November 9, 2001

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)	)	ASLBP No. 97-732-02-ISFSI

DECLARATION OF C. ALLIN CORNELL

C. Allin Cornell states as follows under penalty of perjury:

I. WITNESS CREDENTIALS AND SCOPE OF TESTIMONY

1. I am currently a professor (research) at Stanford University in Stanford, California and an independent engineering consultant. In the former capacity I perform research and supervise a Senior Research Associate and several Ph.D.-level graduate students in the areas of probabilistic analysis of structural engineering and earthquake engineering. As a consultant, I assist engineering and earth sciences firms, industrial concerns, and government agencies in developing and applying methodologies and standards for probabilistic seismic hazard analysis, engineering safety assessments, natural hazards analyses, and earthquake engineering. Through my teaching, research and consulting activities (described below) I have developed an expertise in earthquake engineering, probabilistic engineering analysis of seismic loads on structures and structural responses to such loads, and the development of structural design guidelines and codes. I am providing this declaration in support of Applicant's Motion for Summary Disposition of Part B of Contention Utah L in the above captioned proceeding concerning the Private Fuel Storage Facility ("PFSF").

NUCLEAR REGULATORY COMMISSION

Docket No. 72-22 Official Exh. No. State's 129

In the matter of PFS

Staff ______ IDENTIFIED ✓

Applicant ______ RECEIVED ✓

Intervenor ✓ REJECTED ______

Cont'g Off'r ______

Contractor ______ DATE 6-27-02

Other ______ Witness Bartlett

Reporter R. Davis

seismic standards that explicitly use this principle include the draft International Standards Organization ("ISO") guidelines for offshore structures [Ref. 13 (Banon et al., OMAE 2001 on ISO)], Federal Emergency Management Agency ("FEMA") guidelines for building assessment [Ref. 14 (FEMA 273 pp. 2-5)], and DOE Standard 1020 [Ref. 11 (Table C-3, p. C-5)]. Further, the NRC staff has stated, with respect to the seismic design of nuclear facilities: "The use of probabilistic techniques and a risk-graded approach are compatible with the direction provided by the Commission on Direction Setting 12, 'Risk-Informed, Performance-Based Regulation.'" [Ref. 15 (SECY-98-071 pp. 3-4)].

16. Under the risk-graded approach to the seismic design, ISFSIs such as the PFSF, can be assigned a higher probability of failure than a nuclear power plant because the potential consequences of seismic failure of ISFSIs are much less severe than those for nuclear power plants. The radioactive inventory that potentially could be released to the environment from an ISFSI is less because the spent fuel has decayed significantly and because a spent fuel canister is under much lower pressures than a reactor's coolant boundary; higher pressures will disperse any released radioactivity farther from the source. The NRC has rejected the notion that licensing standards should be as high for ISFSIs as for nuclear power plants, noting that "[t]he potential ability of irradiated fuel to adversely affect the public health and safety and the environment is largely determined by the presence of a driving force behind dispersion. Therefore, it is the absence of such a driving force, due to the absence of high temperature and pressure conditions at an ISFSI (unlike a nuclear reactor operating under such conditions that could provide a driving force), that substantially eliminate the likelihood of accidents involving a major release of radioactivity from spent fuel stored in an ISFSI." [Ref. 16 (60 Fed. Reg. 20,883 (1995))].

17. Further, an ISFSI facility as a whole is inherently less vulnerable to earthquake-initiated accidents than a nuclear power plant. An ISFSI is largely passive; it does not have active cooling and safe-shutdown systems necessary for maintaining the integrity of the high-pressure reactor coolant boundary and for shutting down after a large earthquake, as does a nuclear power plant. The NRC has recognized the reduced seismic

vulnerability of an ISFSI by stating that for ISFSIs, such as dry storage casks, which do not involve massive storage structures, "the required design earthquake will be determined on a case-by-case basis until more experience is gained with licensing these types of units." [Ref. 17 (45 Fed. Reg. 74,697 (1980), as cited in Ref. 15 (SECY-98-071 p. 2).]

