

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))	July 22, 1999

STATE OF UTAH'S REQUEST FOR ADMISSION OF
LATE-FILED AMENDED UTAH CONTENTION Q¹

Introduction

Pursuant to 10 C.F.R. § 2.714, the State of Utah hereby seeks the admission of late-filed Amended Contention Q. Amended Contention Q challenges the adequacy of the Applicant's analysis of potential accidents that may damage the integrity of spent fuel cladding. The contention is based on newly issued NRC Interim Staff Guidance document ISG-12 - Buckling of Irradiated Fuel Under Drop Conditions (May 21, 1999), which is attached as Exhibit 2. ISG-12 recommends that any analyses which rely on report UCID-21246 by the Lawrence Livermore National Laboratories ("LLNL Report") should be re-done, using either the new information about the effects of irradiation, or an alternative method which demonstrates that cladding stress

¹ This amended contention is supported by the Declaration of Marvin Resnikoff in Support of State of Utah's Amended Contention Q (July 22, 1999), which is attached hereto as Exhibit 1.

remains below yield. PFS relies for its analysis on the LLNL Report.

As discussed below, the amended contention satisfies the Commission's standards for late-filing.

Background

The State's original contention Q charged that: "The Applicant has failed to adequately identify and assess potential accidents, and therefore, the Applicant is unable to determine the adequacy [of] the ISFSI design to prevent accidents and mitigate the consequences of accidents as required by 10 CFR 72.24(d)(2)." State of Utah's Contentions on the Construction and Operating License Application by Private Fuel Storage LLC for An Independent Spent Fuel Storage Facility (November 23, 1997) ("State's Contentions") at 114-115. Bases 1 and 3 related to the failure to take into account stresses on fuel cladding that would increase its vulnerability to impacts:

1. The Applicant states that "the most vulnerable fuel" can withstand 63 g in the most adverse orientation. SAR at 8.2-32. However, the Applicant does not provide the basis for its statement. The Applicant does not specify whether this includes fuel with leaks and cladding failures which has been stored underwater for many years and dry for many more years. Furthermore the Applicant has not provided the g loading that would cause such fuel to fail.

* * *

3. The cask maximum lift heights of 10 and 18 inches imply that vertical drops greater than these amounts would result in damage to the canister or interior contents. SAR at 10.2-9. The Applicant must not only address lifting accidents while onsite at the ISFSI, but at the intermodal transfer site or during transport on either rail or highway, where significant damage could occur during an accident with potential

resulting release of nuclear material. Cladding of spent fuel elements is likely to be very brittle through extensive radiation embrittlement, so cladding failure is likely during such accidents.

State's Contentions at 114-115.

In opposing the admission of Contention Q, the Applicant stated that it relied for its analysis on the LLNL Report, which identifies the 17 x 17 Westinghouse fuel assembly as the "most vulnerable fuel." Applicant's Answer to Petitioner's Contentions at 208 (December 24, 1997) ("Applicant's Answer to Contentions"). According to the Applicant, the LLNL Report states that despite having "the worst combination of the longest unsupported length and the thinnest cladding wall thickness," the Westinghouse fuel can "sustain a load in bending equivalent to 63 g's at 380 degrees Celsius without exceeding the yield strength of the cladding at that temperature." *Id.*, citing LLNL Report at § 4.0, page 4.

Both the Applicant and the Staff challenged the State's failure to provide a basis for its concern that the cladding was more vulnerable to rupture than supposed by the Applicant. Applicant's Answer to Contentions at 209; NRC Staff's Response to Contentions Filed by (1) the State of Utah, (2) the Skull Valley Band of Goshute Indians, (3) Ohngo Gaudadeh Devia, (4) Castle Rock Land and Livestock L.C., *et al.*, and (5) the Confederated Tribes of the Goshute Reservation and David Pete (December 24, 1997) at 39-40.

Contention Q and its bases were denied admission in their entirety by the

Licensing Board in LBP-98-7, 47 NRC 142, 195, *aff'd on other grounds*, CLI-98-13, 48 NRC 26 (1998). Without explaining its application of the law to the facts, the Board summarily ruled that the contention and its bases:

fail to establish with specificity any genuine material dispute; impermissibly challenge the Commission's regulations or rulemaking-associated generic determinations; lack materiality; lack adequate factual or expert opinion support, and/or fail properly to challenge the PFS application.

LBP-98-7, 47 NRC at 195.

AMENDED CONTENTION Q: The Applicant has failed to adequately identify and assess potential accidents involving impacts to fuel cladding. Therefore, the Applicant is unable to determine the adequacy of the ISFSI design to prevent accidents and mitigate the consequences of accidents as required by 10 CFR 72.24(d)(2).

