RAS 2062

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	Docket No. 72-22-ISFSI
PRIVATE FUEL STORAGE, LLC	)	ASLBP No. 97-732-02-ISFSI
(Independent Spent Fuel Storage Installation)	)	August 2, 2000

STATE OF UTAH'S REQUEST FOR ADMISSION OF LATE-FILED CONTENTIONS UTAH LL THROUGH OO
(Relating to the DEIS's analysis of spent fuel transportation risks)
(Non-proprietary Version)

Pursuant to 10 CFR § 2.714, the State of Utah hereby seeks the admission of late-filed Utah Contentions LL through OO which challenge the failure of the draft Environmental Impact Statement[1] ("DEIS") to accurately assess risks posed by transportation of spent fuel to the PFS facility.[2]

The State meets the late-filed factors and, for the reasons stated below, the State requests the Board to admit Utah Contentions LL through OO. These contentions are

[1] NUREG -1714, *Draft Environmental Impact Statement for the Construction and Operation of an Independent Spent Fuel Storage Installation on the Reservation of the Skull Valley Band of Goshute Indians and the Related Transportation Facility in Tooele County, Utah*, June 2000.

[2] The Board has set a 15 page limit for "a motion to admit a late-file contention...." Memorandum and Order (Granting Page Limit Extension and Providing Additional Pages for Late-Filed Contention Motions, dated February 9, 2000 at 2 (*emphasis added*)), reasoning that a party may need ten pages for the contention and five to address the late filed factors. As the Board referred to contention in the singular, the State reads the Board's Order to allow more than 15 pages when filing four late filed contentions in the one document. Thus, this 26 page pleading requesting admission of four late-filed contentions meets the intent of the Board's Order.

Template = SECY-037

SECY-02

supported by the Declaration of Dr. Martin Resnikoff, attached hereto as Exhibit 1.

I. INTRODUCTION

These contentions pertain to the transportation analysis sections of the DEIS, Chapter 5 and Appendices C and D, for the proposed PFS facility in Skull Valley, Utah (NUREG-1714). The Staff's analysis evaluates the impact of incident-free transport and accidents in transporting half the nation's commercial irradiated fuel to the PFS facility, by studying and generalizing the specific case of shipping irradiated fuel from the Maine Yankee reactor to the proposed PFS facility in Skull Valley. The DEIS transportation analysis was prepared by NRC contractor Science Applications (SAIC, Oak Ridge).

The transportation analysis in the DEIS bears little resemblance to and hardly relies on the PFS Environmental Report ("ER"). As set forth in the State's original Contention V, the analysis in the ER was completely inadequate because it relied on Table S-4, which is in turn based on grossly outdated and inadequate transportation analyses. State of Utah's Contentions on the Construction and Operating License Application by Private Fuel Storage, LLC for an Independent Spent Fuel Storage Facility ("State's Contentions") (November 23, 1998), at 144-161. Although the NRC Staff vigorously opposed the admissibility of Contention V, the DEIS generally adopts the methodology and scope demanded by the State in Contention V, particularly the use of the RADTRAN 4 computer model in place of reliance on Table S-4. Nevertheless, the NRC's analysis is deficient in numerous significant respects.

First, DEIS underestimates the risks posed by transportation of spent fuel to the PFS facility because it ignores the impacts on incident-free transportation of intermodal transfer

from trucks to railheads near reactor sites. Second, the DEIS does not describe the type of railroad cars to be used for transporting casks to the PFS facility, or evaluate the accident risks posed by putting extremely heavy loads on the rails. Third, the DEIS underestimates the risk of the most severe category of accident by understating both the probability and the consequences. Finally, the DEIS does not calculate the environmental impacts of a maximum credible accident nor does it address economic risks or consequences of a transportation accident.

II. LEGAL DISCUSSION

A. The DEIS Contains Data and Methodologies That Differ Significantly from the Environmental Report.

Pursuant to 10 C.F.R. § 2.714(b)(2)(iii), environmental contentions must be based in the first instance on the applicant's environmental report. The Commission will consider new or amended environmental contentions, however, "if there are data or conclusions in the NRC draft or final environmental impact statement . . . that differ significantly from the data or conclusions in the applicant's document." In this case, both the methodology and the data used in the DEIS differ significantly from the ER. Rather than employing the outdated and generic report, WASH-1238, "Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants," published in 1972, as the Applicant has done in the ER, the DEIS utilizes the RADTRAN 4 computer model to model specific routes, and the population zones and radiation risks along each route.

RADTRAN is a computer model developed by Sandia National Laboratories to estimate population risks associated with the transportation of radioactive material. The first

version of RADTRAN was issued in the late 1970s. In the context that it was used for the DEIS, the term "risk" has special meaning; it refers to the product of the probability of a given event and its likely consequences, summed up over the entire range of possible events. That is, the RADTRAN 4 computer code was used in the DEIS to calculate an expected risk to populations over the duration of the transportation campaign.

RADTRAN 4 also includes an economic model designed to provide order of magnitude estimates for the financial impact of transportation accidents involving a release of radioactive material. It estimates, based on the calculated concentration of radioactive material following an accident, the cost of emergency response, surveying, evacuation, and cleanup. The assumptions and methodology are contained in the technical manual[3] for RADTRAN 4.

Using the RADTRAN 4 model, the Staff compares the calculated impacts to its most recent generic transportation analysis, NUREG-170, prepared in 1976. This is the same type of analysis conducted in NUREG-1437, Addendum 1, "Generic Environmental Impact Statement of License Renewal of Nuclear Plants," August 1999, which employs RADTRAN 4. NUREG-1437 analyzes the cumulative impacts of transporting commercial irradiated fuel through Nevada, akin to the cumulative impact of transporting half the nation's commercial irradiated fuel through Utah.

There are great differences between the DEIS and the Applicant's ER with respect to transportation of spent fuel. The ER addresses the transportation-related impacts of the

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[3] SAND89-2370, Neuhauser, K.S. and Kanipe, F.L., "RADTRAN 4 Volume II: Technical Manual," Revision 1 (March 1995).