B. Factors Determining Failure Probability for Facilities and Structures

18. While the risk-graded approach is implemented in somewhat different ways in the various fields of seismic design, the standards of practice almost invariably utilize a DBE defined at some mean annual probability of exceedance and a set of design procedures and acceptance criteria. Both the procedures and the acceptance criteria include conservatisms that, implicitly or explicitly, are intended to implement "performance goals" (e.g., target levels of the seismic failure probability for the facility or structure), which are defined in a manner reflecting the anticipated consequences of the failure. These conservatisms are typically embedded in the various codes and standards pursuant to which the design of a structure or facility is accomplished.

19. Both the MAPE of the DBE and the level of conservatism incorporated in the design procedures and criteria affect the failure probability of seismically-designed facilities and structures. A lower (or higher) failure probability can be achieved by keeping the design procedures and criteria fixed while reducing (or increasing) the MAPE of the DBE; or, alternatively, by fixing the MAPE while making the design procedures more or less conservative; or by adjusting both elements simultaneously. Whichever choice is made among these alternatives, it is important to understand that both the MAPE and the level of conservatism in the design procedures and criteria must be considered when assessing and comparing the safety implications of various seismic design standards. One fact remains true, however: because of the conservatisms incorporated in all seismic design procedures and criteria, the probability of failure of a seismically-designed facility or structure is virtually always less than the MAPE of the DBE. In other words, virtually facilities and structures designed against a given DBE have a mean return period to failure that is longer than the mean return period of the

earthquake for which they are designed. In practical terms, this means that seismically-designed facilities and structures are able to withstand a more severe, i.e., more infrequent, earthquake than that used as the DBE.

20. The application of these principles of risk-graded seismic design is perhaps most clearly and explicitly seen in the U.S. Department of Energy's Standard 1020. The basis for DOE Standard 1020 is a set of "performance categories" (1 to 4) for seismically designed facilities and structures with increasing consequences of failure, and thus decreasing probabilities of failure as their performance goals [Ref. 11 (DOE 1020, p. 1-2 and p. C-2)]. DOE is responsible for (1) facilities such as ordinary buildings (Performance Category 1 or PC1) designed to protect occupant safety, (2) essential facilities and buildings that should continue functioning after an earthquake with minimal interruption (PC 2), (3) important facilities such as ISFSIs that contain hazardous materials (PC3), and (4) critical facilities such as those involving nuclear reactors (PC4).

21. The performance goals for DOE structures, systems and components in the four performance categories PC1 to PC4 are set as mean annual failure probabilities of 10^{-3}, $5x10^{-4}$, 10^{-4}, and 10^{-5}, respectively [Ref. 11 (DOE 1020, p. C-5)] reflecting the increasing consequences of failure. On the other hand, MAPEs for the design basis ground motions are set as $2x10^{-3}$, 10^{-3}, $5x10^{-4}$, and 10^{-4}, respectively. These values are uniformly larger than the performance goals.

22. To bridge the gap between the performance goals and the DBE MAPEs, the DOE 1020 standards call for design procedures and evaluation criteria that vary among the categories, ranging from those "corresponding closely to model building codes" for PC1 and PC2 , to those for PC4 which "approach the provisions for commercial nuclear power plants" [Ref. 11 (DOE 1020, p. 2-2, C-4 to C-5)]. The quantitative effect, in terms of reducing earthquake risk, of applying the conservatisms built into these various design procedures and criteria is reflected in the ratios between the MAPE of the design basis ground motions and the corresponding performance goal probabilities. These ratios are 2, 2, 5 and 10, respectively [Ref. 11 (DOE 1020, p. C-5)]. The ratios are called "Risk Reduction Ratios", R_R, in DOE 1020. The following table

summarizes these three parameters, the DBE MAPE, the Performance Goal, and the R_R for the four performance categories PC1 through PC4 in DOE 1020:

