order (DATE), which is included as Exhibit 2 to this pleading.

of accidents in Section 4, relying to a significant extent on the License Renewal GEIS for the evaluation of environmental impacts. *See* ER at 4-1, 4-41. In response to its regulatory obligation to identify "new and significant" information regarding the environmental impacts of license renewal, Entergy also states that it is aware of none. ER at 5-2, citing 10 C.F.R. § 51.53(c)(3)(iv).

V. CONTENTION: THE ENVIRONMENTAL REPORT FOR RENEWAL OF THE VERMONT YANKEE NUCLEAR POWER PLANT FAILS TO SATISFY NEPA BECAUSE IT DOES NOT ADDRESS THE ENVIRONMENTAL IMPACTS OF SEVERE SPENT FUEL POOL ACCIDENTS.

A. Contention

The Vermont Yankee ER does not satisfy the requirements of 10 C.F.R. § 51.53(c)(3)(iv) and NEPA, 42 U.S.C. § 4332 *et seq.*, because it fails to address new and significant information regarding the reasonably foreseeable potential for a severe accident involving nuclear fuel stored in high-density storage racks in the Vermont Yankee fuel pool. Although an NRC-sponsored study conducted as early as 1979 raised the potential for a severe accident in a high-density fuel storage pool if water is partially lost from the pool (NUREG/CR-0649, *Spent Fuel Heatup Following Loss of Water During Storage* (March 1979) ("1979 Sandia Report")), the NRC has failed to take that risk into account in every EIS it has prepared, including the 1979 GEIS on the environmental impacts of fuel storage; the 1990 Waste Confidence rulemaking (Review and Final Revision of Waste Confidence Decision, 55 Fed. Reg. 38,474, 38,481 (September 18, 1990) ("1990 Waste Confidence Rulemaking"); and the 1996 License Renewal GEIS on which the Vermont Yankee license renewal application relies. Moreover, the environmental impacts of a pool accident were not considered in the 1972

EIS issued in support of the original operating license for the Vermont Yankee nuclear power plant (Final Environmental Statement Related to Operation of Vermont Yankee Nuclear Power Station, Boston Edison Company, Docket No. 50-293 (May 1972) ("1972 Vermont Yankee EIS")).

Significant new information now firmly establishes that (a) if the water level in a fuel storage pool drops to the point where the tops of the fuel assemblies are uncovered, the fuel will burn, (b) the fuel will burn regardless of its age, (c) the fire will propagate to other assemblies in the pool, and (c) the fire may be catastrophic. *See* Thompson Report and Beyea Report. This new information has also been confirmed by the NRC Staff in NUREG-1738, *Final Technical Study of Spent Fuel Pool Accident Risk and Decommissioning Nuclear Power Plants* (January 2001) ("NUREG-1738"), and by the National Academies of Sciences. *See* NAS Committee on the Safety and Security of Commercial Spent Nuclear Fuel Storage, *Safety and Security of Commercial Spent Nuclear Fuel Storage* at 53-54 (The National Academies Press: 2006) ("NAS Report").[12]

Moreover, significant new information, including the attacks of September 11, 2001 and the NRC's response to those attacks, shows that the environmental impacts of intentional destructive acts against the Vermont Yankee fuel pool are reasonably foreseeable. Taken together, the potential for severe pool accidents caused by intentional malicious acts and by equipment failures and natural disasters such as earthquakes is not only reasonably foreseeable, but is likely enough to qualify as a "design-basis accident," *i.e.*, an accident that must be designed against under NRC safety regulations. Thompson Report, §§ 6,7,9.

---

12 Relevant excerpts of NUREG-1738 and the NAS Report are attached as Exhibits 3 and 4, respectively.

The ER also fails to satisfy 10 C.F.R. § 51.53(c)(3)(iii) because it does not consider reasonable alternatives for avoiding or reducing the environmental impacts of a severe spent fuel accident, *i.e.*, SAMAs. Alternatives that should be considered include re-racking the fuel pool with low-density fuel storage racks and transferring a portion of the fuel to dry storage.

This contention is supported by the expert declarations and reports of Drs. Gordon Thompson and Jan Beyea regarding the likelihood and consequences of spent fuel pool accidents at the Vermont Yankee nuclear power plant. *See* Exhibits 1 and 2.

B. Basis for Contention

NEPA requires that new and significant information, not considered in any prior EIS for a proposed action, must be considered in a supplemental EIS if (a) the new information arises before the final action is taken, and (b) the new information shows that the environmental impacts of the proposed action would be significantly different than the impacts presented in the EIS. *Marsh, supra*; 10 C.F.R. § 51.53(c)(3)(iv). Here, significant new information, not previously considered by the NRC in any EIS, shows that the impact of high-density spent fuel pool storage at Vermont Yankee would be significantly greater than contemplated in prior EISs. Therefore the NRC must consider the environmental impacts of a pool accident in a supplemental EIS for the Vermont Yankee license renewal decision.

This contention also meets the standard established in *Harris* for pleading an admissible contention seeking consideration of a severe accident in an EIS, because it presents sufficient information to create a "genuine material dispute of fact or law adequate to warrant further inquiry" into the question of whether the likelihood of a pool

fire falls within the range of probability considered reasonably foreseeable by the NRC. *Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), LBP-00-19, 52 NRC 85, 97-98 (2000), affirmed on other grounds, CLI-01-11, 53 NRC 370 (2001).[13] In addition, it meets the standard established in *Limerick Ecology Action v. NRC,* that a party may litigate the question of whether NEPA requires consideration of the environmental impacts of intentional and malicious acts against a nuclear facility by presenting sufficient evidence to challenge the factual basis for the policy against such consideration. *See* note 9 above.

1. The potential for a pool fire has not been considered in any previous EIS.

As discussed above in the contention, new information regarding the potential for a pool fire is presented in NUREG-1738, the NAS Report, and the Thompson Report. All of these documents were written after the issuance of the License Renewal GEIS, and therefore they qualify as "new information" for purposes of requiring a supplemental EIS. As the Court recognized in *Hodges v. Abraham,* 300 F.3d 432, 447 (4th Cir. 2002), an agency may review and consider previously issued NEPA documents in determining

---

13 While the ASLB later ruled that the one accident scenario it selected for litigation in the *Harris* case was "remote and speculative" [LBP-01-09, 53 NRC 239, 271], that decision is not dispositive here, by virtue of significant factual differences, including differences in the plants' designs. While Harris is a pressurized water reactor ("PWR"), Vermont Yankee is a boiling water reactor ("BWR"). As a PWR, Harris has two major design features which render it less vulnerable than Vermont Yankee to a pool fire: first, the fuel pools are partially below ground, and second, the pools are in a separate building from the reactor building. In contrast, the pool at Vermont Yankee is above ground, and therefore it is more vulnerable to a breach in the pool wall or floor. NAS Report at 33. Unlike Harris, the Vermont Yankee pool is also located in the same building as the reactor. Given an early release from the Vermont Yankee reactor as part of a core-melt accident, hot gases and radioactive material from the reactor would spread throughout the building. The radiation field and the thermal environment would be more extreme than would be the case in the Harris pool building if two of the pools in that building were to suffer fires. Thompson Report, § 6.