ISFSI in Sections 4.7 (radioactive material movement) and 5.2 (transportation accidents). According to the Applicant, the environmental impacts of spent fuel transportation are addressed in 10 C.F.R. § 51.52 and the accompanying Table S-4. ER at 4.7-1, 5.2. The ER uses the numerical values in Table S-4 for its evaluation of the transportation-related environmental impacts of the proposed ISFSI, claiming that these values are conservative with respect to the scope of activities of he PFS facility. Id. The generic impact of shipping irradiated fuel from a reactor to a final repository or reprocessing plant is then multiplied by the number of expected shipments to determine the generic cumulative impact.

Table S-4 makes many assumptions that are different from the assumptions used in the DEIS. For instance, based on WASH-1238, Table S-4 assumes a transportation distance of 1,000 miles and calculates a total dose to the crew of 1.2 person-rems. In contrast, the DEIS uses the distance between the PFS facility and the Maine Yankee reactor, which is 2,781 miles. DEIS at.5-39. For the general public along transportation routes at a rest stop, WASH-1238 assumes ten persons spend an average of 3 minutes at an average distance of 3 feet. RADTRAN assumes persons will be exposed as passengers, crew, and handlers during storage and stops, both on and off route. Assumptions for specific shipments are input into the RADTRAN program. Based on standard assumptions for the Maine Yankee shipment, the DEIS estimates incident-free radiological consequences of 10.4 person-rems/year if shipments are completely by rail from reactor sites to the PFS facility, and 23 person-rems/year if fuel is transferred to the PFS facility via an intermodal transfer facility at Timpie. DEIS at 5-37.

The assumptions underlying the dose analysis differ in Table S-4 and in the DEIS.

Table S-4 estimates a population dose of 1.8 x 10^{-5} person-rems/cask mile. In contrast, the Staff estimates that, over the 20 years of shipping fuel to PFS, the population dose will be 23 x 20 or 460 person-rems if an intermodal transfer is used at Timpie, and 10.4 x 20 or 208 person-rems if the fuel is shipped directly to the PFS facility by rail. DEIS at 5-46. Since the total distance over a 20 year period is given in the DEIS as 2.1 x 10^{6} miles and there are 4 casks per train, the total incident-free dose calculated using Table S-4 is 152 person-rems. DEIS at 5-37. Further, WASH-1238 assumes 300,000 persons reside along the 1,000 mile route, whereas the DEIS assumes that almost 1.25 million persons will reside along the Maine Yankee route by the year 2020. DEIS at 5-40.

There are other differences in assumptions between Table S-4 and the DEIS. Table S-4 assumes that a cask will weigh 70 to 100 tons, but the Applicant's ER assumes that the cask plus rail carriage will weigh more than 211 tons. WASH-1238 assumes 7 PWR fuel assemblies in a rail cask, and 650 curies of fission products released in the event of a serious accident. In contrast, the DEIS assumes a cask containing 24 PWR fuel assemblies, with a release of 3,300 curies of cesium in the event of a severe accident. In addition, other radionuclides as semi-volatiles, gases and particulates would also be released in a severe accident, including up to 520 curies of Cobalt-60. To this end, the DEIS (Appendix D) provides a listing of "physical/chemical group" and "dispersibility category" for each radionuclide, and calculates releases for volatiles, gases and particulates. The DEIS then uses RADTRAN 4 to multiply the probabilities and consequences of credible accidents to arrive at a specific risk estimate. In contrast, Table S-4 does not calculate the risk of an accident, but instead concludes that it is small without any analysis.

In addition to the difference in assumptions, the methodology used in the DEIS is radically different from the methodology used in the ER. For an accident, Table S-4 assumes the probability is so small that the risk does not have to be calculated. In order to calculate incident-free transportation doses, the Applicant in the ER simply multiplies the numbers in Table S-4 for shipments from a reactor to a final repository or reprocessing plant by the expected number of shipments from reactors to PFS. In evaluating incident-free transportation doses, in contrast, the DEIS evaluates a specific route, from Maine Yankee to the PFS facility, taking into account the fraction of urban, suburban, and rural populations along a specific route.

Based on the above discussion, it is obvious that the data and conclusions in the DEIS differ significantly from the data and conclusions in the Applicant's ER. The contentions presented below are based on those differences and thus comply with 10 CFR § 2.714(b)(2)(iii).

B. An EIS Must Be Adequate to Support Agency Decisionmaking

NEPA requires federal agencies[4] to examine the environmental consequences of their actions, before taking those actions, in order to ensure "that important effects will not be overlooked or underestimated only to be discovered after resources have been committed or the die otherwise cast." Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 349 (1989). In order for an EIS to serve its function of informing decision makers and the

[4] The courts have confirmed that NEPA applies to major federal action proposed by all federal agencies, including the NRC. *See e.g.*, Baltimore Gas and Electric Co. v. Natural Resources Defenise Council, Inc., 462 U.S. 87 (1983).

public, it is "essential" that the EIS not be based on "misleading" assumptions. Hughes River Watershed Conservancy v. Agriculture Dept., 81 F.3d 437, 446 (4th Cir. 1996). Another function of NEPA is to "ensure[] that relevant information about a proposed project will be made available to members of the public so that they may play a role in both the decision making process and the implementation of the decision. Robertson, 490 U.S. at 349. Furthermore, courts have held that federal agencies must take a "hard look" at all of the significant consequences of their actions. *See e.g.*, Baltimore Gas, 462 U.S. at 97. Thus, an environmental impact statement must evaluate the environmental impacts of a project in sufficient detail to permit a meaningful analysis.

As discussed below in Contentions Utah LL through OO, the DEIS overlooks the impacts on intermodal transfer from trucks to railheads near reactor sites and thus underestimates the risks posed by transportation of spent fuel to the PFS facility. Furthermore, the DEIS has not taken a "hard look" at accident risk posed by placing extremely heavy loads on railroad cars, nor does the DEIS describe the type of cars that PFS will use. Moreover, important information has not been made available to members of the public, such as calculation of the environmental impacts of a maximum credible accident or the economic risks or consequences of a transportation accident. For these reasons, the DEIS does not satisfy NEPA.