BASIS: Relying on the LLNL Report, the Applicant calculates that the most vulnerable fuel cladding in the storage casks at the PFS facility can withstand an impact of 63 g. SAR at 8.2-32 and Reference 21. According to a recently issued Staff guidance document, ISG-12, the analytical method advocated by LLNL is "simplistic," and "may not yield acceptable results." ISG-12 at 1. A sample calculation provided in ISG-12 shows a "buckling load" of 13.86 g, which is far lower than the 63 g calculated by the Applicant. Apparently, the new analysis takes into account two factors which were not previously considered: the weight of the pellets, and the stiffness of the pellets which "could have been fused or locked to the cladding." *Id.* These are effects of

irradiation, which are only now being recognized by the NRC.²

The ISG-12 recommends that if the analytical method described in the LLNL Report is used to assess fuel integrity for cask drop accidents, "the analysis should use the irradiated material properties and should include the weight of the fuel pellets." *Id.* at 2. Alternatively, "an analysis of fuel integrity which considers the dynamic nature of the drop accident and any restraints on fuel movement resulting from cask design is acceptable if it demonstrates that the cladding stress remains below yield." *Id.* The Applicant has not performed either the recommended analysis, or the alternative analysis. Now that the Staff has raised such fundamental questions about the integrity of fuel cladding, there is no basis for confidence in the integrity of the cladding unless and until the Applicant performs a new analysis.

The Applicant has previously argued that the Commission has determined that the cladding need not be maintained if additional confinement is provided, and that the "canister could act as a replacement for the cladding." Applicant's Answer to State's Contentions at 209-210, *citing* 51 Fed. Reg. 19,106, 19,108 (1986); 53 Fed. Reg. 31,651 (1988); 10 C.F.R. § 72.122(h)(1). Section 72.122(h) provides that:

The spent fuel cladding must be protected during storage against degradation that leads to gross ruptures or the fuel must be otherwise confined such that degradation of the fuel during storage will not pose operational safety problems

² In fact, although the NRC Staff opposed the admissibility of the original Contention Q, ISG-12 appears to have been issued in response to the very issues raised by the State's contention.

with respect to its removal from storage. This may be accomplished by canning of consolidated fuel rods or unconsolidated assemblies or other means as appropriate.

The Applicant appears to believe that this regulation allows it to disregard a cladding failure and fall back on the canister as the sole means of confining radioactivity in the cask. This is a misinterpretation of the regulation that would eviscerate the defense-in-depth, multiple barrier approach on which the Applicant has relied in its license application.³ The regulation merely provides that if the cladding fails, then the licensee may substitute another, *additional* protective barrier, such as an additional canister. Reg. Guide 3.48, Standard Format and Content for the Safety Analysis Report for an Independent Spent Fuel Storage Installation or Monitored Retrievable Storage Installation (Dry Storage) (1989) also contemplates that license applications will address "protection by multiple confinement barriers and systems." Reg. Guide 3.48 § 3.3.2. It would utterly defeat the concept of multiple confinement, as well as the representations in the license application regarding the assurance of safety through defense-in-depth, if one of the confinement barriers could be completely disregarded when it failed.

³ The SAR for the PFS facility refers to Chapter 7 of the Holtec HI-STORM Topical Safety Analysis Report ("TSAR") for a description of the "confinement design" for the HI-STORM storage system. PFSF SAR § 4.2.1.5.5. As explained in the TSAR, the HI-STORM cask relies on "multiple confinement barriers provided by the fuel cladding and the MPC enclosure vessel [*i.e.*, the canister] to assure that there is no release of radioactive material to the environment." Holtec Report HI-951312, Revision 5, at 7.2-1 (February 1999).

The cask maximum lift heights of 10 and 18 inches imply that vertical drops greater than these amounts would result in damage to the canister or interior contents. SAR at 10.2-9. The Applicant must not only address lifting accidents while onsite at the ISFSI, but at the intermodal transfer site or during transport on either rail or highway, where significant damage could occur during an accident with potential resulting release of nuclear material. Cladding of spent fuel elements is likely to be very brittle through extensive radiation embrittlement; so cladding failure is likely during such accidents.

Satisfaction of Late Filed Factors:

The State meets the 10 CFR § 2.714(a) late filed factors for amending its contention.

Good Cause: First, the State has good cause for the late filing. Dr. Resnikoff discovered ISG-12 on the NRC's web site on July 2, 1999.⁴ He was later informed by a member of the NRC Staff that the ISG-12 had been put on the website on June 18, 1999.⁵ A librarian at the NRC's Public Document Room ("PDR") also informed him that the ISG-12 probably was filed in the PDR sometime around the 18th of June.

⁴ Exhibit 2 shows the date on which Dr. Resnikoff downloaded ISG-12 from the NRC web site.