whether to supplement an EIS. Here, the history of NRC's NEPA consideration of spent fuel storage risks shows that although the NRC has been aware of the risks of high-density fuel pool fires for many years, it has not publicly disclosed or analyzed that risk in any EIS. Nor has the NRC updated the License Renewal GEIS to address the additional information about the risks of pool fires that has accumulated over the years since publication of the License Renewal GEIS. Thus, the NRC has failed to take the "hard look" required by NEPA. *Marsh,* 490 U.S. at 374.

a. The EIS for the original Vermont Yankee license and other nuclear power plant licenses did not consider impacts of pool accidents.

Since the early 1980's, the EISs for the licensing of all U.S. nuclear plants have considered the potential for severe accidents. This consideration has been based on the findings of the Reactor Safety Study (WASH-1400) (1975). As later summarized by the NRC, the Reactor Safety Study concluded that the risks of beyond design-basis accidents in the low-density spent fuel storage pools in use at that time were "orders of magnitude" below the risks of reactor core accidents, because of the "simplicity of the spent fuel storage pool design." NUREG-1353, Regulatory Analysis for the Resolution of Generic Issue 82, "Beyond Design-basis Accidents in Spent Fuel Pools" at ES-1 (April 1989) ("NUREG-1353"). The simple features of low-density spent fuel storage were:

> (1) the coolant is at atmospheric pressure, (2) the spent fuel is always subcritical and the heat source is low, (3) there is no piping which can drain the pool and (4) there are no anticipated operational transients that could interrupt cooling or cause criticality.

Id. at ES-1. Thus, the 1972 EIS for the Vermont Yankee plant, where spent fuel initially was stored in low-density racks, had no reason to address the environmental impacts of pool accidents.

Shortly after WASH-1400 was published, then-President Carter cancelled the national program for reprocessing of spent fuel, and licensees began to use high-density racks to store an ever-increasing inventory of spent fuel at nuclear power plant sites. This decision to store an increasing volume of spent fuel onsite led to the use of high-density storage racks, which "results in a larger inventory of fission products in the pool, a greater heat load on the pool cooling system, and less distance between adjacent fuel assemblies." NUREG-1353 at ES-1.

b. The 1979 Sandia Report showed risks of high-density pool storage.

In March of 1979, the NRC published a report by one of its contractors, Sandia National Laboratories, showing that in the case of total, instantaneous drainage of water from a pool, densely packed spent fuel, even a year after discharge, would likely heat up to the point where its zircaloy cladding would burst and then catch fire. Analysis in the report also showed that partial drainage would be a more severe condition, causing older fuel to ignite. 1979 Sandia Report. *See* Thompson Report, § 2.

c. The 1979 GEIS did not address pool fire risks.

In August of 1979, several months after publishing the 1979 Sandia Report, the NRC issued the 1979 GEIS, which constitutes the only EIS the NRC ever prepared for the specific purpose of evaluating spent fuel storage impacts. Using the assumption that all pool storage space as originally designed had been expanded by re-racking with medium-density or high-density storage racks (*see* 1979 GEIS at 3-2), the GEIS examined the impacts of fuel storage in pools and found that storage of fuel in pools "has an insignificant impact on the environment." *Id.* at 8-2.

Despite the recent publication of the 1979 Sandia Report, the GEIS made no mention of the potential for a pool fire in high-density fuel storage pools. The GEIS' only reference to the 1979 Sandia Report was to cite it as a footnote to the following statement:

> Assuming that the spent fuel stored at an independent spent fuel storage installation is at least one year old, calculations have been performed to show that loss of water should not result in fuel failure due to high temperatures *if proper rack design is employed.*[28]
>
> ———
>
> 28. "Spent Fuel Heatup Following Loss of Water During Storage," Report NUREG/CR-0649, March 1979.

1979 GEIS at 4-21 (emphasis added). But the GEIS did not mention the fact that the only rack design that could have been deemed "proper" by the authors of the 1979 Sandia Report was a low-density rack design, because Sandia had found that fuel stored in a high-density rack would burn if water were lost from the pool.

Thus, the 1979 GEIS purported to take account of the 1979 Sandia Study, but actually did not address the known, significant risk implications of the study, thereby failing to satisfy the "hard look" standard for an EIS. *Robertson,* 490 U.S. at 349; *Marsh,* 490 U.S. at 374. *See also Hughes River Watershed Conservancy v. Agriculture Dept.*, 81 F.3d 437, 446 (4th Cir. 1996) (holding that in order for an EIS to serve its functions of informing decision-makers and the public, it is "essential" that the EIS not be based on "misleading" assumptions).

d. The 1990 Waste confidence rulemaking ignored the risk of pool fires.

The NRC next addressed the environmental risks of spent fuel storage in the 1990 revision to the Waste Confidence rulemaking, where the agency examined the

environmental impacts of storing spent fuel at reactor sites for an additional 30 years pending the opening of a final repository. 1990 Waste Confidence Rulemaking Notice, 55 Fed. Reg. 38474. In response to comments on the potential for spent fuel pool accidents, the Commission asserted that it had spent "several years" studying "in detail" the "catastrophic loss of reactor spent fuel pool water possibly resulting in a fuel fire in a dry pool." 55 Fed. Reg. at 38,481.[14] The NRC made no mention of the 1979 Sandia Report, however, which had found that partial loss of water from a pool posed a more serious risk than complete and instantaneous drainage.

Moreover, while the NRC cited NUREG-1353 (*id.* at 38,481), it failed to note the observation in NUREG-1353 that: "some laboratory studies have provided evidence of the possibility of fire propagation between assemblies in an air cooled environment." NUREG-1353 at ES-1. Nor did the NRC respond to the recommendation of NUREG-1353 that the NRC undertake a "re-examination" of the risks of spent fuel pool accidents. NUREG-1353 at ES-1.

Finally, the NRC asserted that BWR fuel aged over six months would not burn, although NUREG-1353 considered only low- and medium-density BWR racks, not high-density racks (see pp 4-9 to 4-11 of NUREG-1353).

c. The License Renewal GEIS merely repeated the inadequate analysis in the 1990 Waste Confidence rulemaking.

