21044

December 3, 1999

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Commission

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22-ISFSI
	)	
(Private Fuel Storage Facility)	)	ASLBP No. 97-732-02-ISFSI

APPLICANT'S RESPONSE OPPOSING STATE OF UTAH'S PETITION FOR INTERLOCUTORY REVIEW OF LBP-99-43

Applicant Private Fuel Storage L.L.C. ("Applicant" or "PFS") hereby files its response to the State of Utah's Petition for Interlocutory Review of LBP-99-43 ("State's Pet."). For the reasons described below, Applicant opposes the State's Petition and requests the Commission to deny the petition.

I. BACKGROUND

In the Safety Analysis Report ("SAR") accompanying PFS' license application, PFS relied upon data from NUREG-1536, Standard Review Plan for Dry Cask Storage Systems (Jan. 1997) and a Sandia National Laboratories report, SAND80-2124, Transportation Accident Scenarios for Commercial Spent Fuel (Feb. 1981), to demonstrate that off-site radiation dose consequences complied with 10 C.F.R. § 72.106(b). The State filed, and the Board admitted, contention Utah C, which argued that the Applicant's off-site dose analysis failed to comply with § 72.106(b) because it inappropriately relied upon certain data from NUREG-1536 and SAND80-2124, and it failed to take into account all exposure pathways. See LBP-98-7, 47 NRC 142, 185-86, reconsideration

granted in part and denied in part on other grounds, LBP-98-10, 47 NRC 288, aff'd on other grounds, CLI-98-13, 48 NRC 26 (1998).

On December 10, 1998, the NRC Staff submitted requests for additional information ("RAI") to PFS, including RAI SAR 7-1 on the SAR's dose analysis. RAI SAR 7-1 stated that "[t]he calculation in the SAR has been done inappropriately" and requested PFS to "[r]evise the calculation" in the SAR "to show compliance with the accident dose limits in 10 CFR 72.106(b)." RAI SAR 7-1. PFS revised the calculation as requested by the RAI, and submitted the revised calculation to the Staff on February 10, 1999, copying the State a few days thereafter. See PFS Response to RAI SAR 7-1, February 10, 1999 (Attachment 1 hereto). PFS' February 10, 1999 RAI response stated that "[t]he calculation of the impacts (individual doses) . . . for the PFSF has been revised . . . to show compliance with the accident dose limits in 10 CFR 72.106(b)." See Attachment 1 at 1. This RAI response, together with others, was subsequently incorporated into the SAR.[1]

On April 21, 1999, PFS filed a motion for summary disposition on contention Utah C based upon the revised dose analysis set forth in RAI SAR 7-1. The Board granted PFS' motion on June 17, 1999, ruling that PFS' revised dose analysis rendered the bases in contention Utah C moot. LBP-99-23, 49 NRC 485, 494 (1999).

On June 23, 1999, more than four months after receiving PFS' RAI response and its revised dose calculation,[2] the State sought admission of a late-filed contention chal-

[1] Letter from Parkyn (PFS) to Director, NMSS of May 19, 1999 (5/19/99) (enclosing License Application Amendment #3).

[2] The State acknowledged receiving the revised dose calculation in mid-February. See State of Utah's Request for Admission of Late-Filed Amended Utah Contention C at 18 (June 23, 1999).

lenging the revised calculation. See State of Utah's Request for Admission of Late-Filed Amended Utah Contention C (June 23, 1999). On November 4, 1999, the Board denied the State's request. LBP-99-43. The Board based its decision on the State's failure to demonstrate good-cause for filing the contention more than four months after receiving the revised dose calculation, and for failing to demonstrate, in the absence of good cause, that the other four factors strongly favor admission of the contention. Id., slip op. at 16-17. On November 19, 1999, the State filed its petition.

II. STANDARD FOR OBTAINING INTERLOCUTORY REVIEW

The Commission has long disfavored interlocutory review, and will undertake this extraordinary action only in the most compelling circumstances. Georgia Power Co. (Vogtle Electric Generating Plant, Units 1 and 2), CLI-94-15, 40 NRC 319, 321 (1994). The Commission will entertain a petition for review of an interlocutory Board order only if the petitioner can satisfy one of the two standards of 10 C.F.R. § 2.786(g). Sacramento Municipal Utility District (Rancho Seco Nuclear Generating Station), CLI-94-2, 39 NRC 91, 93 (1994). The petitioner must demonstrate that the challenged Board ruling either:

> (1) Threatens the party adversely affected by it with immediate and serious irreparable impact which, as a practical matter, could not be alleviated through a petition for review of the presiding officer's final decision; or
>
> (2) Affects the basis structure of the proceeding in a pervasive or unusual manner.

10 C.F.R. § 2.786(g). The petitioner requesting interlocutory review must demonstrate by a "clear and convincing showing" that at least one of the two criteria is met.[3]

[3] Arizona Public Service Co. (Palo Verde Nuclear Generating Station, Units 2 and 3), ALAB-742, 18 NRC 380, 383 (1983).

III. THE STATE'S PETITION DOES NOT MEET THE STANDARD FOR OBTAINING INTERLOCUTORY REVIEW

The State's Petition fails to satisfy either of the standards of 10 C.F.R. § 2.786(g). At issue is the State's assertion that the Board's application of the five late-filing factors in 10 C.F.R. § 2.714(a)(1)(i)-(v) "is fundamentally inconsistent with Commission regulations and precedent governing the admissibility of contentions." State's Pet. at 10. For this reason, the State charges that the Board has made "a fundamental legal error" which presents a "novel issue."[4] Id. at 4. Even assuming such assertions were true, NRC precedent clearly demonstrates that these are not "compelling circumstances" sufficient to justify the "extraordinary action" of granting interlocutory review.[5]

A. State's Petition Fails to Satisfy the First Prong of 10 C.F.R. § 2.786(g)

The State's Petition fails to satisfy the first prong of the interlocutory review test: "immediate and serious irreparable impact which, as a practical matter, could not be alleviated through a petition for review of the [Board's] final decision." 10 C.F.R. § 2.786(g)(1). Indeed, the State does not even attempt to satisfy this test.[6] Appellate case

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[4] Through its incomplete citation to the Commission's Statement of Policy on Conduct of Adjudicatory Proceedings, CLI-98-12, 48 NRC 18, 23 (1998), the State attempts to insinuate that all "novel issues" are granted interlocutory review. See State's Pet. at 4. However, the State neglects to point out that CLI-98-12 continues on to state that "[t]he Commission, however, will evaluate any matter put before it to ensure that interlocutory review is warranted." CLI-98-12, supra, 48 NRC at 23. The State makes no specific connection between the facts in the present case and the Policy Statement. Here, just like in a prior case, "[t]he Policy Statement is . . . unhelpful, as it refers to interlocutory appeals only generally and nowhere suggests that such appeals are permissible in situations like [petitioner's]." Sequoyah Fuels Corp. and General Atomics (Gore, Okla. Site) CLI-94-11, 40 NRC 55, 62 (1994).

