July 21, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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| In the Matter of | ) | |
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| ENTERGY NUCLEAR OPERATIONS, INC. | ) | Docket No. 50-293 |
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| (Pilgrim Nuclear Power Station) | ) | ASLBP No. 05-842-03-LR |
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# NRC STAFF'S RESPONSE TO JULY 14, 2006 LICENSING BOARD ORDER

## INTRODUCTION

On July 14, 2006, the Atomic Safety and Licensing Board (Board) issued an 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; Setting Deadlines for Briefs and Responses; and Scheduling Telephone Conference) (Order). The Order directed the litigants to submit briefs addressing the relevance of the definition of "new and significant information" contained in Regulatory Guide (RG) 4.2, Supplement 1[1] to this proceeding of the Nuclear Regulatory Commission (Staff) hereby responds to the Board's Order.

## DISCUSSION

The Board's Order requested that the participants focus on "the references in the definition in question to '(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 CFR Part 51*, or (2) information that was not considered in the analyses summarized in

[1] Supplement 1 to Regulatory Guide 4.2, Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses (September 2000) (RG 4.2S1).

NUREG-1437 and *leads to an impact finding different from that codified in 10 CFR Part 51.'"*[2] Order at 3-4 (citation omitted). The Board also asked that the participants address each item of "postulated 'new and significant information'" separately. *Id.* at 4.

Before addressing the Board's Order, the Staff reiterates its position that issues pertaining to onsite spent fuel storage are outside the scope of this proceeding, absent a Commission waiver of 10 C.F.R. § 51.53(c)(2), which states that an applicant is not required to provide information regarding the storage and disposal of spent fuel. *See Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 2 and 3), CLI-01-17, 54 NRC 3 (2001). The issue of onsite spent fuel storage is a Category 1 issue that "cannot be examined further in a license renewal proceeding." *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 2 and 3), LBP-01-06, 53 NRC 138, 165 (2001), *aff'd*, CLI-01-17, 54 NRC 3 (2001).

I The Relevance of the Definition of "New" and "Significant" Information

The Board has asked that the participants discuss the relevance of the definition of "new and significant information" found in RG 4.2S1 to the issues raised in this case, understanding that the Regulatory Guide is merely guidance and is not binding on the applicants or the Staff.

Regulatory guides are

> issued to describe and make available to the public such information as methods acceptable to the NRC staff for implementing specific parts of the NRC's regulations, techniques used by the staff in evaluating specific problems or postulated accidents, and data needed by the NRC staff in its review of applications for permits and licenses. [They] are not substitutes for regulations, and compliance with them is not required. Methods and solutions different from those set out in the guides will be acceptable if they provide a basis for the findings requisite to the issuance or continuance of a permit or license by the Commission.

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[2] NUREG-1437 is the "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," (1996) ("NUREG-1437" or "GEIS").

RG 4.2S1 at i. Thus, the information and guidance in a regulatory guide, including definitions, may be challenged and alternate ways of meeting the regulations may be proposed.

It has been held that a supplement to an Environmental Impact Statement is not required "every time new information comes to light."[3] Supplementation is required for "only those changes that cause effects which are significantly different from those already studied."[4] The new information must present a "seriously different picture of the environmental impact" of the action.[5] The impact must affect "the quality of the human environment in a significant manner or to a significant extent not already considered."[6] The Staff submits that the above is applicable to the instant case, in that for any information that is alleged to be "new" to be considered "significant," it must affect the environment in a "significant manner or to a significant extent not already considered."[7]

For the purpose of responding to the Board's Order, the Staff will rely on those sources considered in the GEIS and in the analyses summarized in the GEIS. These include: "Review and Final Revision of Waste Confidence Decision," 55 Fed. Reg. 38,474 (Sept. 18, 1990) (Revision); "Proposed Waste Confidence Decision," 54 Fed. Reg. 39,767 (Sept 28, 1989); "Regulatory Analysis for the Resolution of Generic Issue 82," (April 1989) (NUREG-1353); "Value/Impact Analyses of Accident Preventive and Mitigative Options for Spent Fuel Pools," (1989) (NUREG/CR-5281); "Seismic Failure and Cask Drop Analysis of the Spent Fuel Pools at

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[3] *Hydro Resources, Inc.* (P.O. Box 15910, Rio Rancho, NM 87174), LBP-04-23, 60 NRC 441, 448 (2004), *quoting Hydro Resources, Inc.* (2929 Coors Road, Suite 101, Albuquerque, NM 87120), CLI-99-22, 50 NRC 3, 14 (1999) (*citing Marsh v. Oregon Natural Resources Council*, 490 U.S. 360, 374 (1989)), *rev. den*. CLI-04-39, 60 NRC 657 (2004).