IV. Proposed Contentions Utah LL through OO

A. Contention Utah LL. The DEIS fails to comply with the requirements of 10 CFR § 51.70 and NEPA in that it underestimates the risks posed by transportation of spent fuel

to the PFS facility, because it ignores elements of the project which affect the transportation risks. Specifically:

1. The DEIS ignores the impacts of incident-free transportation that result from the loading of fuel and from the intermodal transfer from trucks to railheads near reactor sites.

Basis: The DEIS claims to comprehensively consider the risks of transporting spent fuel by rail and intermodal transfer. DEIS at Chapter 5. However, the DEIS ignores the impacts of incident-free transportation that results from the intermodal transfer from trucks to railheads near reactor sites. The Maine Yankee-to-PFS route, chosen for specific analysis by the NRC Staff, is not representative in this respect. The Maine Yankee reactor has a rail line directly into the plant. In contrast, among the 19 other reactors owned by PFS members, 14 do not have rail access and therefore would require intermodal transfer to move spent nuclear fuel from truck to rail. Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (July 1999), U.S. Department of Energy ("Yucca Mt. DEIS") Table J-12 at 4-5. For these reactors, as well as additional reactors owned by PFS's non-member customers, irradiated fuel will have to be transported by heavy-haul truck to the nearest railhead. Because heavy-haul truck transportation involves greater incident-free radiation exposures to workers and the general public than does rail transportation, as further described below, this lack of analysis means that incident-free risks have been underestimated.

For each reactor that requires intermodal transfer from the reactor to the railhead,

the radiological impacts on workers as a result of cask loading and transfer operations would be comparable to radiological impacts at the Timpie intermodal transfer facility. Those impacts are estimated in the DEIS to be 11.98 person-rems per year. DEIS at 5-47. In addition, reactor personnel who load and seal the canisters, and who transfer the canisters to a transportation overpack would also receive doses that are not included in the DEIS. According to the DEIS, the additional occupational dose to crew members resulting from this exposure at the Timpie end of the operation is 0.50 person-rems per year. Total exposure from these two operations would be 12.48 person-rems per year. DEIS at 5-45 to 5-46.

Since the additional exposure to workers from these operations on the reactor end of the spent nuclear fuel transport will mirror exposure on the Timpie end, an equivalent amount of exposure, adjusted for the smaller number of reactors affected, should be added to the calculations. Specifically, since 14 of the 19 reactors owned by PFS members will require intermodal transfer from a heavy-haul truck to a rail line, an additional dose to crew members of 9.2 person-rems per year (14/19^{ths} of 12.48) is expected.

In addition, there would be additional radiological exposures to members of the public due to intermodal transportation from reactor sites to railheads. Heavy-haul trucks travel at much slower speeds than trains, resulting in more prolonged exposure to the surrounding population. The population dose attributed to heavy-haul transport from Timpie to the PFS facility was listed in the DEIS as 0.23 person-rems per year. DEIS at 5-45 to 5-46. This number was calculated by the Staff assuming a population density of 1.3 persons/km^2 along the heavy-haul route from Timpie to the PFS facility. Near the reactors,

the population density is expected to be much greater, closer to suburban densities. Assuming a population density of 719 persons/km^2 along the heavy-haul routes, the default suburban population density in RADTRAN 4, the increased annual population dose is therefore expected to be 719/1.3 x 0.23 person-rems or 127.2 person-rems/year. Assuming only 14 of 19 reactors require heavy-haul transport, the additional population dose due to heavy-haul transport at the reactor sites is 93.7 person-rems/yr.

Including the additional exposures arising from heavy-haul transport from reactors to railheads, the predicted increase in latent cancer fatalities from the 20-year operation is calculated to be 6 times greater than that given in the DEIS. DEIS at 5-37.[5]

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[5] The DEIS uses the conversion factors of .0005 LCFs per person-rem for exposures to the general public, and .0004 LCFs per person-rem for exposures to crew members. To determine the expected increase in LCFs over the 20 year campaign, the expected annual population doses are obtained by adding the population doses given in the DEIS to the additional population dose due to intermodal transfer at 14/19 reactor sites. Tables 1 and 2 below summarizes these results.

Table 1: Estimated Population Dose due to Intermodal Transfer at 14 Reactors and at Timpie

	Annual Dose, person-rem/year		
	Total Additional Population Dose from reactor-side ITF	**Exposure calculated in DEIS**	**Total Dose, ITF at 14/19ths of reactors and at Timpie**
General Public	93.7	9.41	103.11
Crew Members	9.20	8.83	22.9
Total	102.9	11.98	126.01

Table 2: Estimated Risk (Latent Cancer Fatalities) due to Transportation Activities, Assuming Intermodal Transfer at 14 Reactors

	Risk (LCF)/year	Total Risk (LCF) over 20 years	Risk (LCF) Presented in DEIS
General Public	.051	1.03	.0942
Crew Members	.009	.18	.109
Total	.060	1.21	.203

2. The DEIS does not describe the type of railroad cars to be used for transporting casks to the PFS facility, or evaluate the accident risks posed by putting extremely heavy loads on the rails.

Basis: The DEIS uses an average accident rate, eliminating certain minor accidents, such as grade-crossing and rail yard accidents. The standard railroad car is a two-axle trolley; therefore the accidents in this accident database will primarily relate to this standard car.

PROPRIETARY INFORMATION REDACTED

B. **Contention Utah MM.** The DEIS does not comply with the requirements of NEPA or 10 CFR § 51.70 because it underestimates the risk of the most severe category of accident by understating both the probability and the consequences.