Table 1: DOE Std. 1020-94 Seismic Performance Goals, DBE MAPEs and R_Rs[5]

Performance Category	**Target Seismic Performance Goal (P_F)**	**DBE Exceedance Probability (MAPE)**	**Risk Reduction Ratio (R_R)**
PC1 (e.g., office building)	$1x10^{-3}$	$2x10^{-3}$	2
PC2 (e.g., essential building that should remain operational, such as hospital or police station)	$5x10^{-4}$	$1x10^{-3}$	2
PC3 (e.g., hazardous waste facilities such as ISFSIs)	$1x10^{-4}$	$5x10^{-4}$ (except $1x10^{-3}$ for Western sites near tectonic boundaries)	5 (except 10 for Western sites near tectonic boundaries)
PC4 (e.g., nuclear reactor facility)	$1x10^{-5}$	$1x10^{-4}$ (except $2x10^{-4}$ for Western sites near tectonic boundaries)	10 (except 20 for Western sites near tectonic boundaries)

[5] A revised draft version of DOE Standard 1020 was released in August of this year for comment [Ref. 18 (DOE-1020-2001)]. The primary change is that PC1 and PC2 will be based on the IBC 2000 instead of the UBC model building code. As a result, this table would differ under the proposed standard in that the MAPE of PC1 and PC2 categories would change to $4x10^{-4}$. To be consistent, the MAPE of PC3 is modified slightly to the $4x10^{-4}$ value. The performance goals remain the same in all categories. The R_R for PC3 would therefore be changed from 5 to 4, although no change would be made to the design procedures and criteria for PC3. The R_R column is left blank for PC1 and PC2, but it can be shown that the R_R is still about 2, using the information in NERHP Recommended Provisions for Seismic Regulations for New Buildings and Other structures [Ref. 19 (FEMA-303, at p. 37)] and the procedures outlined in Attachment A hereto. These proposed revisions to DOE 1020, if adopted, would not in any way alter the analyses and conclusions in this Declaration.

23. The actual value of R_R obtained from the design conservatisms for a given SSC is dependent on the shape or slope of the ground motion hazard curve. For example, the PC4 value of 10 cited in the table is representative of locations in the Central and Eastern United States. However, higher risk reduction ratios, e.g., 20 for PC4 facilities, are achieved in western US sites near tectonic boundaries, where hazard curves are steeper [Ref. 11 (DOE 1020, Table 2-1 p. 2-4)]. The higher achievable R_R values have allowed the DOE to specify that higher DBE MAPE levels can be used for PC4 facilities as well as for PC3 facilities in these regions.

24. In DOE 1020, the overall conservatism levels are controlled through acceptance criteria to achieve specific R_R levels [Ref. 11 (DOE 1020, pg. 1-5)]. The document states: "These design and evaluation criteria have been developed such that the target performance goals of the [Natural Phenomenom Hazard] Implementation Guide [set forth in Table 1 above] are achieved" [Ref. 11 (DOE 1020, p. 2-1)]. In other words, the risk reduction levels in DOE 1020 are achieved through use of the DOE design and evaluation criteria specified in Chapter 2 of DOE Standard 1020 and related appendices.[6] For PC4 facilities the risk reduction factor achieved is 10 in most regions.

25. The design guidelines provided by the NRC SRPs also contain many conservatisms that result in risk reduction factors as large as, or larger than, those for PC4 category facilities designed to DOE 1020. NRC SRP standards share with DOE's PC3 and PC4 categories many procedures leading to design conservatism [Ref. 11 (DOE 1020, pp. C-5, C-6)]. These conservatisms are introduced through prescribed analysis