[4] *Id.*, *quoting Hydro Resources, Inc.* (P.O. Box 15910, Rio Rancho, NM 87174), CLI-01-4, 53 NRC 31, 52 (2001).

[5] *Id.*, *quoting Hydro Resources, Inc*., CLI-99-22, 50 NRC at 14.

[6] *Id.*

[7] *Id.*

Two Representative Nuclear Power Plants," (Jan. 1989) (NUREG/CR-5176); and "Severe Accidents in Spent Fuel Pools in Support of Generic Safety Issue 82" (1987) (NUREG/CR-4982). *See* GEIS at 6-75.

The Staff submits that the issue of catastrophic loss of water in a spent fuel pool (SFP) and the possibility of a resulting Zircaloy fire was considered in the GEIS and was considered in analyses supporting the GEIS, and is, therefore not new. In addition, the information cited by the Petitioners is not significant in that it does not lead to an "impact finding different from that codified in 10 CFR Part 51," or affect the "human environment in a significant manner or to a significant extent not already considered."

Chapter 6 of the GEIS addresses "The Uranium Fuel Cycle and Solid Waste Management." Section 6.4.6 addresses spent fuel. NUREG-1437 at 6-70. Section 6.5.6.1 discusses the baseline and possible damage to Zircaloy-clad fuel. *Id.* at 6-72. The section states: "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 38373)." *Id.* at 6-72, 6-75.

The *Federal Register* notice cited as authority for the above statement is the Revision to the Waste Confidence decision cited above. In the Revision, the Commission revisited the second and fourth findings of the Waste Confidence Decision issued on August 31, 1984. *See* 49 Fed. Reg. 34,658. The revision of Finding 4 is relevant to this case and states:

> The Commission finds reasonable assurance 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."

55 Fed. Reg at 38,474.

In discussing a comment made by Public Citizen regarding the risk of fire at a spent fuel pool, the Commission said:

> Regarding the risk of fire at spent fuel pools, the NRC staff has spent several years studying in detail catastrophic loss of reactor spent fuel pool water possibly resulting in a fuel fire in a dry pool. . . . NUREG/CR-4982, referred to in Public Citizen's comment represents an early part of the NRC's study. Its findings were based on generic data on seismic hazards and response of spent fuel pools, which resulted in calculated risk numbers with wide ranges of uncertainty. (See p. xiii.) Subsequent study of the consequences and risks due to a loss of coolant water from spent fuel pools was conducted by the NRC, and the results were published in NUREG/CR-5176 . . ., and NUREG-1353. These reports were cited in the Commission's Proposed Waste Confidence Decision Review (54 FR 39767-39797, at p.39795, September 28, 1989). Also issued in 1989, as part of the NRC staff's study, was . . . NUREG/CR-5281.
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> The analyses reported in these studies indicate that the dominant accident sequence which contributes to risk in a spent fuel pool is gross structural failure of the pool due to seismic events. Risks due to other accident scenarios (such as pneumatic seal failures, inadvertent drainage, loss of cooling or make-up water, and structural failures due to missiles, aircraft crashes and heavy load drops) are at least an order of magnitude smaller. For this study, older nuclear power plants were selected, since the older plants are more vulnerable to seismic-induced failures.
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> It should be noted that for a zircaloy cladding fire in a spent fuel storage pool, an earthquake or other event causing a major loss of cooling water would have to occur within two years after operation of a PWR or six months after operation of a BWR. (See NUREG-1353, p. 4-11.) Thus, during the decades of post-operational storage, even a major loss of cooling water would not be sufficient to cause a cladding fire. During the time the pool would be most vulnerable to a fire, the most-recently discharged fuel assemblies would have to be adjacent to other recently discharged assemblies for a fire to propagate to the older fuel. Considering that a third of the reactor core is typically unloaded as spent fuel each year, the probability of a fire involving even the equivalent of a reactor core--a small portion of a pool's capacity--is quite remote.
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> It should also be noted that even 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 from outside the pool to keep a large fire going, and sudden enough to deny the operators 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.
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> .
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> The plant-specific studies following the 1987 generic study 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 plant-specific and generic followup studies calculated that the average annual probability of a major spent fuel pool failure at an operating reactor was ten to thirty times lower than the average probabilities in the 1987 study. (See NUREG/CR-5176, p. xiii, and NUREG-1353, pp. ES-2-3.) For either BWR or PWR designs, this probability was calculated at two chances in a million per year of reactor operation. (See NUREG-1353, pp. ES-3-4.)
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> After evaluating several regulatory options for reducing the risk of spent fuel pool fires, the NRC regulatory analysis concluded that "[t]he risk[s] due to beyond design basis accidents in spent fuel pools, while not negligible, are sufficiently low that the added costs involved with further risk reductions are not warranted." (See NUREG-1353, pp. ES-6-8.)