---

14 The NRC also cited a set of technical studies, all of which evaluated a total and instantaneous loss of water from the pool rather than partial water loss: NUREG/CR-4982, *Severe Accidents in Spent Fuel Pools in Support of Generic Issue 82* (1987); NUREG/CR-5176, *Seismic Failure and Cask Drop Analysis of the Spent Fuel Pools at Two Representative Nuclear Power Plants* (1989); NUREG/CR-5281, *Value/Impact Analysis of Accident Preventative and Mitigative Options for Spent Fuel Pools;* NUREG-1353, *Regulatory Analysis for the Resolution of Generic Issue 82, Beyond Design-basis Accidents in Spent Fuel Pools* (1989). *See* Thompson Report, § 2.

In the rulemaking notice for the license renewal rule, the Commission claimed to have generically considered the environmental impacts of on-site spent fuel storage in the context of the NRC's GEIS for license renewal. Final Rule, Environmental Review for Renewal of Nuclear Power Plant Operating Licenses, 61 Fed. Reg. 66,537, 66,538, (December 18, 1996). According to the GEIS, the environmental impacts of pool storage of spent fuel are very small. As summarized in an appendix to the NRC's regulations for implementation of NEPA:

> The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on a site with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage area is not available.

Table B-1 of 10 CFR 51, Subpart A, Appendix B to 10 C.F.R. Part 51. *See also* License Renewal GEIS at 6-83.

The License Renewal GEIS also states that "[c]urrent and potential environmental impacts from spent-fuel storage have been studied extensively and are well understood." *Id.* at 6-8 3. But the License Renewal GEIS contains no new analysis of the potential for spent fuel pool accidents, and appears to rely entirely on the 1990 Waste Confidence rulemaking. *Id.* (referring to "generic determination of no significant environmental impact in [NRC] regulations at 10 CFR 51.23," which was promulgated in the Waste Confidence rulemaking.

2. Only the 1979 GEIS has evaluated the environmental impacts of deliberate and malicious acts against spent fuel pools.

The 1979 GEIS contains an appendix which discusses the potential impacts of a deliberate attack on a fuel pool. *Id.,* Appendix J. The GEIS postulated an attack by up to 83 adversaries, and damage to between one and 1,000 fuel assemblies by high-explosive

charges. But the analysis was insufficient to address the environmental impacts of a deliberate attack on the fuel because it underestimated the potential for a pool fire if the explosives succeeded in lowering the pool's water level.

Since the 1979 GEIS was published, the NRC has declined to consider the impacts of deliberate or malicious acts against fuel pools or any other aspect of nuclear facilities in an EIS, including the License Renewal GEIS. *See* License Renewal GEIS at 5-18 and discussion above in Section III.B.3.b.

3. Significant new information shows the reasonably foreseeable potential for a pool fire, and that the consequences are high.

Significant new information, not considered by the NRC in any previous EIS, shows that the potential for a severe fire in Vermont Yankee's high-density fuel storage pool is significant and that the consequences of such a fire would be extreme.

a. Significant new information shows that fuel of any age will burn if uncovered.

Significant new information, consisting primarily of the attached Thompson Report and two government-sponsored studies -- NUREG-1738 and the NAS Report -- undermines the conclusion of the NRC's previous EISs that (1) only recently discharged fuel will burn, and (2) complete drainage of a fuel pool is a more severe case than partial drainage. *See* 1990 Waste Confidence Rulemaking Notice, 55 Fed. Reg. at 38,481. Total or partial loss of water from a fuel pool containing high-density racks will initiate either an air-zirconium reaction or a steam-zirconium exothermic reaction within hours. Thompson Report, § 2. Once initiated, this reaction could spread to nearby, previously uninvolved, fuel assemblies. A significant fraction of the pool's inventory of radioactive isotopes, notably cesium-137, could be released to the atmosphere and would then travel

downwind as a plume, causing extensive environmental contamination. *See* Beyea Report.

In NUREG-1738, the NRC Staff also reached the conclusion that regardless of the age of the fuel in a pool, the fuel will burn shortly after the tops of the fuel assemblies are uncovered. *Id.* at 2-1 – 2-2. As summarized in the report, adiabatic heatup of the fuel, caused by disruption of the passive cooling process, may cause a radioactive release within 24 hours after the fuel assemblies are uncovered, even for fuel aged five years. *Id.* at 2-2.

In a subsequent study which focused on the vulnerability of fuel pools to attack, a committee of the National Academies of Sciences ("NAS"), which included former NRC official Robert Bernerno, reviewed NUREG-1738 and other more recent studies that followed on the work done in NUREG-1738. While a significant portion of the report was classified, the unclassified portion of the report reported the committee's general conclusions that:

> For some scenarios, the fuel could be air cooled within a relatively short time after its removal from the reactor. If a loss-of-coolant event took place before the fuel could be air cooled, however, a zirconium cladding fire could be initiated if no mitigative actions were taken. Such fires could release some of the fuel's radioactive material inventory to the environment in the form of aerosols.
>
> For a partial-loss-of-pool-coolant event, the analysis indicates that the potential for zirconium cladding fires would exist for an even greater time (compared to the complete-loss-of-pool-coolant event) after the spent fuel was discharged from the reactor because air circulation can be blocked by water at the bottom of the pool. Thermal coupling between circulation can be blocked by water at the bottom of the pool. However, this heat transfer model has been modeled simplistically in the MELCOR runs performed by Sandia.
>
> If the water level is above the top of the fuel racks, decay heat in the fuel could cause the pool water to boil. Once water levels fall below a certain level in the fuel assembly, the exposed portion of the fuel cladding might heat up sufficiently to ignite if no mitigative actions were taken. This could result in the release of a

substantial fraction of the cesium inventory to the environment in the form of aerosols.

NAS Report at 53-54 (footnote omitted).

Thus, new information shows the existence of a class of severe pool accident scenarios that have not been previously evaluated or that have been evaluated improperly, either generically or for the Vermont Yankee site.

b. Significant new information shows the credibility of events leading to a fuel pool accident

Significant new information also shows that total or partial loss of water from a fuel pool, either through equipment failure or deliberate malicious acts, is not a remote or speculative event. For a variety of scenarios, including external and internal events and deliberate and malicious acts, a severe pool accident is a credible and reasonably foreseeable event. Indeed, the estimated probability for a number of scenarios is within the range considered by the NRC to constitute a design-basis accident, which must not only be discussed in an ER and EIS, but which must be designed against under NRC safety regulations. *See* Section VII. below.

i. Accidents caused by human error, equipment failure, and natural forces are credible.