⁵ See also Declaration of Jean Braxton, attached hereto as Exhibit 3.

Hence, Dr. Resnikoff discovered the document within a reasonable time of its being publicly released, and he and the State's attorneys have taken a reasonable amount of time to prepare the Amended Contentions, *i.e.*, slightly more than a month after the document was publicly issued. In this context, it must be noted that both Dr. Resnikoff and the State's attorneys have been extremely busy during the past month, conducting and responding to discovery and responding to numerous and voluminous summary disposition motions. Considering these many competing obligations, the timing of this request was most expeditious.

Development of a Sound Record: The State's participation will assist in developing a sound record. Dr. Resnikoff, who has considerable expertise in technical issues regarding the storage and degradation of spent nuclear power plant fuel, will testify regarding Amended Contention Q.

Availability of Other Means for Protecting The State's Interests: The State has no alternative means, other than this proceeding, for protecting its interest in an adequate dose assessment and protection of its citizens from excessive radiation doses.

Representation by Another Party: The State's position will not be represented by any other party, as there is no other party with a similar contention admitted to this proceeding.

Broadening of Issues or Delay of the Proceeding: The admission of Amended Contention Q will not unduly broaden or delay the proceeding. The issue

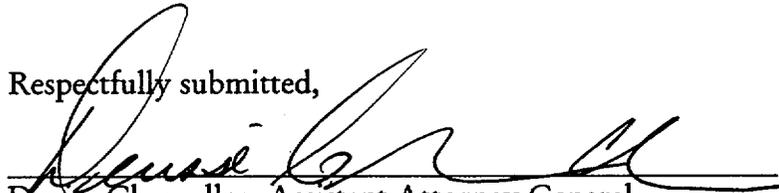
of whether the analysis described in the LLNL Report should be re-done is a discrete one, on which the Staff has given specific guidance. The acceptable g-force is subject to numerical calculation. To the extent that the litigation does broaden or delay the proceeding, it is nevertheless important and worthwhile, because it raises a fundamental safety issue on which both the State and the NRC Staff apparently agree that a new analysis must be done.

Conclusion

For the foregoing reasons, Amended Contention Q is both admissible and meets the Commission's standard for late filed contentions. Accordingly, it should be admitted.

DATED this 22rd day of July, 1999.

Respectfully submitted,



Denise Chancellor, Assistant Attorney General

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Connie Nakahara, Special Assistant Attorney General

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CERTIFICATE OF SERVICE

I hereby certify that a copy of STATE OF UTAH'S REQUEST FOR
ADMISSION OF LATE-FILED AMENDED UTAH CONTENTION Q was served
on the persons listed below by electronic mail (unless otherwise noted) with
conforming copies by United States mail first class, this 22rd day of July, 1999:

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Denise Chancellor
Assistant Attorney General
State of Utah

EXHIBIT 1

UNITED STATES OF AMERICA
BEFORE THE U.S. NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
PRIVATE FUEL STORAGE, L.L.C.)
(Independent Spent Fuel)
Storage Installation)

Docket No. 72-22-ISFSI

July 22, 1999

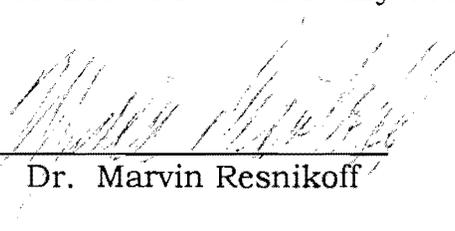
**DECLARATION OF DR. MARVIN RESNIKOFF IN SUPPORT OF
STATE OF UTAH'S AMENDED CONTENTION Q**

, Dr. Marvin Resnikoff, declare under penalty of perjury 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 its contentions regarding Private Fuel Storage, L.L.C.'s proposed Independent Fuel Storage Installation. I assisted in the preparation of State of Utah's original Contention Q, which were submitted at that time. A statement of my qualifications was attached to November 1997 declaration.

2. I am familiar with Private fuel Storage's ("PFS's") license application and Safety Analysis Report in this proceeding, as well as the applications for the storage and transportation casks PFS plans to use. I am also familiar with NRC regulations, guidance documents, and environmental studies relating to the transportation, storage, and disposal of spent nuclear power plant fuel, and with NRC decommissioning requirements.

3. I assisted in the preparation of the State of Utah's Amended Contention Q. The technical facts presented in Amended Contention Q are true and correct to the best of my knowledge, and the conclusions drawn from those facts are based on my best professional judgment.