*Id.* at 38,481-82. *See also Id.* at 38,511-12. While some of these findings have been refined over the years (*e.g.,* the possibility of propagation from newer to older fuel) the final conclusion has remained the same: The risk of SPF fires is small. *See e.g.,* NUREG-1738 at 22.

It is clear that the Commission considered spent fuel fires and catastrophic loss of SFP water in the GEIS. The NUREGs cited by the Commission in the Revision include an analysis of beyond design basis accidents in SFPs. *See* NUREG-1353. That report analyzed the risk of beyond design basis accidents in SFPs with high density racks and the possibility of fire propagation between assemblies in an air-cooled environment. *Id.* at 1-1. The report also referenced the 1979 Sandia report (NUREG/CR-0649) for its conclusions that in certain fuel

rack configurations "a self-sustaining zirconium-air oxidation reaction can be initiated and . . . this self sustaining reaction can propagate from one region of the pool to another.[8] *Id.* at 4-7. The Sandia findings were based on, among other things, the instantaneous draining of water from the SFP. *Id*. at 4-8 to 9. NUREG-1353 considered several accident sequences for SFP fires, including: high-energy missiles generated by tornadoes or turbine failure, aircraft crashes, inadvertent draining of the SFP, and beyond design basis earthquakes. In analyzing the releases and consequences of the SFP accidents, the report assumed two limiting cases in which a Zircaloy fire is assumed. One of these was propagation of the cladding fire throughout the entire SFP. *Id.* at 4-39.

The conclusion that should be drawn from the above discussion is that the Commission, in developing the GEIS, considered SFP accidents involving catastrophic loss of water, partial or complete, in pools with high density racks, and the possibility of self-sustaining zirconium fires that can propagate to other assemblies and to the entire SFP.

Subsequent analyses, such as NUREG-1738,[9] have refined and confirmed the conclusions made in the earlier studies. To the extent that the Petitioners claim that the information in NUREG-1738 is new or significant, it is not. The Staff briefed this issue in the Responses to the petitions to intervene, and will not address it further in this brief on the issue of whether the information is "new," other than to reiterate that 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. NUREG-1738 "concluded that the risk of [spent fuel pool] accidents is acceptably small." *Id.* at 22.

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[8] The Sandia Report also considered the partial drain-down scenario. *See* NUREG/CR-0649 at 39-40, 73-78, 86-87.

[9] NUREG-1738 is the "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants," (2001).

The next questions to be addressed are (1) whether any of the information cited by Pilgrim Watch and the Massachusetts Attorney General is new, and (2) if new, whether it is significant. While, for purposes of responding to the Board's Order, the discussion of whether the information is new may be confined to consideration of whether the issue was considered in the GEIS and, therefore, codified in Appendix B to Subpart A of 10 C.F.R. Part 51, or in the analyses summarized in the GEIS, the determination of whether the information is significant should be based on current knowledge.