[5] Applicant notes that the State's cavalier observation that "the Commission has made a practice of accepting petitions for interlocutory review," State's Pet. at 4 n.6, ignores the gravity of granting interlocutory review and overlooks the extensive case law history strictly enforcing the standards.

[6] The State places its entire argument under the rubric of "pervasive and unusual" effect, part of the second prong of the interlocutory review test. State's Pet. at 4, 7; see 10 C.F.R. § 2.786(g)(2).

law establishes that Board rulings on admitting contentions do not present exceptional delay or expenses sufficient to meet the interlocutory review criteria.[7]

B. State's Petition Fails to Satisfy the Second Prong of 10 C.F.R. § 2.786(g)

The State's Petition fails to satisfy the second prong of the interlocutory review test: that the Board's ruling "[a]ffects the basis structure of [the] proceeding in a pervasive or unusual manner." 10 C.F.R. § 2.786(g)(2). In fact, the State applies the wrong test. The State attempts to show only that the Board's ruling will have a "pervasive and unusual effect on the proceeding." State's Pet. at 7 (emphasis added). This, of course, completely ignores the requirement to demonstrate that the "basis structure" of the proceeding is affected, the essential element of the second prong. 10 C.F.R. § 2.786(g)(2).

NRC case law clearly demonstrates that the second criterion is not satisfied here, even if the State had addressed it. The State's Petition asserts that the Board has made a "fundamental legal error" in its application of the five late-filing factors for determining admissibility of a contention, State's Pet. at 4, and that the Board's ruling "is fundamentally inconsistent with Commission regulations and precedent governing the admissibility of contentions." State's Pet. at 10. NRC case law clearly establishes that such issues do not "[a]ffect[] the basis structure of the proceeding" within the meaning of 10 C.F.R. § 2.786(g)(2). The fact that a ruling is important or novel, as the State has asserted here, does not change the basic structure of the proceeding. Sequoyah Fuels, CLI-94-11, supra, 40 NRC at 63. A legal error, standing alone, does not alter the basic structure of a proceeding and therefore does not justify interlocutory review. See, e.g., Dr. James E. Bauer

[7] Cleveland Electric Illuminating Co. (Perry Nuclear Power Plant, Units 1 and 2), ALAB-675, 15 NRC 1105, 1113-14 (1982); Duke Power Co. (Catawba Nuclear Station, Units 1 and 2), ALAB-768, 19 NRC 988, 992-93 (1984).

(Order Prohibiting Involvement in NRC-Licensed Activities), CLI-95-3, 41 NRC 245, 246-47 (1995). Nor does the admission or rejection of a contention.

> [Whether] the Licensing Board failed to apply the proper criteria for admissibility of contentions and incorrectly interpreted Commission regulations [are] reasons [that] have not been adequate in practice to demonstrate that the structure of a proceeding has been affected in a pervasive or unusual way, where the ultimate result is that the Licensing Board simply admits or rejects particular issues for consideration.

Rancho Seco, CLI-94-2, supra, 39 NRC at 94. Most specifically, NRC case law establishes that a Board ruling on the five late-filing factors, including the good cause factor, for admission of a contention does not affect the basis structure of the proceeding in a pervasive or unusual manner, even where the Board's ruling "was assertedly in conflict with Commission case law, policy, or regulations" and "may well be in error."[8]

In short, the State's Petition does not wash with Commission case law. Even if it were true, the State's assertion that the Board committed legal error in applying the five late-filing factors satisfies neither of the two prongs of the interlocutory review test. Because the petition fails to satisfy either of the two standards in 10 C.F.R. § 2.786, the Commission should deny the State's Petition.

IV. THE LICENSING BOARD HAD GOOD CAUSE FOR REFUSING TO ADMIT THE STATE'S LATE-FILED CONTENTION.

According to the State, the Licensing Board applied the wrong test in finding that the State's late-filed contention was untimely. The State claims that the Board should have measured timeliness not from the date the information that formed the basis of its

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[8] Perry, ALAB-675, supra, 15 NRC at 1113 (citations omitted); accord, Cleveland Electric Illuminating Co. (Perry Nuclear Power Plant, Units 1 and 2), ALAB-706, 16 NRC 1754, 1756-58 (1982), cited with approval, Safety Light Corp. (Bloomsburg Site Decontamination), CLI-92-9, 35 NRC 156, 159 n.4 (1992).

contention became publicly available, i.e., the February 1999 RAI response, but rather from the date of the receipt of Revision 3 of the License Application. This argument ignores the Commission's regulations and case law, including the cases cited by the State, and is without merit.

The Commission has long recognized that information contained in newly released documents may properly form the basis of a late-filed contention. Good cause may exist for a "late-filed contention which: (1) is wholly dependent upon the content of a particular document; (2) could not therefore be advanced with any degree of specificity . . . in advance of the public availability of the document; and (3) is tendered with the requisite degree of promptness once that document comes into existence . . . ."[9] The State was certainly put on notice of this principle by the Board's prior ruling in this proceeding that where "a new contention purportedly is based on information contained in a document recently made publicly available, an important consideration in judging the contention's timeliness is the extent to which the new contention could have been put forward with any degree of specificity in advance of the document's release."[10]

The Board properly decided that timeliness is determined from the date when the new information first became available. The Board focused "on the substance and sufficiency of the information available to the contention's sponsor." LBP-99-43, slip op. at 10. As the Board determined, and the State does not contest, the February 1999 RAI Response contained "the requisite factual concreteness[] for the formulation of an updated

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[9] Duke Power Co. (Catawba Nuclear Station, Units 1 and 2), CLI-83-19, 17 NRC 1041, 1043-44 (1983).

[10] Private Fuels Storage, LLC (Interim Spent Fuel Storage Installation), LBP-98-29, 48 NRC 286, 292 (1998).

contention." Id. at 11. The Board therefore decided the State's four-month delay in filing the contention did not constitute good cause. Because the decision is consistent with the Commission's practices and does not do "violence to the plain language of the NRC's regulations," State's Pet. at 5, the Board's decision is based on a rational foundation.

To justify its delay, the State claims, notwithstanding its prior knowledge of the revised dose calculation, that its obligation to file was tolled until PFS formally included the information in the SAR by amending the license application. By the State's logic, all documents other than an amended license application are "extraneous," State's Pet. at 5, 6 fn. 7, and 7, regardless of their content. Accordingly, review of these "extraneous" documents should not be required because it would impose "a particularly significant burden" on the State. State's Pet. at 8. Thus, under the State's approach, the importance of information would depend not on its substance but rather the form in which the information is presented. This post hoc rationalization of its failure to promptly file a contention misrepresents well-established Commission policies.