As discussed in Section 6 of the attached Thompson report, a number of credible scenarios may lead to a severe accident in the Vermont Yankee fuel pool. Many reactor core melt scenarios would involve the interruption of cooling to the pool. Moreover, the high-radiation field produced by a reactor core accident could initiate or exacerbate a pool fire by precluding the presence and functioning of operating personnel. Making the reasonable assumption that the conditional probability of a pool fire accompanying an early containment release is 50%, the overall estimated likelihood of a pool fire,

excluding acts of malice, is on the order of two per 100,000 years (2×10^{-5}). This level of probability is well within the range that NRC considers to qualify as a design-basis accident under the *PFS I* standard, and therefore is cognizable under NEPA.

ii. Accidents caused by intentional malicious acts are credible.

The License Renewal GEIS offers two principal bases for the NRC's refusal to consider the environmental impacts of sabotage, terrorist attacks and other intentional malicious acts in its NEPA review for license renewal: their likelihood is not quantifiable, and that in any event this type of accident is "not reasonably expected." License Renewal GEIS at 5-18. The position taken by the Commission in the GEIS is consistent with other pronouncements by the NRC. *See* discussion in Section III.B.3.b above.

Significant new information shows that the Commission's factual basis for refusing to consider the environmental impacts of deliberate and malicious acts in the License Renewal GEIS is no longer viable, and therefore may be challenged in this proceeding under 10 C.F.R. § 51.53(c)(3)(iv). Most significantly, the NRC's assertion that deliberate malicious acts are not "foreseeable" for purposes of preparing an EIS is contradicted by the agency's own response to the events of September 11, which shows not only that the NRC considers terrorist attacks on nuclear facilities to be foreseeable, but that that defending against them is an extremely high priority.

As of September 11, 2001, it is now clear that terrorists are both capable of and intent upon causing major damage to life and property in the United States. As observed by the ASLB in a 2001 decision:

> Regardless of how foreseeable terrorist attacks that could cause a beyond-design-basis accident were prior to the terrorist attacks of September 11, 2001, involving the deliberate crash of hijacked jumbo jets into the twin towers of the World Trade Center in New York City and the Pentagon in the Nation's capital, killing thousands of people, it can no longer be argued that terrorist attacks of heretofore unimagined scope and sophistication against previously unimaginable targets are not reasonably foreseeable. Indeed, the very fact that these terrorist attacks occurred demonstrates that massive and destructive terrorist acts can and do occur and closes the door, at least for the immediate future, on qualitative arguments that such terrorist attacks are always remote and speculative and not reasonably foreseeable.

Duke Cogema Stone and Webster (Savannah River Mixed Oxide Fuel Fabrication Facility), LBP-01-35, 54 NRC 403, 446 (2001), *reversed,* CLI-02-24, 56 NRC 335 (2002).[15]

Moreover, as the NRC itself has recognized, the September 11 events were by no means the first sub-national attacks on major strategic targets. Two events in 1993 -- the bombing of the World Trade Center parking garage and the intrusion into the Three Mile Island security area and turbine building by a station wagon – had already prompted the NRC to promulgate a rule protecting nuclear power plants against vehicle bombs. *See* Final Rule, Protection Against Malevolent Use of Vehicles at Nuclear Power Plants, 59 Fed. Reg. 38,889, 38,891 (August 1, 1994).[16]

---

15 In that case, the ASLB admitted a contention seeking NEPA consideration of the environmental impacts of a terrorist attack on a proposed factory for fabrication of plutonium-based nuclear power plant fuel. Although the Commission later reversed the ASLB's decision, the ASLB's comment remains trenchant.

16 Other events of the last two decades include the 1983 bombing of the Marine barracks in Beirut; the 1995 bombing of the Federal Courthouse in Oklahoma City; the 1993 plot to bomb the United Nations Building, FBI offices in New York City, the Lincoln Tunnel, the Holland Tunnel, and the George Washington Bridge; the 1995 release of SARIN nerve gas in the Tokyo subway; the 1998 bombing of the U.S. embassies in Tanzania and Kenya; the 2002 bombing of the U.S.S. Cole; and the 2004 bombing of commuter trains in Madrid, Spain.

Since September 11, the NRC has only increased its level of vigilance and preparedness against attacks on nuclear facilities. As summarized by the Chairman of the NRC:

> awareness, resources, and vigilance were there [before September 11], but all went to a higher level when 9/11 showed the determination of enemies of the United States to attack our people and our way of life.

Remarks by NRC Chairman Nils J. Diaz to the Joint NRC/DHS State Security Outreach Workshop (June 17, 2003). Thus, in cooperation with the Department of Homeland Security ("DHS"), the NRC established a series of graded threat levels and associated protective measures, whose purpose was to keep the government in a state of readiness to respond to a threat that was now perceived as persistent.[17]

Moreover, leaders of adversarial sub-national groups have openly admitted that nuclear power stations are near the top of their lists as targets for attacks on civilians in the United States. On October 30, 2001, for example, the Washington Post reported on an interview with a jailed disciple of Osama bin Laden who said there are "more important places, like atomic plants and reactors" that may have been more appropriate targets than the World Trade Center. William Branigan, *In Afghan Jail, a Terrorist Who Won't Surrender,* Washington Post, October 30, 2001.

17 NRC Regulatory Issue Summary 2002-12A, Power Reactors, NRC Threat Advisory and Protective Measures System (August 19, 2002). Notably, the President also has identified nuclear power plants as "key assets" that are "most critical in terms of national-level public health and safety, governance, economic and national security, and public confidence consequences." National Strategy for the Physical Protection of Critical Infrastructures and Key Assets at vii, xii (February 2003). This report can be found on the internet at http://www.whitehouse.gov/pcipb/physical.html

Other federal agencies have also acknowledged that nuclear power plants are particularly attractive targets because of the widespread health and economic damage they can cause if successfully attacked. As summarized by former FBI Director Robert S. Mueller:

> . . . America is awash in desirable targets – those that are symbolic like the U.S. Capitol and the White House – as well as the many infrastructural targets, lie nuclear power plants, mass transit systems, bridges, and tunnels, shipping and port facilities, financial centers, and airports – that if successfully hit, would cause both mass casualties and a crippling effect on our economy."

Thus, after September 11, the NRC began to treat attacks by sub-national adversaries as an inevitable and constant threat requiring perpetual vigilance and preparedness. The NRC's efforts undermine its claim that the potential for such attacks is "remote and speculative." *See PFS II,* 56 NRC at 348-350.

iii. Fuel pools are vulnerable to attack.