## II The Petitioners Have Not Submitted New and Significant Information in Support of Their Contentions

The Petitioners have asserted that they have submitted new and significant information that must be addressed in the Applicant's environmental report (ER). The Board's Order asked the participants to address each item of "postulated 'new and significant information'" separately. Order at 4. With the exception of information related to terrorism, the Staff addresses the information proffered by the Petitioners below. Terrorism will not be addressed because the Commission has held that terrorism-related issues are not admissible in license renewal proceedings. *See Duke Energy Corp*. (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-26, 56 NRC 358 (2002). Although the Petitioners have asked the Board to apply *San Luis Obispo Mothers for Peace, et al. v. NRC*, No. 03-74628 (Ninth Cir. June 2, 2006) to this proceeding, the Staff submits that the Commission's holding in *McGuire* and related cases remain the precedent that must be followed by this Board. The Ninth Circuit's mandate has not yet issued and the Commission has not determined what action, if any, it may take in response to the decision. Therefore, the Board should not entertain terrorism issues.

A. Comparison of Pilgrim Watch Contention 4 Against "New and Significant" Criteria in RG 4.2 Supplement 1

In its Request for Hearing and Petition to Intervene (Request), Pilgrim Watch made several assertions that it claimed were based on new information. In Section 4.0, the Petitioner stated that spent fuel assemblies, already densely packed in the cooling pool, will be increased by 50 percent during the renewal period. Request at 50. This is not new information. Higher storage densities were considered in the 1979 Sandia study, (NUREG/CR-0649 at 16-20, 50-51, 69, 85), and in the 1987 and 1989 studies in support of Generic Safety Issue 82 "Beyond Design Basis Accidents in SFPs", (NUREG/CR-4982 at 51-59 and NUREG-1353 at 4-6, 4-7, 4-9, respectively). Thus, the fact that the spent fuel pools (SFPs) would contain high-density racks was understood at the time of NUREG-1437. Further, the information is not significant. For design basis accidents (DBAs), the environmental impacts associated with storing this amount of fuel have been considered as part of the NRC's licensing reviews and found acceptable. For beyond-DBA events, the regulatory analysis for GI-82 concluded no new regulatory requirements are warranted concerning the use of high density storage racks. *See* NUREG-1353 at 7-1. Based on NUREG-1738 and post-9/11 work, spent fuel stored in SFPs and in dry casks is safe and measures are in place to adequately protect the public. *See e.g.,* "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," at iv, (attachment to March 14, 2005 letter from Chairman Diaz to Senator Domenici) (ML050280428) (Report to Congress).

The Petitioner also alleges that new information regarding the schedule for activities at Yucca Mountain calls the Waste Confidence Decision into question.[10] Request at 58.

[10] This is a direct attack on the Waste Confidence rule and on that ground is inadmissible.

However, the schedule for Yucca Mountain has changed since the promulgation of the Waste Confidence Decision and the Decision has been periodically updated to reflect those changes. The last of these reviews occurred in 1999, when the Commission decided that it was not necessary to revise the Decision and stated that it "would consider undertaking a comprehensive reevaluation of the Waste Confidence findings when the impending repository development and regulatory activities run their course or if significant and pertinent unexpected events occur, raising substantial doubt about the continuing validity of the Waste Confidence findings." *See* "Waste Confidence Decision Review: Status," 64 Fed. Reg. 68,005, 68,007 (Dec. 6, 1999). This finding was reiterated by the Commission in 2005. *See* State of Nevada; Denial of a Petition for Rulemaking, 70 Fed. Reg. 48,329 (Aug. 17, 2005). Thus, there is nothing new that would call the Waste Confidence Decision or Regulation into question, as the repository development and regulatory activities have not run their course.