The most severe transportation accident considered in the DEIS is a "Severity Category 6" accident, involving "[s]evere impact damage plus fire severe enough to cause fuel oxidation with release of greater amounts of fuel particulates than category 5." DEIS at D-6, Table D.2. The DEIS estimates that the probability of an accident of this severity is 1 x 10^{-12} per mile for shipment by rail. DEIS at D-7. Specifically,

1. **The DEIS employs the average rail accident rate, not the rail accident rate for specific rail lines that will be used.**

Basis: In order to assess transportation impacts, the DEIS considers and generalizes from one specific route, from the Maine Yankee reactor to the PFS facility. DEIS at 5-39. The DEIS employs the computer program Interline to specify the rail routes by minimizing the number of transfers between railroad companies. As a result the main line routes, which generally consist of passenger routes and have the lowest accident rates, are not necessarily chosen, nor are the most direct routes necessarily chosen. For example, the rail route in New York State does not follow a direct route across the state, but dips down from Schenectady to Binghamton then back up to Buffalo. DEIS at 5-41. The DEIS accident rate analysis employs the average rail accident rate for the country. This rate includes better maintained high speed tracks, rather than using the accident rate for tracks actually taken. Similar to accident rates the NRC employs for different types of highways

(Interstate rural, Interstate urban, rural, urban, and so on), the Staff must discuss the accident rates for different types (quality) of rail lines if the DEIS is to comply with NEPA.

2. The probability of a severe accident is higher than estimated in the DEIS.

Basis: According to the 1987 Modal Study, the probability of an accident of any severity occurs with a frequency 1.19×10^{-5} accidents/train mile.[6] This accident rate is based on the accident database of the Federal Railroad Administration ("FRA"). Assuming, as the DEIS does, that the average distance from a reactor to the proposed PFS facility is 2,120 rail miles (DEIS at 5-35) and that 50 shipments of 4 casks will occur each year for 20 years, an estimated 25 rail accidents will occur transporting loaded casks to the proposed PFS facility[7]. An additional 7 rail accidents will occur transporting loaded casks from the PFS facility to the Nevada line[8]. Similarly, an estimated 32 accidents will occur moving empty HI-STAR overpacks from the proposed PFS facility. These will be accidents of varying severity, some severe and some minor.

To estimate the probability of a severe accident, the conditional probability that an

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[6] Fischer et al, 1987. "Shipping Container Response to Severe Highway and Railway Accident Conditions." (Frequently referred to as the Modal Study). NUREG/CR-4829. Lawrence Livermore National Laboratory. Prepared for U.S. Nuclear Regulatory Commission.

[7] 50 shipments/yr x 2120 mi/shipment x 1.19 x 10-5 accidents/mi x 20 yrs = 25 accidents to the PFS facility.

[8] 100 shipments/year x 10 years x 590 miles/shipment x 1.19×10^{-5} accidents/mile = 7 accidents going from PFS to the proposed repository at Yucca Mountain.

accident will be severe is multiplied by the accident rate. The DEIS for the proposed PFS facility uses the conditional probabilities developed by the Modal Study in its transportation risk assessment. The most severe accident, a category 6 accident, has a conditional probability of 1.25 x 10^{-4}. That is, approximately 1.25 in 10,000 accidents are classified as a category 6 accident. An estimated 4.36 x 10^{6} train-km will be traversed in the course of the PFS campaign. DEIS at 5.35. The probability of a category 6 accident occurring during the PFS transportation campaign is:

$$7.4x10^{-6}\frac{accidents}{train\text{-}km}x1.25x10^{-4}\frac{category6\_accidents}{accident}x4.36x10^{6}train\text{-}km=4.03x10^{-3}=\frac{4}{1000}$$

Thus, the probability of a category 6 accident occurring over the duration of the shipping campaign is 4 in 1,000 (or 4 x 10^{-3}), greater than the 3.5 accidents per 1000 (or 3.5 x 10^{-3}) estimated in the DEIS.[9]

The DEIS further underestimates the likelihood of the occurrence of a Category 6 accident because it assumes that some of the accidents that will occur will be minor. However, the database upon which it is relying to assign categories of accidents does not include specific minor accidents, such as grade-crossing or railyard accidents. The DEIS discussion of injury and fatality rates is based on a 1994 study by Saricks and Kvitek of

[9] The DEIS states that that 1 in 10,000 accidents will be severe enough to release RAM, and assumes that there will be 35 accidents overall. DEIS at D-7. The probability of an accident severe enough to release RAM, therefore, will be 35/10,000, or 3.5 x 10^{-3}.

railcar accidents across the country between the year 1986 and 1988.[10] DEIS at D-7. The Saricks and Kvitek study carefully considers the DOT rail accident database but generally eliminates accidents that are minor, such as grade crossing accidents, since these will not lead to a release from a shipping cask. The DEIS relies on the Saricks study to calculate transportation risk, without accounting for the fact that the Saricks study has eliminated a number of accidents from consideration. As a result, the DEIS does not accurately reflect the frequency of a category 6 accident. Thus, if one employs the Saricks study of accident rates, then one must also change the accident severity distributions to reflect the fact that minor accidents have been removed. If not, the likelihood of a severe accident is then too low. In order for the DEIS not to be based on misleading assumptions, the DEIS must re-examine the methodology it employed. *See e.g.*, Hughes River, 81 F.3d at 446. In calculating the risk of a Category 6 accident, the DEIS must either include all accidents and the accident severity fractions that appear in RADTRAN 4; or, if it chooses to remove minor accidents from consideration, alter the accident severity distributions accordingly.

3. The DEIS underestimates the radiological consequences of a Severity Category 6 accident, by underestimating the release fraction for CRUD.

Basis: As recognized in the DEIS, a corrosion product known as Chalk River Unidentified Deposits ("CRUD") is deposited on fuel cladding during reactor operation, and is observed to be loosely adhered on power reactor fuel. DEIS at D-6, note 8. CRUD

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[10] ANL/ESD TM-68, Saricks, C. and Kvitek, T., "Longitudinal Review of State-Level Accident Statistics for Carriers of Interstate Freight" (March 1994), Argonne National Laboratory.

contains neutron-activated nuclides and may also contain fissile particles and fission products[11]. It must therefore be considered in estimating overall radionuclide inventory which is, in turn, critical to evaluating the radiological consequences of a severe accident.