A range of means is available to intentionally initiate a pool fire at the Vermont Yankee plant. Thompson Report, § 7 and Table 7-1. Moreover, both the NRC Staff and the National Academies of Sciences have found that spent fuel storage pools are vulnerable to intentional damage. As the NRC Staff conceded in a 2001 memorandum to the Commissioners:

> Until recently, the staff believed that the DBT [design-basis threat] of radiological sabotage could not cause a zirconium fire. However, NUREG-1738 does not support the assertion of a lesser hazard to the public health and safety, given the possible consequences of sabotage-included uncovery of the fuel in the SFP when a zirconium-fire potential exists.

SECY-01-0100, Memorandum to the Commissioners from William D. Travers, Executive Director for Operations ("EDO") re: Policy Issues Related to Safeguards, Insurance, and Emergency Preparedness Regulations at Decommissioning Nuclear Power Plants Storing Spent Fuel in Spent Fuel Pools (WITS 200000126) (June 4, 2001), attachment at 13.[18] The memorandum went on to say that the NRC is "conducting detailed analyses of the effects of the DBT of radiological sabotage on SFPs," and that it will "use the results of these analyses to determine, on a plant-specific basis, whether

---

Testimony before the Senate Committee on Intelligence of the United States Senate (February 16, 2005).

18 A zirconium-induced fire potential exists in virtually any high-density spent fuel pool that is filled with fuel, or even partially filled, as is the case at the Vermont Yankee nuclear plant. Thompson Report, § 2.

radiological sabotage can result in conditions which could lead to zirconium fires at a decommissioning plant." *Id.* Thus, by embarking on its own investigation into the vulnerability of spent fuel pools to sabotage-included fires, the Staff has effectively conceded that acts of malice against spent fuel are credible and worthy of consideration in the NRC's NEPA decision-making process.

The NAS Report also reports a similar conclusion:

> A terrorist attack that either disrupted the cooling system for the spent fuel pool or damaged or collapsed the pool itself could potentially lead to a loss-of-pool-coolant event. The cooling system could be disrupted by disabling or damaging the system that circulates water from the pool to heat exchangers to remove decay heat. This system would not likely be a primary target of a terrorist attack, but it could be damaged as the result of an attack on the spent fuel pool or other targets at the plant (e.g., the power for the pumps could be interrupted.) The loss of cooling capacity would be of much greater concern were it to occur during or shortly after a reactor offloading operation, because the pool would contain a large amount of decay heat.

NAS Report at 48. The NAS committee also evaluated studies of aircraft crashes and assaults on fuel pools using explosives, and reported that:

> . . . there are some scenarios that could lead to the partial failure of the spent fuel pool wall, thereby resulting in the partial or complete loss of pool coolant. A zirconium cladding fire could result if timely mitigative actions to cool the fuel were not taken.

NAS Report at 49. Notably, the NAS was not able to give any details in support of its conclusion, but referred instead to a classified report for that information. *Id.*

c. **The NRC has adequate qualitative tools to evaluate the potential for intentional malicious acts against the Vermont Yankee plant.**

In the License Renewal GEIS, the NRC asserts its inability to quantify the likelihood of sabotage as a rationale for refusing to address its impacts in an EIS. GEIS at 5-18. The fact that the risk of sabotage may not be easily quantifiable is not an excuse

for failing to address it in an EIS, however. As provided in the Council on Environmental Quality's regulations implementing NEPA, 40 C.F.R. § 1502.22, the agency must make an attempt to evaluate reasonably foreseeable significant adverse effects if the costs of obtaining the information are not exorbitant. Even if the costs of obtaining the information are exorbitant, the agency must acknowledge that the information exists but is unavailable, make a statement of the relevance of the information to the evaluation of impacts in the EIS, summarize existing relevant and credible scientific evidence, and provide the agency's evaluation of the impacts based on generally accepted theoretical approaches or research methods. *See also* 10 C.F.R. § 51.71 ("To the extent that there are important qualitative considerations or factors that cannot be quantified, these considerations or factors will be discussed in qualitative terms.").

In fact, the Commission has already shown itself capable of qualitatively analyzing the potential for intentional destructive acts against nuclear facilities. By proceeding with the 1994 vehicle bomb rulemaking, which was directly responsive to the World Trade Center bombing and the Three Mile Island vehicle intrusion incident, the Commission abandoned its previous position that the difficulty of quantifying the probability of such events means that they can be ignored. While the Vehicle Bomb rule was promulgated under the AEA rather than NEPA, the rationale for the rule is relevant here because it demonstrates that the NRC has the capacity and information necessary to perform a qualitative analysis of the potential for deliberate and malicious acts. In that instance, the NRC performed a "conditional probabilistic risk analysis" to assess the vulnerability of a nuclear power plant to a vehicle bomb. Vehicle Bomb Rule, 59 Fed.

Reg. at 38,891. In using the findings of this analysis to develop the vehicle-bomb rule, the NRC took a qualitative approach to assessing the probability of a vehicle-bomb event.

In the preamble to the rule, the Commission explicitly recognized that even if the likelihood of malicious or insane acts cannot be quantified, they may not be ignored:

> Over the past several years, a number of National Intelligence Estimates have been produced addressing the likelihood of nuclear terrorism. The analyses and conclusions are not presented in terms of quantified probability but recognize the unpredictable nature of terrorist activity in terms of likelihood. The NRC continues to believe that, although in many cases considerations of probabilities can provide insight into the relative risk of an event, in some cases it is not possible, with current knowledge and methods, to usefully quantify the probability of a specific vulnerability threat.
>
> The NRC notes that, although not quantified, its regulatory analysis recognizes the importance of the perception of the likelihood of an attempt to create radiological sabotage in assessing whether to redefine adequate protection. The NRC's assessment that there is no indication of an actual vehicle threat against the domestic commercial nuclear industry was an important consideration in concluding that neither the Three Mile Island intrusion nor the World Trade Center bombing demonstrated a need to redefine adequate protection.
>
> The NRC does not agree that quantifying the probability of an actual attack is necessary to a judgment of a substantial increase in overall protection of the public health and safety (a less stringent test of the justification of for a rule change). *Inherent in the NRC's current regulations is a policy decision that the threat, although not quantified, is likely in a range that warrants protection against a violent external assault as a matter of prudence.*

59 Fed. Reg. at 38,890-9 (emphasis added). The NRC further elaborated on what it meant by it use of the term "likely," by identifying several factors that make up the "domestic threat environment" and noting the degree to which it had changed in recent years:

> The vehicle bomb attack on the World Trade Center represented a significant change to the domestic threat environment that ... eroded [our prior] basis for concluding that vehicle bombs could be excluded from any consideration of the domestic threat environment. For the first time in the United States, a conspiracy with ties to Middle East extremists clearly demonstrated the capability and motivation to organize, plan and successfully conduct a major vehicle bomb

> attack. Regardless of the motivations or connections of the conspirators, it is significant that the bombing was organized within the United States and implemented with materials obtained on the open market in the United States. Accordingly, the Commission believes that the threat characterized in the final rule is appropriate.