[6] The State's witness has suggested that the risk reduction ratio does not measure the conservatism in a DOE PC category's design procedures and criteria, but rather that it is simply defined as the ratio of the DBE MAPE to the Performance Goal, and hence it is only the ratio required to achieve the goal. Although one might arguably draw that conclusion from the statement in DOE 1020 that the "required degree of conservatism in the deterministic acceptance criteria is a function of the specified risk reduction ratio," [Ref. 11 (DOE 1020, p. C-5)], the quote in the body of the text clearly confirms that, upon selecting the required ratio DOE then established the prerequisite design and evaluation criteria in Chapter 2 of the DOE-1020 to achieve the goals. Therefore, the ratio also becomes a measure of the conservatism provided for by the design and evaluation criteria set forth in Chapter 2 of DOE Standard 1020 and the related appendices.

methods, specification of material strengths, limits on inelastic behavior, etc. The conservatism levels in NRC seismic SRPs are not explicitly keyed to values of R_R. Nonetheless, the risk reduction factors achieved through the use of NRC guidelines for typical SSCs have been found in application to be equal to, or higher than, those called for in DOE 1020 for PC4 facilities, since they are greater than 10 in most regions. DOE 1020 acknowledges the higher R_R levels provided by the NRC SRPs by stating that the "[c]riteria for PC4 approach the provisions for commercial nuclear power plants". [Ref. 11 (DOE 1020, p. 2-2, C-4 to C5). There is recent independent technical support both for the general conclusion that NRC SRPs provide equal or greater levels of conservatism than DOE 1020, and for the quantitative finding that the R_R levels for typical systems, structures, and components designed to NRC SRPs are in the range 5 to 20 or greater [Ref. 20 (NUREG/CR-6728 at Chapter 7)].[7]

C. Application of General Principles to the PFSF

26. At the PFSF, designing for the 2,000-year MRP DBE ground motion and using the NRC SRPs means that typical important-to-safety systems, structures and components can be expected to have seismic failure probabilities 5 to 20 or more times lower than the DBE MAPE, i.e., 2.5×10^{-5} to 1×10^{-4} or lower (i.e., seismic failure MRPs of 10,000 to 40,000 years or more). Therefore, the PFSF would easily meet the DOE performance objectives of 1×10^{-4} for PC-3 facilities under which ISFSIs, such as the PFSF, would fall. The State's expert witness, Dr. Arabasz, agreed that ISFSIs, such as the PFSF, would appropriately be classified PC-3 facilities under DOE-1020 and that the performance objective of 1×10^{-4} for the PFSF would be an appropriate standard on which to determine the acceptability of its seismic design. Arabasz Dep. at 80-81.

27. Applying a risk-graded seismic approach, a performance objective of 1×10^{-4} for ISFSIs such as the PFSF is consistent with the NRC's performance objectives for operating nuclear plants, which pose higher radiological hazard consequences than

[7]Demonstration of these conclusions requires a somewhat detailed technical discussion, which is presented in Attachment A to this Declaration.

paper)]. This is also the case with respect to the risk acceptance guidelines promulgated by the NRC where the subsidiary performance objectives are the risk metrics Core Damage Frequency (CDF) and Large Early Release Frequency (LERF). [Ref. 5 (Reg. Guide 1.174 at p. 10)] and [Ref. 22 (SECY-00-0077 at p. 6)]. The reasons for focusing on annual risks in making facility safety decisions include the fact that any facility providing a needed service will, at the end of its operating life, most likely be replaced by some other facility used for the same purposes with its own, similar risks. The spent fuel to be stored at the proposed PFSF is currently being stored in or near nuclear power plants, and after leaving the PFSF it will likely be stored at the proposed Yucca Mountain facility.

V. SUMMARY

50. In this Declaration I have explained why the use of probabilistic seismic hazard analysis to establish the design basis ground motions at the PFSF site is consistent with current NRC practice and that in other technical fields. I have showed that the 2000-year mean return period ground motions (i.e., those with mean annual probabilities of exceedance of $5x10^{-4}$) together with the NRC SRPs design procedures and acceptance criteria will provide an appropriate level of public safety for the PFS ISFSI. Finally, I have addressed each of the bases asserted by the State in support of Part B of Contention Utah L and established that they do not undercut or controvert my conclusions.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on November 9, 2001.