As measured at Sandia National Laboratories, the amount of CRUD on a fuel assembly can be extremely variable. Generally BWR fuel assemblies have much higher surface concentrations. The Sandia report estimating CRUD contribution to radioactive inventory, SAND88-1358,[12] provides a range of CRUD surface activity densities for both PWR and BWR reactors. This surface activity density is multiplied by the total surface area inside a cask in order to obtain an estimate of the CRUD inventory for a cask.

CRUD may escape from a breached or leaking canister, even if the fuel is undamaged. Yuan 1995 (referenced in footnote 11). Since CRUD resides on the outer surface of fuel assemblies, the cladding does not have to be broken to release CRUD to the interior of a shipping cask. Id. Further, all spalled CRUD will be released into the environment if there is a leakage path available, such as a failed seal or open vent.

The major radioactive component contained in CRUD is Cobalt-60. Therefore, although the DEIS does not specifically address the environmental impacts of a CRUD release, it is possible to determine whether the DEIS has considered those impacts by evaluating its treatment of Cobalt-60 releases. As shown in Table D.5, the DEIS considers

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[11] ANL/EAD-1, Yuan, et al, RISKIND - A Computer Program for Calculating Radiological Consequences and Health Risks for Transportation of Spent Nuclear Fuel (November 1995), Appendix D.

[12] SAND88-1358. Sandoval et al. "Estimate of Crud Contribution to Shipping Cask Containment Requirements." January 1991.

Cobalt-60 to behave like a particulate in the event of an accident. Id. Eleven other radionuclides are also listed in Table D.5 as having the properties of particulates (other radionuclides are listed as volatiles or gases). Table D.4 of the DEIS provides release fractions for particulates, volatiles, and gases, in each of the six categories of accidents. No distinction is made in Table D.4 between the release fraction for Cobalt-60 and the release fraction for the eleven other radionuclides listed in Table D.5: the same release fraction is given for each category of accident. For instance, the release fraction in the event of the severe accident (category 6), is calculated at 2.0×10^{-5}.

This calculation is not logical, and appears to significantly underestimate the release fraction for Cobalt-60. The release fraction for Cobalt-60 should be higher because it is found both inside *and* outside of the fuel. In the form of CRUD, Cobalt-60 can be released in a Category 3 accident that does no damage to the fuel. *See* Table D-2 at D-6. In a Category 6 accident, involving damage to fuel, Cobalt-60 that adheres to the outside of fuel assemblies *and* Cobalt-60 on the inside of fuel assemblies will be released. In contrast, the other particulates would be released only in the event of damage to the fuel.[13]

Moreover, the Staff's calculation of the release fraction for Cobalt-60 is also inconsistent with other studies. As discussed previously, SAND88-1358 assumed that 100% of CRUD would be spalled from fuel rods for all impact-related releases. Moreover, the DEIS for the Yucca Mountain repository is based on default assumptions contained in the

[13] The State notes that the listing of "physical/chemical group" and "dispersibility category" do not appear in the PFS ER. These have been constructed by Staff contractors for the DEIS.

RISKIND computer code, which include a 100% release of CRUD in the event of a severe accident.[14] As seen in the following table, the State's calculations show that including CRUD and employing the software program RISKIND, a person residing in an area contaminated by an accidental release for one week would incur a 10% greater dose. If a person resided in a contaminated area for one year, the increased dose due to CRUD release would be 23.5%.

Table 3: CRUD contribution to Population Dose using RISKIND

long-term exposure time	100% CRUD Release Fraction[1]		10^{-5} CRUD release Fraction[2]		% difference
	population-dose	LCF	population-dose	LCF	
1 week	6880	3.44	6190	3.095	10.0
1 year	24300	12.15	18600	9.3	23.5
50 years	194000	97	157000	78.5	19.1

1. Release Fraction Assumed in SAND88-1358 and ANL/EAD-1
2. Release Fraction given in DEIS

Accordingly, the DEIS underestimates the radiological consequence of a severity 6 accident and, thus, does not comply with NEPA.

C. **Contention Utah NN. The DEIS fails to comply with the requirements of 10 CFR § 51.70 and NEPA in that it does not describe or analyze the environmental impacts of a maximum credible accident.**

Basis: Significantly, in the DEIS, the NRC has declined to analyze or describe the environmental and economic impacts of a maximum credible accident. It has instead

[14] ANL/EAD-1, Yuan et al., "RISKIND - A Computer Program for Calculating Radiological Consequences and Health Risks for Transportation of Spent Nuclear Fuel" (November 1995), Argonne National Laboratory.

calculated the transportation "risk." This risk is expressed in terms of the fractional likelihood of latent cancer fatalities, calculated for various volumes of spent fuel shipped. *See*, for example, DEIS Table 5.7 at page 5-38, which calculates "Annual expected latent cancer fatalities (LCFs) for potential accident risk to the public during SNF transport." Assuming 200 shipments per year, the DEIS estimates an accident risk of 2.2×10^{-3} for both rail and intermodal transport. Although the DEIS identifies six categories of accident severity in Appendix D (*see* page D-6), nowhere does the DEIS explain what the health and/or economic consequences would be for an accident of any of those severity categories. Thus, the reader is left with a numerical abstraction that has no factual content. One is left to wonder what would happen in a Category 6 accident: how many people would die? How many people would get sick? What would be the effects on wildlife? How much land would be contaminated? How long would the contamination last? How much would it cost to clean up the contamination and compensate people for death, illness, and property loss? None of these questions is answered by the DEIS.

Reliance on a numerical abstraction to describe risks is inconsistent with the approach taken by federal agencies in other cases. For instance, DOE's Environmental Impact Statement prepared for the Yucca Mountain repository contains an extensive discussion of the consequences of severe transportation accidents. Yucca Mt. DEIS at App. H. A consequence analysis is also generally provided in EISs for nuclear power plants. *See*, *e.g.*, Final Environmental Statement related to the operation of Seabrook Station, Units 1 and 2, NUREG-0895 at 5.34 through 58 (health consequences); 5-58 through 5-60 and 5-64 through 71 (economic consequences); and 5-65 through 71 (health and economic risks).