Id., 59 Fed. Reg. at 38891. These same considerations continue to apply in the post-September 11 environment, and indeed are all the more persuasive of a sea change in the "domestic threat environment." Thus, motive, capacity, and the pattern of past incidents are relevant to a qualitative analysis.

Thus the circumstances of this case satisfy the NRC's qualitative standard for determining that deliberate and destructive acts against the Vermont Yankee spent fuel pool are reasonably foreseeable.

d. Other GEIS grounds for refusing to address impacts of deliberate malicious acts are invalid.

As additional grounds for refusing to consider the environmental impacts of intentional destructive acts, the GEIS asserts that NRC security regulations provide reasonable assurance that the risk from sabotage is small, and that the consequences of an intentionally caused accident would be "no worse than" the consequences of internally initiated events. *Id.* at 5-18. These rationales are invalid.

First, NEPA's procedural requirements are independent of the AEA, and must be satisfied regardless of an applicant's compliance with NRC regulations for implementation of the AEA. *Limerick Ecology Action v. NRC,* 869 F.2d at 730.

Second, the radiological consequences of a pool fire would be quite different from the consequences of a reactor accident, and in some respects worse. The principal radioactive isotopes released in a severe reactor accident are generally short-lived, and thus the most important concern in avoiding or mitigating those impacts is to evacuate

people as quickly as possible from the area. In contrast, the principal radioactive isotope released by a pool fire consists of cesium-137, which has a half-life of 30 years.[19] Immediate evacuation is still an important consideration, but long-term land contamination is an additional factor that must be planned for. The land area affected by a radiological release from a pool fire could be contaminated for decades, requiring permanent relocation of entire communities and their associated businesses, farms and institutions.

Moreover, the area of land contaminated by a release could be much larger for a pool fire than a reactor accident because the inventory of radioactivity that may be released from a pool is so much larger than the inventory of radioactivity that may be released from the core. As demonstrated in Table 3-3 of the Thompson Report, much more radioactive material is held in the pool than in the core.

In any event, even assuming for purposes of argument that the consequences of a reactor accident and a pool accident were the same, the SAMAs appropriate for each type of accident would be different. In considering the environmental impacts of sabotage, it is particularly important to consider SAMAs which could mitigate the impacts of sabotage. Using a combination of low-density wet storage and dry storage would virtually eliminate the vulnerability of the Vermont Yankee fuel pool to attack. *See* Thompson Report, § 8. Thus, NEPA requires a discussion of the environmental impacts of a pool fire, regardless of whether a pool fire's impacts would be bounded by the impacts of a reactor accident.

---

19 While the reactor core contains cesium-137, the quantity is much smaller than the quantity of cesium-137 contained in the pool. Thompson Report, § 3.

e. NRC's policy rationales in *PFS II* and *Diablo Canyon* are not supported.

In the *PFS II* and *Diablo Canyon* decisions, the Commission gave a number of policy and fact-based rationales for refusing to consider the environmental impacts of deliberate and malicious acts in its NEPA decisions. Petitioner will respond to them in this section of the contention.

In *Diablo Canyon* and *PFS II,* the Commission argued that the possibility of a terrorist attack is "too far removed from the natural or expected consequences of agency action to require a study under NEPA." *Diablo Canyon,* 57 NRC at 6-7, quoting *PFS II,* 56 NRC at 349. This argument must be rejected because it "runs counter to the evidence before the agency." *Southwest Center v. U.S. Forest Service,* 100 F.3d 1443, 1448 (9th Cir. 1996). In particular, the argument ignores the federal government's own determinations that nuclear facilities are highly attractive targets to terrorists, as well as the NRC's own actions demonstrating how seriously it takes the threat.

The Commission's ruling also is inconsistent with the agency's own long-established policy and practice of addressing the environmental impacts of external events in accident analyses conducted under NEPA. *Sierra Club v. NRC,* 862 F.2d 222, 228 (9th Cir. 1988) (reversing a decision that was "contrary to the NRC's own policy (and one that accords with common sense)"). Under its own NEPA guidance, NRC considers accidents caused or exacerbated by a range of initiating events, including internal events (such as equipment failure) and external events (such as tornados, floods, earthquakes, and explosions at adjacent facilities). NUREG-1555, Environmental Standard Review Plan for Environmental Review for Nuclear Power Plants at 7.2-3 (October 1999). None of these external events would constitute "natural" consequences of operation of the

Vermont Yankee nuclear power plant. If they were to occur while the plant is operating, however, they could cause an accidental release of radioactivity to the environment, which would not have occurred had the nuclear facility not been licensed.[20]

In *Diablo Canyon* and *PFS II,* the Commission also argued that inquiries into the environmental impacts of terrorist attacks are not "manageable." *Diablo Canyon,* 57 NRC at 6-7, and *PFS II,* 56 NRC at 349 and note 33, quoting *Metropolitan Edison Co. v. People Against Nuclear Energy,* 460 U.S. 766, 776 (1983). According to the NRC, those who seek a NEPA evaluation of the environmental impacts of terrorist attacks effectively seek an open-ended, "worst-case" analysis that has "no stopping point." *PFS II,* 56 NRC at 354.

The Commission's citation to *Metropolitan Edison Co. v. People Against Nuclear Energy* is completely inapposite. In that case, the Supreme Court ruled that psychological effects posed by the risk of an accident at the Three Mile Island nuclear power plant were "too remote from the physical environment" to warrant preparation of an EIS. 460 U.S. at 774. The Supreme Court "emphasize[d]" that it was considering, in that case, "the effects caused by the *risk* of an accident." *Id.* (emphasis added). Here, in contrast, Petitioner is concerned about actual physical environmental effects in the event

---

20 In a footnote to *PFS II,* the Commission attempted to distinguish "natural" events from terrorist attacks on the ground that natural events are "closely linked to the natural environment of the area within which a facility will be located, and are reasonably predictable by examining weather patterns and geological data for that region." 56 NRC at 347, note 18. Attacks on nuclear facilities, however, are also "closely linked" to those facilities, in the sense that they are desirable targets. Furthermore, the Commission's argument that natural events are "reasonably predictable" amounts to a reprise of the claim that environmental impacts must be quantifiable in order to be cognizable. *See Limerick Appeal Board Decision,* 22 NRC at 701. As discussed above in Section V.B.3.c, the Commission itself disavowed this position in the Vehicle Bomb Rule. Finally, the Commission's position is inconsistent with 10 C.F.R. § 51.71, which requires a discussion of qualitative factors that cannot be quantified.

of a terrorist attack on the Vermont Yankee fuel pool. As the Court recognized in *Metropolitan Edison,* "[t]he situation where an agency is asked to consider effects that will occur if a risk is realized, for example, if an accident occurs at TMI-1, is an entirely different case," where its holding would not apply. *Id.* at 775.

