Exhibit 2

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 $\mu Ci/cm^2$ crud surface activity for PWR rods and the 1254 $\mu Ci/cm^2$ 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:

- DOE-HDBK-3010-94. December 1994. *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities.* U.S. Department of Energy, Washington, D.C.
- 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 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 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**

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

CERTIFICATE OF SERVICE

I hereby certify that copies of the Applicant's Motion for Summary Disposition Of Utah Contention C – Failure to Demonstrate Compliance with NRC Dose Limits, Statement Of Material Facts on Which No Genuine Dispute Exists and Affidavit of William Hennessy 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 21st day of April 1999.

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