The State cannot ignore the "basic principle that a person who invokes the right to participate in an NRC proceeding also voluntarily accepts the obligations attendant upon such participation." Catawba, CLI-83-19, supra, 17 NRC at 1048. The Commission has held that "intervenors are expected to raise issues as early as possible." Id. at 1050. When a licensing-related document becomes available, an intervenor must file promptly its contentions based on that document.[11] "[W]here information is available to the public several months before a contention is filed and the contention is untimely submitted, then

[11] See Public Service Co. of New Hampshire (Seabrook Station, Units 1 and 2), LBP-89-4, 29 NRC 62, 70 (1989), aff'd, ALAB-918, 29 NRC 473 (1989), remanded, Massachusetts v. NRC, 924 F.2d 311, 333-337 (D.C. Cir. 1991), appeal dismissed as moot, ALAB-946, 33 NRC 245 (1991).

good cause for the tardiness is negated." Commonwealth Edison Co. (Braidwood Nuclear Power Station, Units 1 and 2), LBP-85-11, 21 NRC 609, 628 (1985). "Statements that such material is too voluminous or written in too abstruse or technical language are inconsistent with the responsibilities connected with participation in Commission proceedings and, thus, do not present cognizable arguments." Catawba, CLI-83-19, supra, 17 NRC at 1048. "To the extent that [filing as early as possible] leads to contentions that are superseded by the subsequent issuance of licensing-related documents, those changes can be dealt with by either modifying or disposing the superseded contentions." Id. at 1050.

The State ignored these general principles. More surprisingly, in a case that the State had itself cited (State's Pet. at 6 fn.7, 7), the Commission explicitly recognized that information outside the application can be the basis for a contention. As stated by the Commission, petitioners have an "'ironclad obligation' to examine the application, and other publicly available documents, with sufficient care to uncover any information that could serve as the foundation of a contention." Duke Energy Corp. (Oconee Nuclear Station, Units 1, 2 and 3), CLI-99-11, 49 NRC 328, 338 (1999) (emphasis added).

More specifically, and in another case which the State itself had cited (State'sPet. at 5), the Commission has explicitly stated that information in RAIs can be the basis of a late-filed contention. Baltimore Gas & Electric Co. (Calvert Cliffs Nuclear Power Plant, Units 1 and 2), CLI-98-25, 48 NRC 325, 350 (1998). "[I]f a petitioner concludes that a Staff RAI or an applicant RAI response raises a legitimate question about the adequacy of the application, the petitioner is free to posit that issue as a new or amended contention, subject to complying with the late-filing standards of section 2.714(a)." Id. (citation omitted). There is not even a hint that a petitioner may sit back and wait for the RAI re-

sponse to be incorporated into the license application itself. Other decisions have reached the same conclusion. See, e.g., Carolina Power & Light Co. (Shearon Harris Nuclear Power Plant), LBP-99-25, 50 NRC 25, 27 fn. 4 (1999) ("While the pendency of a Staff requests [*sic*] for additional information (RAI) such as [intervenor's] exhibit 1 is not a basis for delaying the filing of contentions, such an RAI may provide the basis for a contention.")(citation omitted).[12] Contrary to the State's assertion, the admissibility standards do not require a petitioner to wait until the challenged information is incorporated into an application. Rather, they merely require the petitioner to promptly proffer a contention that identifies how the information underlying its contention makes the license application unacceptable.

V. CONCLUSION

For the foregoing reasons, Applicant requests that the Commission deny the State's petition for interlocutory review of LBP-99-43.

Respectfully submitted,

Paul Gaukler

Jay E. Silberg
Ernest L. Blake, Jr.
Paul A. Gaukler
SHAW PITTMAN
2300 N Street, N.W.
Washington, DC 20037
(202) 663-8000
Counsel for Private Fuel Storage L.L.C.

Dated: December 3, 1999

[12] NRC cases have also recognized that other licensing-related documents may support a late-filed contention. See, e.g, Public Service Co. of New Hampshire (Seabrook Station, Units 1 and 2), ALAB-734, 18 NRC 11 (1983) (recognizing that late-filed petitions may be based on QA procedures).

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Commission

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PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	ASLBP No. 97-732-02-ISFSI

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing "Applicant's Response Opposing State of Utah's Petition for Interlocutory Review of LBP-99-43" were served on the persons listed below (unless otherwise noted) by e-mail with conforming copies by U.S. mail, first class, postage prepaid, this 3rd day of December 1999.

Richard A. Meserve, 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

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: sfc@nrc.gov

Greta J. Dicus, Commissioner
U.S. Nuclear Regulatory Commission
Mail Stop O-16 G15
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738
e-mail: cmrdicus@nrc.gov

Nils J. Diaz, Commissioner
U.S. Nuclear Regulatory Commission
Mail Stop O-16 G15
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738
e-mail: cmrdiaz@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: jmer@nrc.gov

Office of the Commission Appellate Adjudication
Mail Stop: 16-G-15 OWFN
U. S. Nuclear Regulatory Commission
Washington, DC 20555
e-mail: hrb@nrc.gov

G. Paul Bollwerk III, Esq., Chairman Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: GPB@nrc.gov

Dr. Jerry R. Kline
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: JRK2@nrc.gov; kjerry@erols.com

Dr. Peter S. Lam
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: PSL@nrc.gov

* Susan F. Shankman
Deputy Director, Licensing & Inspection
Directorate, Spent Fuel Project Office
Office of Nuclear Material Safety & Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
Attention: Rulemakings and Adjudications Staff
e-mail: hearingdocket@nrc.gov
(Original and two copies)

* Adjudicatory File
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Catherine L. Marco, Esq.
Sherwin E. Turk, Esq.
Office of the General Counsel
Mail Stop O-15 B18
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
e-mail: pfscase@nrc.gov

Denise Chancellor, Esq.
Assistant Attorney General
Utah Attorney General's Office
160 East 300 South, 5th Floor
P.O. Box 140873
Salt Lake City, Utah 84114-0873
e-mail: dchancel@state.UT.US

John Paul Kennedy, Sr., Esq.
Confederated Tribes of the Goshute Reservation
1385 Yale Avenue
Salt Lake City, Utah 84105
e-mail: john@kennedys.org

Joro Walker, Esq.
Land and Water Fund of the Rockies
2056 East 3300 South, Suite 1
Salt Lake City, UT 84109
e-mail: joro61@inconnect.com

Diane Curran, Esq.
Harmon, Curran, Spielberg & Eisenberg, L.L.P.
1726 M Street, N.W., Suite 600
Washington, D.C. 20036
e-mail: dcurran@harmoncurran.com

Danny Quintana, Esq.
Skull Valley Band of Goshute Indians
Danny Quintana & Associates, P.C.
68 South Main Street, Suite 600
Salt Lake City, Utah 84101
e-mail: quintana@xmission.com

* By U.S. mail only

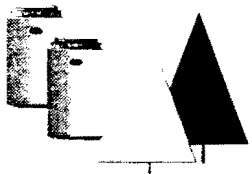
Paul A. Gaukler

Document #: 843334 v.3

Document #: 843334 v.3

ATTACHMENT 1

(PFS Response to RAI SAR 7-1, February 10, 1999)



Private Fuel Storage, L.L.C.