In any event, the Commission's argument is directly contradicted by the agency's own pragmatic approach to evaluating the potential for specific types of terrorist attacks, as outlined in the 1994 Vehicle Bomb Rule. The Vehicle Bomb Rule demonstrates that it is possible to evaluate the potential for and credibility of attack scenarios, and to identify a range of reasonable alternatives for avoiding or mitigating the impacts of such attacks. Here, the Attorney General seeks a hearing on whether just such an analysis is required for the Vermont Yankee license renewal decision, including a full discussion of the potential consequences of a range of credible events involving destructive intentional acts against the Vermont Yankee spent fuel pool. The Attorney General also seeks an evaluation of a range of reasonable alternatives to the proposed action, including combined low-density pool storage and dry storage. It is only common sense that the analysis requested by Petitioner is no more open-ended than the analysis the NRC performed in promulgating the Vehicle Bomb Rule.

In the *Diablo Canyon* decision, the Commission also attempted to justify its exclusion of the Petitioners' environmental contentions on the ground that "NEPA's public process is not an appropriate forum for considering sensitive security issues." CLI-03-01, 57 NRC at 7. The Commission cited no legal basis, however, that would excuse it from compliance with NEPA. Without a specific and conflicting statutory basis, the mere sensitivity of information does not provide an excuse for noncompliance

with NEPA. Compliance with NEPA is required "unless specifically excluded by statute or existing law makes compliance impossible." *Limerick Ecology Action v. NRC,* 869 F.2d at 729, citing *Public Service Co. of New Hampshire v. NRC,* 582 F.2d 77, 81 (1st Cir.), *cert. denied,* 439 U.S. 1046 (1978). *See also Flint Ridge Development Corp. v. Scenic Rivers Association of Oklahoma,* 426 U.S. 776, 787-88 (1976).

Moreover, to the extent that the Commission is bound by legal requirements to protect sensitive information, the Commission has failed to demonstrate that those requirements render it "impossible" to consider the environmental impacts of deliberate and malicious against the Vermont Yankee fuel pool. In fact, the Commission's position is inconsistent with its own practice under another public participation statute, Section 189a of the AEA. 42 U.S.C. § 2239. The NRC has never denied a licensing hearing simply because sensitive, proprietary, or safeguards information may be discussed in the hearing. Instead, it implements procedures that limit access to sensitive information to parties who have signed confidentiality agreements.[21] The NRC can also use these procedures to limit access to sensitive information regarding the vulnerability of the Vermont Yankee fuel pool to the parties and interested government participants. The Commission also failed to recognize that it can *solicit* public comment, even if it does not disclose all the details of its environmental analysis. State and local governments, which have expertise in and responsibility for implementing back-up security and emergency response measures, also have valuable contributions to make to the decision-making

---

21 *See, e.g,* 10 C.F.R. §§ 2.744(e) (procedures for handling safeguards information in NRC hearings), 10 C.F.R. Part 2 Subpart I (procedures for handling classified information in NRC hearings); *Pacific Gas & Electric Company* (Diablo Canyon Nuclear Power Plant), ALAB-410, 5 NRC 1398, 1405 (1977) (granting intervenor's security expert access to confidential security plans during the operating license proceeding for Diablo Canyon).

process.

Finally, the NRC ignores the fact that in numerous instances, other agencies such as the U.S. Department of Energy ("DOE") have prepared EISs containing information that was not accessible to the general public.[22] In none of these instances did the DOE refuse to prepare an EIS because it would involve the discussion of sensitive information. Instead, the publicly available version of the EIS redacted sensitive information. By following appropriate procedures and obtaining appropriate clearances, interested citizens and state and local governments may gain access to the information.

Finally, in *Diablo Canyon,* the Commission asserted that its refusal to prepare an EIS on the environmental impacts of a terrorist attack "comports with the practical

---

22 For instance, the DOE has restricted circulation of some sensitive information, and withheld other information under the classification of "Official Use Only."For example, Appendix H of the DOE's EIS for the proposed Yucca Mountain high-level radioactive waste repository, which discusses consequences of accidents at the repository, is not in the hard copy of the EIS that was circulated to the public, nor is it on the internet. DOE/EIS-0250F, Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada at H-1 (February 2002). Instead, it was placed in Volume 4 of the Final EIS, which must be specially ordered from the DOE. *Id.,* Readers Guide at 3.

Another EIS prepared by the DOE contains an air transportation accident analysis that is not published in the publicly available version of the EIS, but is contained in an "Official Use Only document." DOE/EIS-236-S2, Draft Supplemental Programmatic Environmental Impact Statement on Stockpile Stewardship and Management for a Modern Pit Facility, Vol. II at C-15 and Tables C.4-1, C.4-2, C.4-3 (May 2003).

The DOE has also prepared EISs containing highly sensitive classified information. *See, e.g.,* DOE/EIS-0161, Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling, Vol. I at 2-1 (October 1995) (evaluating environmental impacts of recycling and production of tritium for nuclear weapons); DOE/EIS-0319, Final Environmental Impact Statement for the Proposed Relocation of Technical Area 18 Capabilities and Materials at the Los Alamos National Laboratory at iii, 5-1 (August 2002) (evaluating environmental impacts of sabotage on a DOE research facility).

realities of spent fuel storage and the congressional policy to encourage utilities to provide for spent fuel storage at reactor sites pending construction of a permanent repository." CLI-03-01, 57 NRC at 7. Nothing in the Nuclear Waste Policy Act, however, exempts spent fuel storage from the requirements of NEPA. In fact, the statute specifically requires that the Commission's actions must be consistent with NEPA. 42 U.S.C. § 10152.

4. The consequences of a pool fire are different and potentially more severe than the consequences of a reactor accident.

It is important to consider the environmental impacts of a pool fire, because pool fire impacts are fundamentally different than the impacts of a reactor accident, and therefore have different implications for the consideration of alternatives. *See* discussion above in Section V.B.3.b.iv.

5. The ER and the EIS must discuss reasonable and feasible alternatives for avoiding or mitigating a pool fire.

As discussed above in Sections III.B.1.c and III.B.3.d, NEPA and the NRC's implementing regulations require the consideration of reasonable alternatives to the proposed action, including SAMAs for avoiding or mitigating the consequences of severe accidents. A range of options is available for reducing or avoiding the impacts of a pool fire, including returning the plant to its original design configuration of low-density pool storage of spent fuel and placing excess spent fuel in dry storage. Thompson Report, § 8. This option would allow the pool to survive a loss of water without damage to the fuel, thus avoiding a pool fire. *Id.* The technologies of low-density storage and dry storage are reasonable and feasible, and therefore should be considered. *Idaho Conservation League v. Mumma,* 956 F.2d 1508, 1519-20 (9th Cir. 1992).