C. Allin Cornell

ATTACHMENT A

DETERMINATION OF RISK REDUCTION FACTORS FOR SSCs AT FACILITIES DESIGNED USING NRC SEISMIC SRP STANDARDS

The objective of this Attachment is to show the analytical process used to determine quantitatively the degree of conservatism inherent in the design procedures and acceptance criteria found in both DOE Standard 1020 and the NRC SRPs. This level of conservatism is captured in the risk reduction factor or ratio R_R. By calculating the values of R_R resulting from DOE Standard 1020 and the NRC SRPs, the risk reduction factors implicit in the SRP design procedures and criteria can be compared to risk reduction factors expressly provided for in DOE 1020. The precise calculated value of R_R depends on several technical parameters (defined below) whose values may vary from site to site and from SSC to SSC. Accordingly, one can produce only a representative range of R_R values for both the SRP and DOE 1020. (As an example, Figure C-4 on page C-11 of DOE-1020 [Ref. 11] shows the range of R_R values for SSCs designed to the criteria specified for category PC4 SSCs in DOE-1020.)

The risk reduction ratio, R_R, is defined in NUREG/CR-6728 [Ref. 21 pp. 7-9] by the equation:

$$R_R = F_R^{K_H} \left(e^{x_p \beta}\right)^{K_H} e^{-\frac{1}{2}(K_H \beta)^2}$$

A different formulation of this same equation appears also in DOE-1020 at page C-9. In this equation, the variables are as follows:

- K_H, a measure of the slope of the PSHA seismic hazard curve;
- β, a measure of the degree of uncertainty in the response and capacity of SSCs;

- F_R, a measure of the margin (achieved by the procedures and criteria) between the level of the DBE and a reference SSC capacity; and
- x_p, a measure of the margin between this reference capacity and the median value of the SSC capacity.

These variables are defined in more detail in both of the references cited above (DOE 1020 at Appendix C.2 and NUREG/CR-6728 at Section 7.2).

For the purposes of this comparison, I will use for both the SRP and the DOE 1020 R_R determinations a range of values for the hazard curve slope $K_H = 2.1$ to 3.3 (NUREG/CR-6728 at pg. 7-6). These values are representative of the relevant hazard interval (10^{-4} to 10^{-5}) for nuclear power plants at CEUS sites (DOE 1020 at pg. C-8-9, and C-12)[1], and also of the relevant hazard interval (10^{-3} to 10^{-4}) for DOE PC3 (i.e., ISFSI) SSCs at the PFSF site (e.g., the K_H at the PSFF site for peak ground acceleration is 2.8, as determined from [Ref. 28 (Revised Geomatrix Appendix F at Fig. 6-11 __)]. For simplicity, I use here a typical value of $\beta = 0.4$. (The conclusions are quite insensitive to β as shown in DOE 1020 at Figure C-4 on page C-11.) These values for K_H of 2.1 to 3.3 and for β of 0.4 are common to the calculations below of the R_R for both DOE 1020 and the NRC SRP.

First, I consider the DOE 1020 R_R standards. For these standards, the appropriate value of x_p is 1.28 and the appropriate value of F_R is 1.5 SF, both of which appear in DOE 1020 at Eq. C-6, pg. C-9. For PC4 the value of the "scale factor" SF is set at 1.25 (and for PC3 it is set at 1.0) in order to achieve the desired risk reduction ratio R_R [DOE 1020 at pg. 2-13]. Substitution of the above values for K_H, β, x_p, and F_R into the equation for R_R leads to a range of values of R_R from 8

[1] For clarity, if one uses this reference, it needs to be pointed out that the K_H range above corresponds precisely to the A_R range of 2 to 3 that will be found at this citation; A_R is an alternative hazard curve slope measure, DOE 1020, at pg. C-8).

to 17 for DOE 1020 category PC4, as can be seen on Figure C-4 on page C-11 of DOE 1020. The results of these and similar calculations were used in DOE 1020 to confirm the conclusion that the DOE 1020 design procedures and acceptance criteria set forth in Chapter 2 would achieve a value of R_R of about 10, as required to meet the PC4 performance goal. DOE 1020 at p. C-12.