Dr. Marvin Resnikoff

July 22, 1999

EXHIBIT 2

ISG-12 - Buckling of Irradiated Fuel Under Drop Conditions

[Dry Cask Storage](#) | [News and Information](#) | [NRC Home Page](#) | [E-mail](#)

Spent Fuel Project Office

Interim Staff Guidance - 12

Issue: Buckling of Irradiated Fuel Under Bottom End Drop Conditions

Discussion:

Fuel rod buckling analyses under bottom end drop conditions have traditionally been performed to demonstrate integrity of the fuel following a cask drop accident. The methodology described by Lawrence Livermore National Laboratory (LLNL) to analyze the buckling of irradiated spent fuel assembly under a bottom end drop in their report UCID-21246 is a simplified approach. It assumed that buckling occurred when the fuel rod segment between the bottom two spacer grids reached the Euler buckling limit. The weight of fuel pellets was neglected in the analysis; only the weight of the cladding was considered. Material properties for unirradiated cladding were used. The buckling analysis also neglected the stiffness of the pellets which could have been fused or locked to the cladding. It assumed the total weight of the cladding to be on top of the fuel rod segment between the bottom two spacer grids. In addition, it also assumed that the fuel rod segment between the bottom two spacer grids was pin-connected. The restraint and lateral support of the fuel basket structure to the fuel assemblies were ignored in the analysis.

The weight of pellets and irradiated material properties should be included in any end drop analysis. With these changes, the simplistic method of UCID-21246 may not yield acceptable results. For example, the staff conducted calculations using the same methodology as LLNL report UCID-21246 except irradiated material properties for the clad, and the weight of fuel pellets are included in the calculations. The most vulnerable fuel assembly in the LLNL report, a 17x17 Westinghouse fuel assembly, was chosen for this exercise. Euler buckling loads for the clad were calculated using the following formula:

$$P_{cr} = 2EI/L^2$$

where

$$E_{clad} = 10.47 \times 10^6 \text{ psi}$$

$$I_{clad} = 1/4 \times (r_o^4 - r_i^4) = 1/4 \times (0.187^4 - 0.1645^4) = 3.85 \times 10^{-4} \text{ in}^4$$

$$L = 24 \text{ inches}$$

The results indicate that

$$P_{cr} = 69 \text{ lb}$$

Since the weight of cladding and pellets for the 144 inch-long fuel rod is about 4.98 lb, the buckling load in terms of gravitational acceleration (g) is

$$P_{cr}/W = 69/4.98 = 13.86 \text{ g}$$

This is considerably smaller than the 82 g reported in the LLNL report UCID-21246. However, there are several bounding assumptions in this approach which make the results unrealistically low for predicting cladding failure.

Conclusion:

Analyses of fuel rod buckling performed to demonstrate fuel integrity following a cask drop accident yield results which contain a large margin to actual failure. The calculated onset of buckling does not imply fuel or cladding failure. Where such analyses yield unacceptable results, more realistic analyses of dynamic fuel behavior are appropriate and acceptable. If the cladding stress remains below yield strength, the fuel integrity is assured.

Recommendation:

If the analytical approach described in the LLNL report UCID-21246 for axial buckling is used to assess fuel integrity for the cask drop accident, the analysis should use the irradiated material properties and should include the weight of fuel pellets.

Alternately, an analysis of fuel integrity which considers the dynamic nature of the drop accident and any restraints on fuel movement resulting from cask design is acceptable if it demonstrates that the cladding stress remains below yield. If a finite element analysis is performed, the analysis model may consider the entire fuel rod length with intermediate supports at each grid support (spacer). Irradiated material properties and weight of fuel pellets should be included in the analysis.

The appropriate section of Standard Review Plan, NUREG-1536, should be revised to clearly reflect analytical approach for fuel rod buckling analyses.

Approved

E. William Brach

Date

301.415.8500

EXHIBIT 3

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)	
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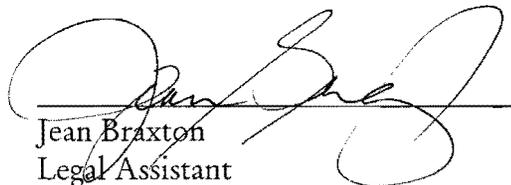
DECLARATION OF JEAN BRAXTON IN SUPPORT OF
STATE OF UTAH'S AMENDED CONTENTION Q

I, Jean Braxton, declare under penalty of perjury and pursuant to 28 U.S.C. § 1746
that:

1. I am a legal assistant employed at the Utah Attorney General's Office.
2. I am assisting State's counsel in this proceeding.
3. I contacted the Nuclear Regulatory Commission's ("NRC") webmaster,

Ms. Joan Hoffman on July 22, 1999, and inquired when the Interim Staff Guidance
document ISG-12 was placed on the NRC's webpage.

4. Ms. Hoffman told me that ISG-12 was placed on the NRC's webpage on
June 18, 1999 at 11:37 a.m.


Jean Braxton
Legal Assistant

July 22, 1999