P.O. Box 340910, La Crosse, WI 54602-4910
John D. Parkyn, Chairman of the Board

February 10, 1999

Director, Office of Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
PRIVATE FUEL STORAGE FACILITY
PRIVATE FUEL STORAGE, L.L.C.
DOCKET NO. 72-22/TAC NO. L22462

Reference:
1) NRC Letter, Delligatti to Parkyn, Request for Additional Information, dated December 10, 1998
2) NRC Letter, Delligatti to Parkyn, Request for Additional Information on License Application, dated April 1, 1998
3) PFS Letter, Parkyn to Director, Office of Nuclear Material Safety and Safeguards, U. S. Nuclear Regulatory Commission, dated January 21, 1999

Enclosed are the responses of Private Fuel Storage, L.L.C. to the Requests for Additional Information (RAI) set forth in Reference #1. Also enclosed are the remaining responses to the first RAI transmitted by Reference #2. The timing for submittal of these latter responses was governed by the Staff's statement in Reference #1 that it would review the remaining first round RAI responses at the same time it reviews the responses to the second round RAI responses. As explained in our letter of January 21, 1999 (Reference #3), we have taken that statement to mean that we should submit the remaining first round RAI responses when the second round RAI responses were submitted. The enclosed submittal reflects that understanding.

RAI reference material that includes proprietary data, safeguards information, or extensive calculations/reports will be submitted under separate covers. If you have any questions regarding this response, please contact me at (608) 787-1236 or our Project Director, John Donnell, at (303) 741-7009.

Sincerely,

John D. Parkyn, Chairman
Private Fuel Storage

JDP:cls
Enclosures

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Copy to: Ms. Denise Chancellor, Esq. - State of Utah
Mr. Richard Condit - Land and Water Fund of the Rockies
Mr. Mark Delligatti - U.S. NRC
Mr. John Donnell - Private Fuel Storage
Mr. John Paul Kennedy, Esq. - Confederated Tribes of the Goshute Reservation
Mr. Danny Quintana, Esq. - Skull Valley Band of Goshute Indians
Mr. Jay Silberg, Esq. - Shaw, Pittman, Potts & Trowbridge
Mr. Sherwin Turk - U.S. NRC
Mr. Joro Walker, Esq. - Land and Water Fund of the Rockies
Mr. Scott Northard - Private Fuel Storage
Mr. Leon Bear - Skull Valley Band of Goshute Indians
Mr. Asadul H. Chowdhury, Ph.D. - CNWRA
Mr. Murray C. Wade - Oak Ridge National Laboratory

SAFETY ANALYSIS REPORT

CHAPTER 7 – RADIATION PROTECTION

7-1 Revise the calculation of the impacts of the accident using the release fractions and methodology contained in Interim Staff Guidance-5 (ISG-5), Accident Dose Calculations (Nuclear Regulatory Commission, 1998) to show compliance with the accident dose limits in 10 CFR 72.106(b).

- The calculation in the SAR has been conducted inappropriately. The use of a respirable fraction of 5% for the release of Co-60 is not appropriate. The SAR cites Table XX of SAND80-2124 to justify the use of this fraction. However, page 39 of this document indicates that this fraction was measured for particulates released from the interior of the fuel via a burst-rupture mechanism. The majority of the source of Co-60 from the spent fuel would be from the CRUD on the exterior of the fuel assemblies.

- The licensee's calculation of accident impacts in the SAR does not follow the most recent staff guidance on calculating the consequences of a postulated loss-of-confinement event. The current staff guidance on this calculation is published by the Spent Fuel Project Office as Interim Staff Guidance - 5 (ISG-5) (Nuclear Regulatory Commission, 1998).

RESPONSE

The calculation of the impacts (individual doses) resulting from the hypothetical canister leakage accident for the PFSF has been revised in accordance with Interim Staff Guidance-5 (ISG-5) to show compliance with the accident dose limits in 10 CFR 72.106 (b).

For the hypothetical accident case, the calculated releases are based on leakage of the canister design that could lead to the largest release of radioactive material. Both TranStor and HI-STORM canisters were evaluated. It was determined that maximum dose rates are associated with postulated leakage of a TranStor canister containing 61 design basis BWR fuel assemblies. While the HI-STORM MPC-68 canister contains seven more BWR fuel assemblies, the calculated leak rate for the MPC-68 under bounding accident conditions of temperature and pressure (1.58 E-5 cc/sec, presented in Section 7.3.3.1 of the HI-STAR TSAR, Holtec Report No. HI-941184, NRC Docket No. 72-1008) is less than that assumed in this analysis for the TranStor canister. A leak rate of 1.0 E-4 cc/sec was used for the TranStor canister under the hypothetical accident conditions. Sufficiently low leak rate test criteria will be established for TranStor canisters to be stored at the PFSF to assure that the leak rate from these canisters will not exceed 1.0 E-4 cc/sec under hypothetical accident conditions.

The radionuclide inventory for the TranStor BWR canister was based on 61 design basis BWR fuel assemblies (GE 8X8) with a burnup of 40,000 MWd/MTU, 6 years cooling time,

and 2.95% enrichment. This is conservative, since fuel with these characteristics is too "hot" for shipment to the PFSF as indicated in Figure 5.0-1 of the TranStor Shipping Cask SAR (SNC-95-71SAR, Docket No. 71-9268), as well as the technical specifications in Chapter 12 of the HI-STORM SAR. This ensures that the inventory used in the calculation exceeds that of fuel authorized for storage at the PFSF. The inventory of isotopes other than ^{60}Co was calculated with the SAS2H and ORIGEN-S modules of the SCALE4.3 system. Isotopes that contribute greater than 0.1% to the total curie inventory for the fuel assembly and iodine were considered.

The ^{60}Co inventory was determined using the 140 μCi/cm^2 crud surface activity for PWR rods and the 1254 μCi/cm^2 crud surface activity for BWR rods provided in NUREG/CR-6487, multiplied by the surface area per assembly (3 E5 cm^2 and 1 E5 cm^2 for PWR and BWR rods respectively), also provided in NUREG/CR-6487. The ^{60}Co source terms were then decay corrected to account for the cooling time, using the half life of ^{60}Co.

The activity released is estimated as the product of: 1) the estimated activity per fuel assembly, 2) the number of fuel assemblies contained in one canister, 3) the fraction of the canister volume released per second, 4) the release fraction (by radionuclide group), and 5) the accident duration. The hypothetical accident duration is assumed to be 30 days. Items 1 and 2 were provided by the cask vendors. Item 3 was calculated by dividing the canister release rate under accident conditions by the canister free gas volume, which was also provided by the cask vendors. Items 4 and 5 are based on the NRC regulatory guidance provided in NUREG/CR-6487 and ISG-5. No credit was taken for holdup (plateout, depositon, etc) of particulates or volatile fission products released from the fuel inside the canister.

The primary approach used in this analysis is to estimate inhalation committed effective dose equivalents for the airborne pathway, since it has been noted by the NRC that, for accident conditions, for all materials of greatest interest for fuel cycle and other radioactive material licenses, the dose from the inhalation pathway will dominate the (overall) dose (NUREG-1140). The approach of conducting inhalation dose estimates is also consistent with guidance provided in NUREG/CR-6410 (*Nuclear Fuel Cycle Facility Accident Analysis Handbook*, 1998) and in DOE-HDBK-3010-94 (*Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*, 1994). However, as a verification of this approach, three additional calculations are performed: 1) an estimate of the doses from submersion in the plume following the accident (to calculate the TEDE from the release), 2) an estimate of thyroid doses from radioiodine in the plume, and 3) an estimate of the doses from environmental pathways following deposition of material from the plume using the RESRAD computer program.