In Section 4.4.2 of the Request, Pilgrim Watch cited NUREG-1738 (Jan. 2001), in which it alleges the NRC staff conceded that if the water in any densely packed spent nuclear fuel pool is lost, even a year and longer after discharge, the fuel will heat up to the point where its zircaloy cladding will melt and then catch fire. Request at 62. This information is not new. The possibility of a SFP fire in a densely packed pool was considered in NUREG/CR-0649 at 12-13, NUREG/CR-4982 at 51-59 and NUREG-1353 at 4-9 to 4-12. Nor is the information significant. Pilgrim Watch's assertion misstates the findings in NUREG-1738, which actually found that about 4-5 years decay time is needed before air cooling is sufficient to preclude a zirconium fire (NUREG-1738 at 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 900 C (the temperature at which the onset of significant fission product release is expected) after 24 hours, NUREG-1738 at 2-2. 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. In NUREG-1738, the staff assumed that if the water level in a fuel storage pool drops to within three feet of the top of the spent fuel, a SFP fire would result. However, this was considered a conservative assumption that was made for all sequences that could lead to uncovering of the fuel (including partial draindown), and the uncertainties in whether these sequences would lead to a SFP fire. *See e.g.,* NUREG-1738 at 3-1 to 3-2, 3-31, 3-35, 3-37, 3-38, A1A-1. Even when all events leading to uncovering of the fuel were conservatively assumed to result in a SFP fire, NUREG-1738 concluded that the risk of a fire in the SFP is low. *Id.* at ix, 5-1. This information, although not in the GEIS is a refinement of earlier knowledge and does not lead to an impact finding different from that codified in 10 C.F.R. Part 51.

Additional analyses of SFP accidents performed since 9/11 indicate that the time period between uncovering of the fuel and onset of cladding oxidation is significant, in both complete and partial draindown scenarios, and provides a substantial opportunity for successful event mitigation. These analyses, which more fully account for relevant heat transfer and fluid flow mechanisms, also indicate that air-cooling of spent fuel would be sufficient to prevent SFP fires much earlier following fuel offload than previously considered, e.g., in NUREG-1738. *See* Letter dated August 19, 2003, from Ashok Thadani to Robert Alvarez, responding to the Alvarez Report, ML031210075 (Response to Alvarez paper). Thus, the likelihood of a SFP fire would be much less than indicated in NUREG-1738.

In Section 4.4.2.a, Pilgrim Watch alleges that in NUREG-1738, the Staff summarized the conclusions of its most recent analysis of the potential consequences of a loss-of-coolant-accident in a SFP as follows: ". . . plant specific . . . cannot be precluded on a generic basis . . ."

Request at 63. This is not new information. Early studies dating back as far as the 1979 Sandia Report recognized that spent fuel heatup and coolability is dependent on several factors, including decay time, fuel element design, storage rack design, packing density, and room ventilation. NUREG-0649 at 5-6. The information is, moreover, not significant. NUREG-1738 concluded that one could not generically rule out the potential for SFP fires based only on decay time. This represents a refinement in the state of knowledge rather than "new" information. Additional analyses of SFP accidents have been performed since 9/11. These analyses have considered plant-specific details of the SFP and the spent fuel loading patterns for several reference plants. These details include many of the factors mentioned but not addressed in NUREG-1738. This more recent work supports the staff views that the likelihood of a SFP fire remains very low. *See* Report to Congress; Response to Alvarez paper.

In Section 4.4.2.b, Pilgrim Watch states that the cooling water in the SFP could be lost due to an accident, and provides several examples. Request at 64. This is not new information. The types of events cited were considered in previous analyses, *e.g.*, NUREG/CR-4982, Section 2, and NUREG-1353, Section 4.6. The likelihood of these events progressing unmitigated to a SFP fire was found to be very small in all studies. *See, e.g.,* NUREG-1738.

In Section 4.4.2.f, the petitioner states that the consequences of water loss in the SFP caused by accident (or terrorism) could be catastrophic and the excess cancer estimates from such an accident would be between 2,000 and 6,000 cancer deaths. Request at 72. This information is not new. The number of cancer deaths cited is not new and is in the range of estimates from earlier studies. *See* Table 1, appended hereto as Attachment 1.[11] The information is not significant. The probabilistically-weighted consequences (i.e., risk) of these events is low. For example, even when all events leading to uncovering of the fuel were

[11] In an effort to assist the Board, the Staff prepared the Table 1 to simplify the comparison of some of the results in various reports referenced reports.

conservatively assumed to result in a SFP fire, NUREG-1738 concluded that the SFP risk is low, and in the range of operating reactors. *See* NUREG-1738 at 3-45. Additional analyses of SFP accidents performed since 9/11 support the view that the risk from SFP fire remains very low. *See* Report to Congress; Response to Alvarez paper.