D. Contention Utah OO. The DEIS fails to comply with the requirements of 10 CFR § 51.70 or NEPA in that it does not address economic risks or consequences of a transportation accident.

Basis: NRC regulations at 10 C.F.R. § 51.71(d) require that a DEIS must include consideration of "economic benefits and costs" of a proposed project. It is beyond dispute that an accident involving a radiological release during transportation of nuclear waste could have extremely large costs associated with it, for cleaning up contamination, evacuating residents, compensating victims of contamination and businesses and railroads for income losses, and repairing the railroad. Yet, nowhere in the DEIS is there a discussion of the economic risks or consequences of a transportation accident involving spent fuel shipments to the PFS facility.

The NRC Staff failed to avail itself of readily available economic modeling capability in the RADTRAN 5 model, which includes an economic model designed to provide order of magnitude estimates for the financial impact of transportation accidents involving a release of radioactive material.[15] The model estimates, based on the calculated concentration of radioactive material following an accident, the cost of emergency response, surveying,

[15] RADTRAN 5 was initially developed to estimate the economic consequences of plutonium-dispersal accidents. It is documented in SAND96-0957, Chanin, D.I. and Murfin, W.B. "Site Restoration: Estimation of Attributable Costs from Plutonium-Dispersal Accidents." May 1996. Both the model and its documentation are available on the RADTRAN web site hosted by Sandia National Laboratories (http://ttd.sandia.gov/risk/rt.htm), which may be approached by first going to "http://ttd.sandia.gov," then using the "risk" and "rt.htm" links.

evacuation, and cleanup. The stand-alone economic model found in RADTRAN 5 is currently available to NRC and the public on the Transnet system run by Sandia National Laboratories (http://ttd.sandia.gov/risk/tnet.htm). RADTRAN 5 is a sensitive and comprehensive model that yields important information on the "costs of compensation for damaged property and lost income, site characterization, demolition, transportation, waste disposal, and ecological restoration." (SAND96-0957, xi.) This readily available information should be included in the DEIS for the consideration of federal decisionmakers, as it has been in other environmental impact statements. *See* Seabrook, NUREG-0895, supra.

Dr. Resnikoff has prepared estimates, included in Appendix A, , attached hereto as Exhibit 3, of costs resulting from a severe rail accident in an average urban area. Those estimates ranged from $31.9 billion to $313 billion.[16] There is no justification for the DEIS's failure to evaluate and consider potential consequences of this magnitude.

LATE FILED FACTORS

The State meets the 10 CFR § 2.714(a) late filed factors for Contentions Utah LL through OO.

Good Cause: The State has good cause for late filing Contentions LL through OO. First, the Federal Register notice for the draft EIS was published June 23, 2000. The State was handed a copy of the draft EIS on or about June 21, 2000 during the evidentiary

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[16] Mr. Resnikoff has relied primarily on RADTRAN 5, which is generally superior to its immediate predecessor, RADTRAN 4, in evaluating economic impacts resulting from releases of radioactive material. However results using RADTRAN 4 should also be considered in some instances where RADTRAN 5 has deficiencies, *e.g*, evaluation of the impact of population densities.

hearings in Salt Lake City. Because the State was fully occupied with evidentiary hearings and the limited appearance sessions before the Licensing Board from June 19 through June 27, 2000, the State could not reasonably be expected to commence copying and reviewing the DEIS until after the hearings concluded on June 27.

Second, the State has had numerous other obligations specifically related to the PFS proceeding. During the month of July the State was engaged in drafting Findings of Fact and Conclusions of Law for Utah Contentions E, R and S, which the State filed on July 31.[17] Also the State needed time to prepare for the NRC public comment hearings on the DEIS held in Utah on July 27 and 28. Furthermore, the State spent additional time in preparing and filing Contention Utah KK during this time period. Another factor in filing late is that during July there are two public holidays in Utah – July 4 and July 24. As a consequence many people are on extended vacation during July.

Third, the issues involved in Contentions LL through OO are complex and require a significant amount of time to review and analyze. Moreover, the State has been diligent in pursuing these issues ever since PFS filed its application. The Board should also take into account, as part of the State's good cause showing, the State's past efforts to timely raise consideration of environmental impacts of transportation on numerous occasions in this proceeding and in comments to the Commission. In this regard, the State filed Contention V, as part of its original contentions, in which it challenged the Applicant's reliance on

[17] The Board granted the State's request for an extension of time until August 7, 2000, to file its findings on Contention R, based on the Staff's recently announced change to emergency planning in one of its guidance document.

Table S-4. The State also filed comments to the Commission's proposed rule change to Part 51 and Draft Addendum 1 to the GEIS for license renewal, NUREG-1437 (hereafter "GEIS, Addendum 1")[18], which accompanied the rule change. In that rulemaking, the Commission proposed to expand the generic findings in Part 51 to the proposed repository at Yucca Mountain, Nevada, and account for the environmental impacts of transportation attributable to the use of higher enriched fuel and higher burnup during the renewal term. 64 Fed. Reg. 9884 (1999). The State also filed an amendment to Contention V after the Commission specifically noted in the generic proceeding that the Utah's concerns about the impacts of spent fuel transportation through Salt Lake City are to be considered in the environmental review for the Private Fuel Storage facility. GEIS, Addendum 1 at A1-8. The Commission's comments illustrate that transportation-related concerns that the State raises today are issues that are within the scope of the environmental review for the PFS facility licensing proceeding.

Fourth, as more fully described in Section II.A supra, both the methodology and the data used in the DEIS differ significantly from the Applicant's Environmental Report. The State's contentions, therefore meet the requirements of 10 C.F.R. § 2.714(b)(2)(iii).

Given the other work requirements the State faced in this proceeding and the complexity of the issues in Contentions LL through OO, the State has good cause for filing the contentions within five weeks of the conclusion of the evidentiary hearing.