The revised accident analysis evaluates the potential inhalation dose to an individual located at two distances downwind: at 500 m (representing the nearest distance from a canister to the OCA fence), and at 3,219 m (representing the location of the nearest resident). For these revised calculations, the respirable fraction of the material released for all radionuclides is assumed to be 1.0. Inhalation committed effective dose equivalent factors and external dose conversion factors for submersion in air for the radionuclides that are greater than 0.1% of the

activity present in the fuel (plus radioiodine) were obtained from the EPA Federal Guidance Report Nos. 11 (1988) and 12 (1993). No correction is made for the amount of time the wind blows in a given direction over the 30-day release period. The accident X/Q values were estimated using a wind speed of 1m/s and atmospheric stability Class F, which is consistent with the guidance in ISG-5. The resulting values are: 1.94E-3 s/m^3 at 500 m downwind, and 9.42E-5 s/m^3 at 3,219 m downwind.

The release and dose estimates for plume passage were conducted using simple calculations and spreadsheet software. A printout of the calculations is shown in Tables 1 through 8 (attached) for downwind distances of 500 m and 3,219 m. For 500 m downwind, Table 1 shows the resulting inhalation CEDE as 74.7 mrem/y and Table 2 shows the effective dose from external exposure during submersion in the plume as 0.153 mrem. The resulting TEDE at 500 m downwind is 74.9 mrem/y, as shown in Table 3. The estimated dose to thyroid from I-129 at 500 m downwind is 0.0234 mrem, as shown in Table 4. For 3,219 m downwind, Table 5 shows the inhalation CEDE as 3.63 mrem/y, and Table 6 shows the effective dose from external exposure during submersion in the plume as 0.00743 mrem. The resulting TEDE at 3,219 m downwind is 3.64 mrem/y, as shown in Table 7. The estimated dose to thyroid from I-129 at 3,219 m downwind is 0.00114 mrem, as shown in Table 8. The radionuclide that contributes the largest amount to the TEDEs in the radionuclide mixture is Co-60 at both downwind distances. Both of the estimated TEDEs are a small fraction of the 0.05 Sv (5 rem) accident limit imposed by 10 CFR 72.106 (b) (i.e., 75 mrem/y is about 1.5% of the 5 rem limit). In addition, the estimated thyroid doses are a small fraction of the 0.5 Sv (50 rem) individual organ limit from 10 CFR 72.106(b) (i.e., 0.0234 mrem is a very small fraction of the 50 rem limit). Because of the small doses that result from the accidental releases, and because these doses are a small fraction of the regulatory limit, it is obvious that doses to the eye, skin, extremities, and internal organs would not exceed their respective limits of 0.15 Sv (15 rem) and 0.5 Sv (50 rem).

As an evaluation of the potential doses from environmental pathways following deposition of material in the plume, a pathway analysis using the RESRAD computer program was next conducted. The first step of this evaluation was to estimate the amount of material deposited on the ground from the plume. This estimate was made assuming that the effluent concentration in a given sector is uniform across the sector at a given distance, as described in Regulatory Guide 1.111 (1977). Using a straight-line trajectory model, this approach requires that the relative deposition rate should be divided by the arc length of the sector at the given downwind distance being considered to estimate deposition. The values of relative deposition (m^{-1}) were obtained from Figure 6 of Regulatory Guide 1.111, with resulting values of 8.0 E-5 m^{-1} at 500 m, and 2.3E-5 m^{-1} at 3,219 m, downwind. As shown in Tables 1 and 5, the deposition estimates were made for each of the radionuclides in the source term. These values, in units of pCi/m^2, were next modified to units of pCi/g to match the input requirements of the RESRAD computer program, by assuming a soil density of 1.5 E+6 g/m^3 and an effective soil depth of 1 cm.

The exposure scenario considered in the RESRAD analysis includes direct exposure to contaminated ground, inhalation of resuspended radioactive material, ingestion of milk and beef following grazing, and ingestion of soil. This scenario is considered to be a conservative

representation of the land use conditions and environment of the land surrounding the PFSF. Since the 500 m downwind location is considered to be along the OCA fence line, it is not possible for an individual to continuously occupy this location. Therefore, for purposes of calculation, an exposure duration of 2,000 h/y is assumed at 500 m downwind. Although natural vegetation at the facility is quite sparse, it is conservatively assumed that the RESRAD default values for fodder intake are met both for the dairy and beef cattle. Default values for human consumption shown in RESRAD for air, milk, beef, and soil were assumed. The default values include inhalation of 1,918 m^3 of air (over 2,000 h/y) with a mass loading factor for air of 2.0E-4 g/m^3, ingestion of 92 L/y of milk, ingestion of 63 kg/y of beef, and ingestion of 36.5 g/y of soil. The same scenario is evaluated at a downwind distance of 3,219 m, except that continuous exposure (8760 h/y) is assumed since this is the location of the nearest resident. The resulting TEDEs for these accident cases were: 2.67 mrem/y at 500 m downwind, and 0.522 mrem/y at 3,219 m downwind. Both of these doses are quite small compared to the 0.05 Sv (5 rem) accident limit imposed by 10 CFR 72.106(b). The dominant exposure pathway is external exposure to contaminated land and the radionuclide with the largest contribution to the dose is Co-60. From this analysis, it is concluded that these doses are sufficiently small compared to the inhalation TEDEs from plume passage (about 4% at 500 m and about 14% at 3,219 m) that they can justifiably be ignored in the accident analysis.

Finally, the doses presented here are likely overestimates of the doses that would potentially result from the estimated airborne releases over a 30-day period since this analysis assumes that the wind blows in a constant direction for 30 days. Variation of wind direction over the release period would reduce the magnitude of the estimated doses downwind.

References:

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- Federal Guidance Report No. 12. September 1993. *External Exposure to Radionuclides in Air, Water, and Soil.* U.S. Environmental Protection Agency, Washington, D.C.
- Federal Guidance Report No. 11. September 1988. *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion.* U.S. Environmental Protection Agency, Washington, D.C.
- NUREG-1140 (McGuire, S.). January 1988. *A Regulatory Analysis on Emergency Preparedness for Fuel Cycle and Other Radioactive Material Licensees*, U.S. Nuclear Regulatory Commission, Washington D.C.
- NUREG/CR-6410. March 1998. *Nuclear Fuel Cycle Facility Accident Analysis Handbook.* Prepared for the U.S. Nuclear Regulatory Commission by Science Applications International Corporation, Washington, D.C.
- Regulatory Guide 1.111. July 1977. *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors.* U.S. Nuclear Regulatory Commission, Washington, D.C.