In Sections 4.4.3.a through d, Pilgrim Watch discusses several mitigation alternatives that would decrease the likelihood of a fire in the Pilgrim SFP, including: Reconfiguring the SFP; Spray Cooling System; Limiting the frequency of offloads of full reactor cores; and Safer Storage Solutions. Request at 73-76. This information is not new. Alternatives to reduce the likelihood of SFP fires were explicitly considered as part of GI-82. As described in NUREG-1353 (1989), these alternatives included: (1) require use of low density racks, (2) improve cooling/makeup systems, (3) install spray systems, (4) modify spent fuel storage rack designs (to improve air circulation should the SFP drain), plus several others. *See generally* NUREG-1353, §§ 3, 5. The information is not significant. For example, full core offloads are permitted, provided SFP decay heat loads are maintained within design basis values. However, BWRs generally do not perform full core offloads. The storage solution proposed by the petitioner was specifically considered in the Alvarez paper. In response to Alvarez, the NRC concluded that the recommendation to move all spent fuel greater than 5 years old into dry casks is not justified, and that spent fuel stored in both wet and dry storage configurations is safe and measures are in place to adequately protect the public. *See* Response to Alvarez paper.

B. Comparison of Massachusetts AG Contention Against "New and Significant" Criteria in RG 4.2 Supplement 1

In his Request for 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 (Petition), the MassAG proffered one contention alleging new and significant information was required to be included in the Applicant's ER regarding SFP fires.

In Section 1, the MassAG states that 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. Petition at 1. The fact that a SFP fire is possible and could have large consequences is not new. Based on the earlier studies summarized in Table 1 (Attachment 1), Staff understanding of the frequencies and the consequences of these events 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, e.g.,* NUREG-1353 at 4-36. The information is not significant. The risk (frequency x consequences) associated with severe SFP accidents (*i.e.*, that lead to a fire) has always been considered to be less than that associated with severe reactor accidents that dominate the risk for reactors. Based on NUREG-1738 and post-9/11 work, the NRC continues to believe that the risk associated with SFP fires is very low. *See* NUREG-1738 at 3-45; Report to Congress; Response to Alvarez paper.

In section V.A, the MassAG averred that although NUREG/CR-0649, conducted in 1979, raised the potential for a SFP accident in a high-density fuel storage pool if water is partially lost from the pool, the NRC has failed to take that risk into account in any EIS it has prepared. Petition at 21. The potential for partial draindown not new information. As noted by the MassAG, this information was available in 1979 in NUREG-0649.[12] The information is also not significant. Even when all events leading to uncovering of the fuel were conservatively assumed to result in a SFP fire, NUREG-1738 concluded that the SFP risk is low. *See* NUREG-1738 at 3-45. Additional analyses of SFP accidents performed since 9/11 indicate that the time period between uncovering of the fuel and onset of cladding oxidation is significant, in both complete and partial draindown scenarios, and provides a substantial opportunity for

[12] Since NUREG-0649 was relied upon in analyses cited in support of the GEIS, the partial draindown scenario was considered in preparing the GEIS.

successful event mitigation. Further analyses, which more fully account for relevant heat transfer and fluid flow mechanisms, also indicate that air-cooling of spent fuel would be sufficient to prevent SFP fires much earlier following fuel offload than previously considered, e.g., in NUREG-1738. *See* Response to Alvarez paper. Thus, the likelihood of a SFP fire would be much less than indicated in NUREG-1738.

The current understanding, based on NUREG-1738 and post-9/11 work, is that the spent fuel stored in SFPs and in dry casks is safe and measures are in place to adequately protect the public. *See* Report to Congress.

In Section V.A, the MassAG alleged 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. Petition at 22. This new information has also been confirmed by the NRC staff in NUREG-1738 and by the National Academies of Sciences (NAS). *Id.* This information is not new. The possibility of a SFP fire in a densely packed pool was considered in NUREG/CR-0649 at 12-13, and in NUREG/CR-4982 at 51-59 and NUREG-1353 at 4-6, 4-7, 4-9. The information is not significant for the same reasons cited in response to Section V.A, *supra*. As stated previously, the MassAG's statements are a mischaracterization of the findings of NUREG-1738. *See* discussion at 11-12, *supra.*

In Section V.B, petitioner alleged that 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. Petition at 23. This information is not new or significant for the same reasons cited in the response to Section I, *supra*.