VI. PETITION FOR IMPOSITION OF BACKFIT ORDER

As discussed above in Section III.A.1, the AEA, implementing regulations, and NRC precedents require the NRC to ensure that operation of the Vermont Yankee nuclear power plant does not pose an undue risk to public health and safety during the license renewal term. As the Commission observed in the preamble to the final license renewal rule, the purpose of the rule is to "ensure that operation during the period of extended operation is not inimical to the public health and safety." 56 Fed. Reg. at 64,945. *See also Petition for Emergency and Remedial Action,* 7 NRC at 404, citing *Power Reactor Development Corp.,* 367 U.S. at 402.

One of the NRC's key measures for ensuring adequate protection of the public is to require that its licensed facilities be designed against "design-basis accidents." *See* discussion above in section III.A.2. The NRC requires that reactor core accidents with a "realistic probability" (*i.e.,* a non-conservative probability) of at least one in ten million per year (10^{-7}) must be included in the design-basis. *PFS I,* 54 NRC at 259-60. By the reasoning of *PFS I,* the same threshold of probability should be set for pool accidents, because they also have a large source term (*i.e.,* inventory of radioactive material) that may be released by the driving force of the high heat of a fire.[23] As discussed above in

---

23 In the *PFS I* decision, the Commission chose a "threshold" probability of 10^{-6} for a design-basis accident at an independent spent fuel storage installation, rather than the 10^{-7} factor used for nuclear power plants. As the Commission explained, the difference in threshold probabilities for design-basis accidents for these two types of facilities is based on the significant difference in the potential consequences of an accident:

> The Commission has previously recognized that the 'public health and safety risks posed by ISFSI storage . . . are very different from the risks posed by the safe irradiation of the fuel assemblies in a commercial nuclear reactor, which requires the adequate protection of the public . . . in the conditions of high temperature and pressures under which the reactor operates.' . . . This is because

Section V.B.3.b and as demonstrated in the Thompson Report, §§ 6, 7, and 9, the frequencies for a range of spent fuel pool accident precursors fall well above the estimated probability level considered by the NRC to establish the "threshold" for a design-basis event. *PFS I,* 54 NRC at 259-60.[24]

There was no need to design against pool fire accidents at the time of initial licensing of Vermont Yankee in 1972, when the former licensee used open low-density racks to store a much smaller quantity of spent fuel. Now that the Vermont Yankee pool has been re-designed to include high-density storage racks, the design of the Vermont Yankee plant poses an undue safety risk of a pool fire. Therefore, pursuant to 10 C.F.R. § 50.109(a)(5), the Commission should require the backfitting of the Vermont Yankee nuclear plant by returning the pool to its original low-density storage configuration and using dry storage for any excess fuel.

While current NRC regulations do not appear to provide for an adjudicatory hearing on the adequacy of any design changes ordered by the NRC, it is a subject on

---

> the danger presented by irradiated fuel 'is largely determined by the presence of a driving force behind dispersion,' such as heat and pressure neither of which is present in an ISFSI. . . . Moreover, the radiological source term is lower at an ISFSI than at a reactor both because the spent fuel has decayed over time prior to placement in an ISFSI and because there are fewer fuel assemblies in an individual cask than in reactor. . . .

54 NRC at 265. [footnotes omitted]. As with a reactor accident, the "driving force," of the heat from a pool fire may disperse a very large amount of radioactive material into the environment. *See* Thompson Report, § 2. Thus, a pool accident is comparable to, and may in some cases be more severe than, the consequences of a reactor core melt accident.

24 In fact, the majority of accidents analyzed in NUREG-1150 fall well within the range of probabilities considered by the NRC to qualify as design-basis accidents. *See* Figure 8.6 of NUREG-1150, for example, which shows that both the median and the average core damage frequency for internal and external events at the Peach Bottom nuclear power plant (a BWR like Vermont Yankee) fall between 10^{-3} and 10^{-5}. This core damage frequency is at least two orders of magnitude above the NRC's threshold probability for a design-basis accident at a nuclear plant.

which the NRC should take comment from the interested public because a variety of potential measures for reducing spent fuel pool fire risks are available, with varying degrees of effectiveness. *See* Thompson Report, § 8. Thus, the Attorney General seeks a discretionary hearing on the adequacy of the design modifications proposed by the Commission.[25]

The choice of design measures could also have a significant impact on the quality of the human environment if the NRC chooses a design measure that is not adequate to prevent the risk of a fire. Thus, the Commission must comply with NEPA by publishing its proposed design measures in the draft EIS for renewal of the Vermont Yankee license. Such design measures are required by the Atomic Energy Act in order to ensure that during the license renewal term operation of the Vermont Yankee nuclear plant and associated fuel pool poses no undue risk to public health and safety. 42 U. 42 U.S.C. § 2133(d).

VII. CONCLUSION

For these reasons, the Commission should grant Petitioner a hearing regarding the issues raised in his contention. In addition, the Commission should initiate a proceeding for the backfitting of the Vermont Yankee nuclear power plant to protect against a design-basis accident involving a fire in the fuel pool.

---

25 In contrast, the Attorney General has the statutory right under NEPA to a hearing on the environmental contention raised in Section V of this pleading.

Respectfully submitted,
COMMONWEALTH OF MASSACHUSETTS

By its Attorneys,

THOMAS F. REILLY
ATTORNEY GENERAL

Diane Curran
Harmon Curran, Spielberg & Eisenberg, L.L.P.
1726 M Street N.W., Suite 600
Washington, D.C. 20036
202/328-3500
dcurran@harmoncurran.com

Matthew Brock, Assistant Attorney General
Environmental Protection Division
Office of the Attorney General
One Ashburton Place
Boston, MA 02108
617/727-2200
matthew.brock@ago.state.ma.us

May 26, 2006

CERTIFICATE OF SERVICE

I certify that on May 26, 2005, copies of the foregoing request for hearing, petition to intervene, and petition for a backfit order, were served on the following in the manner described below:

BY HAND:
Office of the Secretary
U.S. Nuclear Regultory Commission
11555 Rockville Pike
Rockville, MD 20852

Office of the General Counsel
U.S. Nuclear Regultory Commission
11555 Rockville Pike
Rockville, MD 20852

BY FEDERAL EXPRESS:
Terence A. Burke, Esq.
Entergy Nuclear
1340 Echolon Parkway
Mail-Stop M-ECH-62
Jackson, MS 39213

Diane Curran