Table 1 SNC TranStor Cask with BWR Fuel Accident Conditions: Committed Effective Dose Equivalent From Inhalation Plus Deposition Estimates (uCi/m2) at 500 m Downwind

Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Fraction Released per second	Release Fraction	Release Rate (Ci/s)	X/Q (s/m3)	Breathing Rate (m3/s)	DCF (Sv/Bq)	DCF (mrem/uCi)	Exposure Duration (s)	Inhalation CEDE (mrem/y)	Deposition at 500 m (Ci/m2)	Deposition at 500 m Depth = 0.01 m (pCi/g)
									Gases						
H-3	7.96E+01	61	5.71E+06	1.00E-04	1.75E-11	0.3	2.55E-08	1.94E-03	3.30E-04	1.73E-11	6.40E-02	2.59E+06	2.71E-03	2.70E-08	1.80E+00
I-129	7.64E-03	61	5.71E+06	1.00E-04	1.75E-11	0.3	2.45E-12	1.94E-03	3.30E-04	4.69E-08	1.74E+02	2.59E+06	7.05E-04	2.59E-12	1.73E-04
Kr-85	1.30E+03	61	5.71E+06	1.00E-04	1.75E-11	0.3	4.17E-07	1.94E-03	3.30E-04	0.00E+00	0.00E+00	2.59E+06	0.00E+00	4.41E-07	2.94E+01
									Crud						
Co-60	6.00E+01	61	5.71E+06	1.00E-04	1.75E-11	1	6.41E-08	1.94E-03	3.30E-04	5.91E-08	2.19E+02	2.59E+06	2.33E+01	6.78E-08	4.52E+00
									Volatiles						
Sr-90	1.46E+04	61	5.71E+06	1.00E-04	1.75E-11	2.00E-04	3.12E-09	1.94E-03	3.30E-04	3.51E-07	1.30E+03	2.59E+06	6.72E+00	3.30E-09	2.20E-01
Ru-106	1.85E+03	61	5.71E+06	1.00E-04	1.75E-11	2.00E-04	3.95E-10	1.94E-03	3.30E-04	1.29E-07	4.77E+02	2.59E+06	3.13E-01	4.18E-10	2.79E-02
Cs-134	4.77E+03	61	5.71E+06	1.00E-04	1.75E-11	2.00E-04	1.02E-09	1.94E-03	3.30E-04	1.25E-08	4.63E+01	2.59E+06	7.82E-02	1.08E-09	7.19E-02
Cs-137	2.20E+04	61	5.71E+06	1.00E-04	1.75E-11	2.00E-04	4.70E-09	1.94E-03	3.30E-04	8.63E-09	3.19E+01	2.59E+06	2.49E-01	4.97E-09	3.31E-01
									Fines						
Pu-241	1.85E+04	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	5.93E-10	1.94E-03	3.30E-04	2.23E-06	8.25E+03	2.59E+06	8.12E+00	6.27E-10	4.18E-02
Y-90	1.46E+04	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	4.68E-10	1.94E-03	3.30E-04	2.28E-09	8.44E+00	2.59E+06	6.55E-03	4.95E-10	3.30E-02
Pm-147	6.37E+03	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.04E-10	1.94E-03	3.30E-04	1.06E-08	3.92E+01	2.59E+06	1.33E-02	2.16E-10	1.44E-02
Ce-144	8.39E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.69E-11	1.94E-03	3.30E-04	1.01E-07	3.74E+02	2.59E+06	1.67E-02	2.84E-11	1.90E-03
Pr-144	8.39E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.69E-11	1.94E-03	3.30E-04	1.17E-11	4.33E-02	2.59E+06	1.93E-06	2.84E-11	1.90E-03
Eu-154	8.98E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.88E-11	1.94E-03	3.30E-04	7.73E-08	2.86E+02	2.59E+06	1.37E-02	3.04E-11	2.03E-03
Cm-244	8.66E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.78E-11	1.94E-03	3.30E-04	6.70E-05	2.48E+05	2.59E+06	1.14E+01	2.94E-11	1.96E-03
Pu-238	7.12E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.28E-11	1.94E-03	3.30E-04	1.06E-04	3.92E+05	2.59E+06	1.49E+01	2.41E-11	1.61E-03
Sb-125	5.04E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	1.62E-11	1.94E-03	3.30E-04	3.30E-09	1.22E+01	2.59E+06	3.27E-04	1.71E-11	1.14E-03
Eu-155	2.93E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	9.39E-12	1.94E-03	3.30E-04	1.12E-08	4.14E+01	2.59E+06	6.46E-04	9.93E-12	6.62E-04
Am-241	2.37E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	7.60E-12	1.94E-03	3.30E-04	1.20E-04	4.44E+05	2.59E+06	5.60E+00	8.03E-12	5.36E-04
Pu-240	1.21E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	3.88E-12	1.94E-03	3.30E-04	1.16E-04	4.29E+05	2.59E+06	2.76E+00	4.10E-12	2.73E-04
Pu-239	5.53E+01	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	1.77E-12	1.94E-03	3.30E-04	1.16E-04	4.29E+05	2.59E+06	1.26E+00	1.87E-12	1.25E-04
												Total:	**7.47E+01**		

Table 2 SNC TranStor Cask with BWR Fuel Accident Conditions: Effective Dose - External Exposure from Submersion at 500 m Downwind

Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Fraction Released per second	Release Fraction	Release Rate (Ci/s)	Release (Ci)	X/Q (s/m3)	Exposure Duration (s)	DCF (Sv m3/Bq s)	DCF (mrem m3/uCi s)	Effective Dose (mrem)
H-3	7.96E+01	61	5.71E+06	1.00E-04	1.75E-11	0.3	2.55E-08	6.61E-02	1.94E-03	2.59E+06	3.31E-19	1.22E-09	1.57E-07
I-129	7.64E-03	61	5.71E+06	1.00E-04	1.75E-11	0.3	2.45E-12	6.34E-06	1.94E-03	2.59E+06	3.80E-16	1.41E-06	1.73E-08
Kr-85	1.30E+03	61	5.71E+06	1.00E-04	1.75E-11	0.3	4.17E-07	1.08E+00	1.94E-03	2.59E+06	1.19E-16	4.40E-07	9.22E-04
Co-60	6.00E+01	61	5.71E+06	1.00E-04	1.75E-11	1	6.41E-08	1.66E-01	1.94E-03	2.59E+06	1.26E-13	4.66E-04	1.50E-01
Sr-90	1.46E+04	61	5.71E+06	1.00E-04	1.75E-11	2.00E-04	3.12E-09	8.08E-03	1.94E-03	2.59E+06	7.53E-18	2.79E-08	4.37E-07
Ru-106	1.85E+03	61	5.71E+06	1.00E-04	1.75E-11	2.00E-04	3.95E-10	1.02E-03	1.94E-03	2.59E+06	0.00E+00	0.00E+00	0.00E+00
Cs-134	4.77E+03	61	5.71E+06	1.00E-04	1.75E-11	2.00E-04	1.02E-09	2.64E-03	1.94E-03	2.59E+06	7.57E-14	2.80E-04	1.43E-03
Cs-137	2.20E+04	61	5.71E+06	1.00E-04	1.75E-11	2.00E-04	4.70E-09	1.22E-02	1.94E-03	2.59E+06	7.74E-18	2.86E-08	6.76E-07
Ba-137m	2.20E+04	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	7.05E-10	1.83E-03	1.94E-03	2.59E+06	2.88E-14	1.07E-04	3.78E-04
Pu-241	1.85E+04	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	5.93E-10	1.54E-03	1.94E-03	2.59E+06	7.25E-20	2.68E-10	7.99E-10
Y-90	1.46E+04	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	4.68E-10	1.21E-03	1.94E-03	2.59E+06	1.90E-16	7.03E-07	1.65E-06
Pm-147	6.37E+03	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.04E-10	5.29E-04	1.94E-03	2.59E+06	6.93E-19	2.56E-09	2.63E-09
Rh-106	1.85E+03	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	5.93E-11	1.54E-04	1.94E-03	2.59E+06	1.04E-14	3.85E-05	1.15E-05
Ce-144	8.39E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.69E-11	6.96E-05	1.94E-03	2.59E+06	8.53E-16	3.16E-06	4.26E-07
Pr-144	8.39E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.69E-11	6.96E-05	1.94E-03	2.59E+06	1.95E-15	7.22E-06	9.75E-07
Eu-154	8.98E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.88E-11	7.45E-05	1.94E-03	2.59E+06	6.14E-14	2.27E-04	3.29E-05
Cm-244	8.66E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.78E-11	7.19E-05	1.94E-03	2.59E+06	4.91E-18	1.82E-08	2.53E-09
Pu-238	7.12E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.28E-11	5.91E-05	1.94E-03	2.59E+06	4.88E-18	1.81E-08	2.07E-09
Sb-125	5.04E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	1.62E-11	4.18E-05	1.94E-03	2.59E+06	2.02E-14	7.47E-05	6.07E-06
Eu-155	2.93E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	9.39E-12	2.43E-05	1.94E-03	2.59E+06	2.49E-15	9.21E-06	4.35E-07
Am-241	2.37E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	7.60E-12	1.97E-05	1.94E-03	2.59E+06	8.18E-16	3.03E-06	1.16E-07
Pu-240	1.21E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	3.88E-12	1.00E-05	1.94E-03	2.59E+06	4.75E-18	1.76E-08	3.43E-10
Pu-239	5.53E+01	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	1.77E-12	4.59E-06	1.94E-03	2.59E+06	4.24E-18	1.57E-08	1.40E-10
												Total:	**1.53E-01**

Table 3 SNC TranStor Cask with BWR Fuel Accident

Total Effective Dose Equivalent at 500 m Downwind

External Dose (mrem/y)	Plus	Inhalation CEDE (mrem/y)	Equals	TEDE (mrem/y)
1.53E-01	Plus	7.47E+01	Equals	**7.49E+01**

Table 4 SNC TranStor Cask with BWR Fuel Accident Thyroid Dose at 500 m Downwind

Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Fraction Released per second	Release Fraction	Release Rate (Ci/s)	Release (Ci)	X/Q (s/m3)	Breathing Rate (m3/s)	Exposure Duration (s)	Thyroid DCF (Sv/Bq)	Thyroid DCF (mrem/uCi)	Thyroid Dose (mrem)
I-129	7.64E-03	61	5.71E+06	1.00E-04	1.75E-11	0.3	2.45E-12	6.34E-06	1.94E-03	3.30E-04	2.59E+06	1.56E-06	5.77E+03	**2.34E-02**

Table 5 SNC TranStor Cask with BWR Fuel Accident Conditions: Committed Effective Dose Equivalent From Inhalation Plus Deposition Estimates (uCi/m2) at 3,219 m Downwind

Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Fraction Released per second	Release Fraction	Release Rate (Ci/s)	X/Q (s/m3)	Breathing Rate (m3/s)	DCF (Sv/Bq)	DCF (mrem/uCi)	Exposure Duration (s)	Inhalation CEDE (mrem/y)	Deposition at 3,219 m (Ci/m2)	Deposition at 3,219 m Depth = 0.01 m (pCi/g)
									Gases						
H-3	7.96E+01	61	5.71E+06	1.00E-04	1.75E-11	0.3	2.55E-08	9.42E-05	3.30E-04	1.73E-11	6.40E-02	2.59E+06	1.32E-04	1.20E-09	8.02E-02
I-129	7.64E-03	61	5.71E+06	1.00E-04	1.75E-11	0.3	2.45E-12	9.42E-05	3.30E-04	4.69E-08	1.74E+02	2.59E+06	3.42E-05	1.15E-13	7.70E-06
Kr-85	1.30E+03	61	5.71E+06	1.00E-04	1.75E-11	0.3	4.17E-07	9.42E-05	3.30E-04	0.00E+00	0.00E+00	2.59E+06	0.00E+00	1.96E-08	1.31E+00
									Crud						
Co-60	6.00E+01	61	5.71E+06	1.00E-04	1.75E-11	1	6.41E-08	9.42E-05	3.30E-04	5.91E-08	2.19E+02	2.59E+06	1.13E+00	3.02E-09	2.02E-01
									Volatiles						
Sr-90	1.46E+04	61	5.71E+06	1.00E-04	1.75E-11	2.00E-04	3.12E-09	9.42E-05	3.30E-04	3.51E-07	1.30E+03	2.59E+06	3.26E-01	1.47E-10	9.81E-03
Ru-106	1.85E+03	61	5.71E+06	1.00E-04	1.75E-11	2.00E-04	3.95E-10	9.42E-05	3.30E-04	1.29E-07	4.77E+02	2.59E+06	1.52E-02	1.86E-11	1.24E-03
Cs-134	4.77E+03	61	5.71E+06	1.00E-04	1.75E-11	2.00E-04	1.02E-09	9.42E-05	3.30E-04	1.25E-08	4.63E+01	2.59E+06	3.80E-03	4.81E-11	3.20E-03
Cs-137	2.20E+04	61	5.71E+06	1.00E-04	1.75E-11	2.00E-04	4.70E-09	9.42E-05	3.30E-04	8.63E-09	3.19E+01	2.59E+06	1.21E-02	2.22E-10	1.48E-02
									Fines						
Pu-241	1.85E+04	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	5.93E-10	9.42E-05	3.30E-04	2.23E-06	8.25E+03	2.59E+06	3.94E-01	2.80E-11	1.86E-03
Y-90	1.46E+04	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	4.68E-10	9.42E-05	3.30E-04	2.28E-09	8.44E+00	2.59E+06	3.18E-04	2.21E-11	1.47E-03
Pm-147	6.37E+03	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.04E-10	9.42E-05	3.30E-04	1.06E-08	3.92E+01	2.59E+06	6.45E-04	9.63E-12	6.42E-04
Ce-144	8.39E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.69E-11	9.42E-05	3.30E-04	1.01E-07	3.74E+02	2.59E+06	8.10E-04	1.27E-12	8.45E-05
Pr-144	8.39E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.69E-11	9.42E-05	3.30E-04	1.17E-11	4.33E-02	2.59E+06	9.38E-08	1.27E-12	8.45E-05
Eu-154	8.98E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.88E-11	9.42E-05	3.30E-04	7.73E-08	2.86E+02	2.59E+06	6.63E-04	1.36E-12	9.05E-05
Cm-244	8.66E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.78E-11	9.42E-05	3.30E-04	6.70E-05	2.48E+05	2.59E+06	5.54E-01	1.31E-12	8.73E-05
Pu-238	7.12E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.28E-11	9.42E-05	3.30E-04	1.06E-04	3.92E+05	2.59E+06	7.21E-01	1.08E-12	7.17E-05
Sb-125	5.04E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	1.62E-11	9.42E-05	3.30E-04	3.30E-09	1.22E+01	2.59E+06	1.59E-05	7.62E-13	5.08E-05
Eu-155	2.93E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	9.39E-12	9.42E-05	3.30E-04	1.12E-08	4.14E+01	2.59E+06	3.14E-05	4.43E-13	2.95E-05
Am-241	2.37E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	7.60E-12	9.42E-05	3.30E-04	1.20E-04	4.44E+05	2.59E+06	2.72E-01	3.58E-13	2.39E-05
Pu-240	1.21E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	3.88E-12	9.42E-05	3.30E-04	1.16E-04	4.29E+05	2.59E+06	1.34E-01	1.83E-13	1.22E-05
Pu-239	5.53E+01	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	1.77E-12	9.42E-05	3.30E-04	1.16E-04	4.29E+05	2.59E+06	6.13E-02	8.36E-14	5.57E-06
												Total:	**3.63E+00**		