In Section V.B.1, the MassAG states that new information is presented in NUREG-1738, the NAS report, and the Thompson report, all of which were written after the issuance of the license renewal GEIS and, therefore, they qualify as new. Petition at 24. However, 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 1979 in NUREG/CR-0649 at 11, and in the subsequent reports. The later documents do not alter the conclusions regarding the potential for a fire and do not change the conclusion that the risk of an SFP fire is low. The information is not significant for the same reasons cited in the Staff's response to Section V.A, *supra*.

Moreover, 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 at 4-36). The frequency and consequence information provided in the most recent documents cited by the petitioner is not substantially different than that provided in the earlier documents that were available at the time of the license renewal GEIS. Thus, this information would not be considered new.

In Section V.B.1.a, the MassAG states that 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. Petition at 25. 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. *Id.* This information is not new or significant. Although the fuel is now stored in high density racks, the same 4 conclusions still apply, thus, there would still be no reason to address the environmental

impacts of pool accidents. The total heat load is within design basis value for plant and has been reviewed and approved as part of the Staff's safety review.

In Section V.B.1.d, the petitioner states that in response to comments on the Waste Confidence rulemaking, the NRC: (1) made no mention of the 1979 Sandia report, (2) 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, and (3) did not respond to the recommendation of NUREG-1353 that the NRC undertake a re-examination of the risks of SFP accidents. Petition at 28. This information is not new. Although the 1979 Sandia report (NUREG-0649) is not specifically cited in the response to comments, the report is cited in NUREG-1353. NUREG-1353, in turn, is specifically referenced in the 1990 revision of the Waste Confidence Rule that is cited in the GEIS for license renewal (NUREG-1437, p.6-72 through 6-75). The information is not significant for the same reasons cited in the Staff's response to Section V.A, *supra*.

In Section V.B.3.a, the petitioner alleges that significant new information shows that fuel of any age will burn if uncovered. Petition at 30. This statement is false. As discussed on pages 11-12, *supra.,* this statement provides an inaccurate characterization of the findings of both NUREG-1738.

Similarly, the calculations described in the NAS report at 52-54, 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.

The information is not significant for the same reasons cited by the Staff in its response to Section V.A, *supra*.

In Section V.B.3.a, the MassAG avers 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. First, the statement is incorrect in that it 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. As the MassAG himself notes on p.21 of the Petition, the potential for a fire in partial drain-down scenarios was discussed even in the 1979 Sandia study. Thus, this is not new information. It is not significant for the same reasons stated in the Staff's response to Section V.A, *supra*. In addition, as discussed in Appendix 1.A of NUREG-1738, in the event of a total loss of water, the fuel may or may not be able to be sufficiently air-cooled, depending on the age of the fuel (i.e., how long the most recently off-loaded fuel has been out of the reactor.) If the age of the fuel is less than some critical age, there would still be several hours to tens of hours available to implement mitigation measures, such as refilling the pool, or spraying the uncovered spent fuel. (If the age of the fuel is greater than the critical age, then air-cooling alone is sufficient.) In the event of a partial loss of water, air-cooling alone may be insufficient to prevent the exothermic reaction, but there would still be several hours to tens of hours available to implement mitigation measures.

Since the Petitioner's assertion is incorrect, it cannot be either new or significant.

In Section V.B.3.a, the MassAG asserts that once initiated, a fuel fire could spread to nearby, previously uninvolved, fuel assemblies. Petition at 30. The potential for propagation is not new. This was previously identified and considered in NUREG/CR-0649 at 12-13 and NUREG-1353 at 4-7, 8. The information is not significant for the same reasons cited in the Staff's response to Section V.A, *supra*.

In Section V.B.3.a, the petitioner claims that the NRC staff also reached the conclusion that regardless of the age of the fuel in a pool, the fuel will burn after the tops of the fuel assemblies are uncovered. Petition at 31. As discussed at 11-12, *supra.,* this is an inaccurate representation of what was reported in NUREG-1738. See Staff response to Section V.A, *supra*. The information is not significant for the same reasons cited in the Staff's response to Section V.A, *supra*.