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[18]No date of issuance is given on the cover of the Draft GEIS.

Development of a Sound Record: The State will assist in the development of sound record regarding the issues it has raised in this proceeding. The State will present testimony by Dr. Marvin Resnikoff, who has extensive experience in the areas of spent nuclear fuel transportation, storage, and disposal, and is qualified to testify on all of the issues raised in Contentions Utah LL through OO. Dr. Resnikoff will be prepared to offer testimony based on the technical facts and analyses presented in Contentions Utah LL through OO. His resume was submitted as an exhibit to the State's Contentions dated November 27, 1998.

Availability of Other Means for Protecting The State's Interests: As more particularly described in "good cause" section, the State has attempted to raise some of these issues in the past by filing contentions in this proceeding and commenting to the Commission on generic transportation issues. Moreover, the Commission's comments in the generic proceeding suggest this proceeding is the appropriate forum to address specific transportation-related issues relating to the PFS project. GEIS, Addendum 1 at A1-8. There is no other forum in which the State can raise its concerns regarding the DEIS's analysis of spent fuel transportation risks for the PFS facility.

Representation by Another Party: The State's interests in this matter are not represented by any other party.

Broadening of Issues or Delay of the Proceeding: Litigation of this issue may somewhat broaden the proceeding, but is unlikely to delay it. NEPA issues are included in Group III, which is not scheduled for hearing until July 2001. Thus, the addition of these contentions to Group III is not likely to delay that process. Even if the proceeding is

broadened or delayed somewhat by the litigation of Contentions LL through OO, such an effect is warranted given the environmental significance of the issues being raised.

DATED this 2nd day of August, 2000.

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that a copy of STATE OF UTAH'S REQUEST FOR ADMISSION OF LATE-FILED CONTENTIONS UTAH LL THROUGH OO (Relating to the DEIS's analysis of spent fuel transportation risks), was served on the persons listed below by electronic mail (unless otherwise noted) with conforming copies by United States mail first class, this 2nd day of August, 2000:

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	Docket No. 72-22-ISFSI
	)	
PRIVATE FUEL STORAGE, LLC	)	ASLBP No. 97-732-02-ISFSI
(Independent Spent Fuel	)	
Storage Installation)	)	August 2, 2000

DECLARATION OF DR. MARVIN RESNIKOFF IN SUPPORT OF STATE OF UTAH'S REQUEST FOR ADMISSION OF LATE-FILED CONTENTIONS UTAH LL THROUGH OO
(Relating to the DEIS's analysis of spent fuel transportation risks)

I, Dr. Marvin Resnikoff, hereby declare under penalty of perjury and pursuant to 28 U.S.C. § 1746, that:

1. I am the Senior Associate at Radioactive Waste Management Associates, a private consulting firm based in New York City. On November 20, 1997 and January 16, 1998, I prepared declarations which were submitted to the Licensing Board by the State of Utah in support of Contention Utah V, Inadequate Consideration of Transportation-Related Radiological Environmental Impacts, regarding Private Fuel Storage, L.L.C.'s proposed Independent Spent Fuel Storage Installation.

2. I am familiar with Private Fuel Storage's ("PFS's") license application, Safety Analysis Report, and Environmental Report, as well as relevant PFS discovery documents produced in this proceeding. I am also familiar with and have reviewed NRC Staff's Draft Environmental Impact Statement prepared for the PFS facility, NUREG-1714, dated June 2000 ("DEIS"), NRC regulations, including Table S-4, guidance documents, and environmental studies relating to the transportation, storage, and disposal of spent nuclear power plant fuel, with RADTRAN 4, RADTRAN 5 and other relevant computer models, with other technical reports relating to transportation accident studies, and with NRC decommissioning requirements. I have extensive professional experience in the areas of nuclear waste storage, transportation, and disposal.

3. I assisted in the preparation of the State of Utah's Request for Admission of Late-filed Contentions Utah LL through OO. The technical facts presented in these contentions are true and correct to the best of my knowledge, and the conclusions drawn

from those facts are based on my best professional judgment.

4. If Contentions Utah LL through OO are admitted for litigation, I would testify regarding my opinion of the inadequacy of the DEIS in addressing the environmental impacts of and risks posed by transporting spent nuclear power plant fuel across the United States, including the DEIS's insufficient analyses relating to accident risks and radiation exposure consequences, and failure to address economic risks and related consequences of a transportation accident. The technical facts and analyses described in Contentions Utah LL through OO provide an abstract of the testimony I would give, based on the information that has been furnished to date. I would expect to be able to expand upon and refine my testimony, after having an opportunity to review materials produced by the Applicant and the NRC Staff in discovery.

Dr. Marvin Resnikoff
August 2, 2000

APPENDIX A: Economic Consequences Assessment of a Severe Train Accident

Prepared by Dr. Marvin Resnikoff,
Radioactive Waste Management Associates

August 2, 2000

Population Density

This analysis considers the potential impacts on human health and economics of a severe rail accident carrying spent fuel en route to the proposed PFS facility. We consider the effects of an accident in an environment having a population density similar to Salt Lake City, Utah. According to a data sheet included as part of the RADTRAN 5 economic model, Salt Lake City has a population density of approximately 567 persons/km^2. We perform an additional analysis using the average urban population density of the 180 largest cities in the continental U.S., the method used in the RADTRAN 5 economic model.

Accident Scenario

The accident analyzed in this report is a severe train accident in which one of the 4 casks carried by a typical rail shipment of spent nuclear fuel is damaged sufficiently to cause the release of a fraction of its contents. Specifically, it is assumed that 63% of the radioactive gas inventory is released, along with 0.2% of volatile solids and 0.002% of particulates (values obtained from Table D.4 of the DEIS) and 100% of the CRUD inventory.

Results

Table 1, given below, presents the results of our RADTRAN 4 analysis. The two variables in the runs are the atmospheric stability and the assumed evacuation time. In general, the more stable the atmosphere is in the event of an accident (stability class F is the most stable), the more concentrated the effects of the accident. However, the economic impacts will be greatest for accidents occurring under more neutral conditions, where released material is dispersed a greater distance.