Table 6 SNC TranStor Cask with BWR Fuel Accident Conditions: Effective Dose - External Exposure from Submersion at 3,219 m Downwind

Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Fraction Released per second	Release Fraction	Release Rate (Ci/s)	Release (Ci)	X/Q (s/m3)	Exposure Duration (s)	DCF (Sv m3/Bq s)	DCF (mrem m3/uCi s)	Effective Dose (mrem)
H-3	7.96E+01	61	5.71E+06	1.00E-04	1.75E-11	0.3	2.55E-08	6.61E-02	9.42E-05	2.59E+06	3.31E-19	1.22E-09	7.62E-09
I-129	7.64E-03	61	5.71E+06	1.00E-04	1.75E-11	0.3	2.45E-12	6.34E-06	9.42E-05	2.59E+06	3.80E-16	1.41E-06	8.40E-10
Kr-85	1.30E+03	61	5.71E+06	1.00E-04	1.75E-11	0.3	4.17E-07	1.08E+00	9.42E-05	2.59E+06	1.19E-16	4.40E-07	4.48E-05
Co-60	6.00E+01	61	5.71E+06	1.00E-04	1.75E-11	1	6.41E-08	1.66E-01	9.42E-05	2.59E+06	1.26E-13	4.66E-04	7.29E-03
Sr-90	1.46E+04	61	5.71E+06	1.00E-04	1.75E-11	2.00E-04	3.12E-09	8.08E-03	9.42E-05	2.59E+06	7.53E-18	2.79E-08	2.12E-08
Ru-106	1.85E+03	61	5.71E+06	1.00E-04	1.75E-11	2.00E-04	3.95E-10	1.02E-03	9.42E-05	2.59E+06	0.00E+00	0.00E+00	0.00E+00
Cs-134	4.77E+03	61	5.71E+06	1.00E-04	1.75E-11	2.00E-04	1.02E-09	2.64E-03	9.42E-05	2.59E+06	7.57E-14	2.80E-04	6.96E-05
Cs-137	2.20E+04	61	5.71E+06	1.00E-04	1.75E-11	2.00E-04	4.70E-09	1.22E-02	9.42E-05	2.59E+06	7.74E-18	2.86E-08	3.28E-08
Ba-137m	2.20E+04	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	7.05E-10	1.83E-03	9.42E-05	2.59E+06	2.88E-14	1.07E-04	1.83E-05
Pu-241	1.85E+04	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	5.93E-10	1.54E-03	9.42E-05	2.59E+06	7.25E-20	2.68E-10	3.88E-11
Y-90	1.46E+04	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	4.68E-10	1.21E-03	9.42E-05	2.59E+06	1.90E-16	7.03E-07	8.03E-08
Pm-147	6.37E+03	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.04E-10	5.29E-04	9.42E-05	2.59E+06	6.93E-19	2.56E-09	1.28E-10
Rh-106	1.85E+03	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	5.93E-11	1.54E-04	9.42E-05	2.59E+06	1.04E-14	3.85E-05	5.57E-07
Ce-144	8.39E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.69E-11	6.96E-05	9.42E-05	2.59E+06	8.53E-16	3.16E-06	2.07E-08
Pr-144	8.39E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.69E-11	6.96E-05	9.42E-05	2.59E+06	1.95E-15	7.22E-06	4.73E-08
Eu-154	8.98E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.88E-11	7.45E-05	9.42E-05	2.59E+06	6.14E-14	2.27E-04	1.60E-06
Cm-244	8.66E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.78E-11	7.19E-05	9.42E-05	2.59E+06	4.91E-18	1.82E-08	1.23E-10
Pu-238	7.12E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	2.28E-11	5.91E-05	9.42E-05	2.59E+06	4.88E-18	1.81E-08	1.01E-10
Sb-125	5.04E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	1.62E-11	4.18E-05	9.42E-05	2.59E+06	2.02E-14	7.47E-05	2.95E-07
Eu-155	2.93E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	9.39E-12	2.43E-05	9.42E-05	2.59E+06	2.49E-15	9.21E-06	2.11E-08
Am-241	2.37E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	7.60E-12	1.97E-05	9.42E-05	2.59E+06	8.18E-16	3.03E-06	5.61E-09
Pu-240	1.21E+02	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	3.88E-12	1.00E-05	9.42E-05	2.59E+06	4.75E-18	1.76E-08	1.66E-11
Pu-239	5.53E+01	61	5.71E+06	1.00E-04	1.75E-11	3.00E-05	1.77E-12	4.59E-06	9.42E-05	2.59E+06	4.24E-18	1.57E-08	6.78E-12
												Total:	**7.43E-03**

Table 7 SNC TranStor Cask with BWR Fuel Accident

Total Effective Dose Equivalent at 3,219 m Downwind

External Dose (mrem/y)	Plus	Inhalation CEDE (mrem/y)	Equals	TEDE (mrem/y)
7.43E-03	Plus	3.63E+00	Equals	**3.64E+00**

Table 8 SNC TranStor Cask with BWR Fuel Accident Thyroid Dose at 3,219 m Downwind

Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Fraction Released per second	Release Fraction	Release Rate (Ci/s)	Release (Ci)	X/Q (s/m3)	Breathing Rate (m3/s)	Exposure Duration (s)	Thyroid DCF (Sv/Bq)	Thyroid DCF (mrem/uCi)	Thyroid Dose (mrem)
I-129	7.64E-03	61	5.71E+06	1.00E-04	1.75E-11	0.3	2.45E-12	6.34E-06	9.42E-05	3.30E-04	2.59E+06	1.56E-06	5.77E+03	**1.14E-03**