In Section V.B.3.b, the MassAG alleges that significant new information shows that total or partial loss of water from a SFP, either through equipment failure or deliberate malicious acts, is not a remote or speculative event. Petition at 32. 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. *Id.* He further alleges that 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. *Id.* This information is not new. It refers to the frequency of the initiating event and not necessarily the frequency of the fire. In either case, the frequency values that might be assigned to these events today are not substantially different from and are in the same range as the values considered in earlier studies, such as NUREG-1353 at 4-36 and NUREG-1738, Section 3.3, i.e., on the order of 10-7/y to 10-6/y. The petitioner has not provided any new information that would lead to a change in the SFP risk from internal or external events. In addition, none of the reports referenced in the GEIS or the later reports have found that an SFP fire is anything other than a low risk event. The information is not significant for the same reasons contained in the Staff's response to Section V.A, *supra*.

Section V.B.3.b.i states that if the reasonable assumption that the conditional probability of a pool fire accompanying an early containment release is 50% is made, the overall estimated likelihood of a pool fire (excluding acts of malice) is on the order of 2E-5/y. Petition at 32. There is no technical basis provided for the 50% probability value on which this conclusion is based. Thus, whether the information is new is irrelevant. The information is not significant for the same reasons cited by the Staff in its response to Section V.A, *supra*.

In Section V.B.3.d, the MassAG alleges that the radiological consequences of a pool fire would be quite different from the consequences of a reactor accident, and in some respects worse. Petition at 40. This information is not new. *See, e.g.,* NUREG-1465*, "Accident Source Terms for Light Water Reactor Nuclear Power Plants,"* Table 3.10 (Feb. 1995). Nor is the information significant, for the reasons cited in the Staff's answer to Section V.A, *supra*.

The discussion above demonstrates that the information asserted by both Pilgrim Watch and the MassAG is not new and not significant.

In sum, the Petitioner has not demonstrated that there is any "new and significant" information that the Applicant was required to address in its ER, pursuant to 10 C.F.R. § 51.53(c)(iv). Nor has it demonstrated that any of the information cited would lead to a different impact finding than that codified in 10 C.F.R. Part 51.

CONCLUSION

For the reasons discussed above, the petitioner's have not demonstrated that there is new and significant information that identifies a significant environmental issue that was not considered in NUREG-1437 or information that was not considered in the analyses summarized in NUREG-1437 and leads to an impact finding different from that codified in 10 CFR Part 51.

Respectfully submitted,

***/RA/***

Susan Uttal
Counsel for NRC Staff

Dated at Rockville, Maryland
this 21st day of July, 2006

ATTACHMENT 1

Table 1 - Summary of SFP Accident Frequency and Consequence Estimates from Earlier Studies

| Source | Context | Date | Fire frequency (per year) | Latent cancer fatalities | Offsite Property Damage ($ per event) | Interdiction Area (sq. miles) |
|---|---|---|---|---|---|---|
| NUREG/CR-0649 | Analyses of high density racks | 1979 | Note * | -- | -- | -- |
| NUREG/CR-4982 | GI-82 | 1987 | 4E-11 - 7E-5 | 100 - 30,000 | -- | 0 - 224 |
| NUREG-1353 | GI-82 | 1989 | 2E-6 | -- | 3.4E9 - 2.6E10 | 0 - 244 |
| NUREG/CR-6451 | Decommissioning | 1997 | -- | 26,000 - 138,000 | 5E10 - 5E11 | 159 - 2170 |
| NUREG-1738 | Decommissioning | 2001 | 5.8E-7 - 2.4E-6 | 2,200 - 27,000 | -- | -- |
| Thompson | Contention | 2006 | 2E-5 non-malice<br>1E-4 malice | -- | 1E11 | -- |

Note * - Concluded that for certain conditions, the cladding of freshly discharged assemblies would reach the point of ignition. The possibility of propagation from assembly to assembly with the involvement of the entire spent fuel pool was not ruled out.

July 21, 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'S RESPONSE TO JULY 14, 2006 LICENSING BOARD ORDER" and ATTACHMENT 1 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 21st day of July, 2006.

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