Table 1: RADTRAN 4 Calculations: Impact of Severe (Category 6) Rail Accident in Salt Lake City, Utah

File Name	Pasquill Stability Category	Evacuation Time days	Population Dose person-rem	Expected LCFs	Economic Cost 2000$
utaha1.in4	A	1	6.04E+04	30.2	$590,000,000
utaha7.in4	A	7	6.10E+04	30.5	$590,000,000
utahb1.in4	B	1	6.27E+04	31.35	$2,580,000,000
utahb7.in4	B	7	6.40E+04	32	$2,580,000,000
utahc1.in4	C	1	1.24E+05	62	$10,400,000,000
utahc7.in4	C	7	1.29E+05	64.5	$10,400,000,000
utahd1.in4	D	1	2.17E+05	108.5	$20,900,000,000
utahd7.in4	D	7	2.24E+05	112	$20,900,000,000
utahe1.in4	E	1	2.64E+05	132	$23,900,000,000
utahe7.in4	E	7	2.66E+05	133	$23,900,000,000
utahf1.in4	F	1	3.52E+05	176	$1,100,000,000
utahf7.in4	F	7	3.54E+05	177	$1,100,000,000
utahavg1.in4	averaged over all	1	2.29E+05	114.5	$14,300,000,000
utahavg7.in4	averaged over all	7	2.34E+05	117	$14,300,000,000

The results show that, under average atmospheric conditions, a severe accident resulting in a release of a small fraction of the radioactive contents of a rail cask carrying 5-year cooled fuel will result in 115-117 additional latent cancer fatalities to the population of exposed individuals. The economic impacts associated with evacuation, interdiction, and restoration are calculated by RADTRAN 4 to be on the order of $14.3 billion dollars, ranging up to $23.9 billion. This is for a population density of 567 persons/km^2, corresponding to a low-density urban area such as Salt Lake City.

RADTRAN 5 Economic Analysis

RADTRAN 5, the latest version of RADTRAN, includes as a companion a different economic model than the one utilized in previous versions. This model, which is separate from the RADTRAN 5 program, was initially developed to estimate the economic consequences of plutonium-dispersal accidents. The model is documented in a 1996 report by David Chanin and Walter Murfin[1], and both the model and its documentation are available on the RADTRAN web site hosted by Sandia National

[1] SAND96-0957, Chanin, D.I. and Murfin, W.B., "Site Restoration: Estimation of Attributable Costs from Plutonium-Dispersal Accidents." May 1996.

Laboratories (http://ttd.sandia.gov/risk/rt.htm).[2] The economic consequences estimated using the RADTRAN 5 spreadsheet companion are based on the "costs of compensation for damaged property and lost income, site characterization, demolition, transportation, waste disposal, and ecological restoration" (SAND96-0957, xi). For an accident in an urban area, remediation activities are broken into three categories: remediation of lightly, moderately, and heavily contaminated areas. These groups are segmented based on the amount of remediation required to meet a given cleanup criteria. For our analysis, we will assume a cleanup criteria of 0.2 mCi/m^2, a level suggested by the EPA as a cleanup criteria for transuranics (see Appendix B, SAND96-0957).

Different remediation schemes are then employed for areas having contamination levels exceeding the cleanup criteria by certain amounts. Chapter 5 of the SAND96-0957 document outlines the approach used to designate the cleanup categories. For contamination levels of 0.2-0.4 mCi/m^2, the area is designated as "lightly contaminated," and remediation costs are associated with non-destructive decontamination activities such as washing and scrubbing, removing topsoil, and other "surface" decontamination activities. For contamination levels of 0.4-2 mCi/m^2, the area is designated as "moderately contaminated," and remediation costs are associated with destructive decontamination, such as replacement of roofing, furniture, flooring, and all landscaping. For contamination levels above 2 mCi/m^2, the approach is to assume that decontamination is impractical, and the costs incurred are due to condemnation, acquisition, demolition, disposal, and restoration of property.

To perform this analysis, it is essential to estimate which areas are deemed lightly, moderately, and heavily contaminated in order to segment the cost estimate into these three categories. We utilized the output from the RADTRAN 4 runs estimating the consequences of severe accidents in urban areas as input into an economic analysis using the RADTRAN 5 economic model, having in previous studies determined that RADTRAN 4 and RADTRAN 5 yield similar contamination level estimates.

The cost estimates obtained from this model estimate cleanup impact for a release of radioactive material in an urban area with a population density of 1344 $persons/km^2$. This value was obtained by summing the populations and areas contained by the 180 largest cities in the continental U.S., then dividing the cumulative population by the cumulative area. It does not appear that changing the assumed population density has an impact on the calculated cost estimates obtained from the model. Rather, it appears that this average population density has been internalized into the program. Therefore, we calculate the economic impact of a category 6 accident in an urban area having a population density of 1344 $persons/km^2$ using

[2] To access this internet site, it may be necessary to go to the site "http://ttd.sandia.gov" first, then click on link "risk," then on link "rt.htm."

the RADTRAN 5 model.

The results of this analysis, for average meteorological conditions, are presented below, assuming average weather conditions. For comparison, we also present the results of an economic analysis using the RADTRAN 4 code and assuming 1344 persons/km2.

Table 2: Comparison of RADTRAN 4 and RADTRAN 5 Economic Models: Severe Rail Accident, 5 year cooled fuel, 1344 persons/km^2

	Economic Cost, $2000
RADTRAN 4	$31,900,000,000
RADTRAN 5	$313,000,000,000

This comparison shows that there is an order of magnitude difference in economic impact estimates between the two models. Much of this is due to the significantly more detailed cost assessments employed in the RADTRAN 5 economic model, which takes into account replacement costs for contaminated personal items and property as well as compensation for lost income, among other factors. Regardless of which model is used, the result is clear: the economic impacts of a severe transportation accident resulting in a small release of radioactive material would be devastating.