Unlike DOE 1020, the NRC SRPs have not been "tuned" to give a particular R_R (or more precisely a representative value, such as 10 above, applicable to a range of sites). Accordingly, it has been necessary to depend on the numerous engineering evaluations of safety margins and "fragility curves" of SSCs designed to the SRP that have been conducted over the last 20 years in the course of research by the industry and NRC contractors, and on the seismic probabilistic risk assessments and seismic margins studies that have been undertaken at virtually all nuclear power plants in the US (via the NRC IPEEE program). These evaluations have been made by earthquake engineers familiar with nuclear power plant SSC designs prepared to the NRC SRP procedures and criteria, and with the actual behavior of such SSCs in earthquakes as observed in the field and tested in the lab. This experience is summarized in NUREG/CR-6728 at pg. 7-3 by the conclusion: "For nuclear power plant design the factor of safety has typically been 1.25 to 1.5." NUREG/CR-6728 (at pg. 7-4). This "factor of safety" is the variable F_R in the above equation. This factor is, however, coupled with a value of x_p of 2.33. NUREG/CR-6728 (at Ch. 7), which determines the definition of the reference capacity (referred to as a "HCLPF" or C_1) used in engineering evaluations of SRP conservatisms. This value of x_p is much more conservative than that used in DOE-1020.

Using this value of x_p and this range of F_R values one finds (for the same β value and range of K_H values used for the DOE 1020 calculations above) that the R_R for the SRP is in the range 8 to 32. Compared to the range of 8 to 17 calculated for DOE 1020, this result confirms that the

DOE 1020 PC4 standard does indeed only "approach" those of the NRC SRP, as stated in DOE-1020 at page C-5.

If one looks, not at the range of hazard curve slope values of 2.1 to 3.3 used for K_H in the above calculations, but rather at the specific value $K_H = 2.8$ associated with peak horizontal ground acceleration at the PFSF site, the range of NRC SRP R_R values is 12 to 21. For the subset of SSCs sensitive to 1 second spectral accelerations, the ratios range from 8 to 12 based on the reduced slope of the hazard curve for this period. Revised Geomatrix Appendix F at Fig. 6-11.

For simplicity in the body of the declaration and in the [Ref. 29] Applicants Response to the State's Int. 15, Item 9, I have summarized such detailed results in the statement that "the R_R's for typical components SSCs designed to the NRC SRP are in the range 5 to 20 or greater".

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Reference 1: U.S. Nuclear Regulatory Commission, NUREG-1567, *Standard Review Plan for Spent Fuel Dry Storage Facilities*, March 2000.

Reference 2: U.S. Nuclear Regulatory Commission, NUREG-0800, *Standard Review Plan*, August 1988.

Reference 3: 10 Code of Federal Regulations § 100.23.

Reference 4: U.S. Nuclear Regulatory Commission, Regulatory Guide 1.165, *Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion*, March 1997.

Reference 5: U.S. Nuclear Regulatory Commission, Regulatory Guide 1.174, *An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis*, July 1998.

Reference 6: U.S. Nuclear Regulatory Commission, Strategic Assessment Issue Paper, Direction Setting Issue 12, *Risk-Informed, Performance-Based Regulation Strategic Assessment*, September 16, 1996.

Reference 7: U.S. Nuclear Regulatory Commission, SECY-01-0178, *Rulemaking Plan: Geological and Seismological Characteristics for Siting and Design of Dry Cask Independent Spent Fuel Storage Installations, 10 CFR Part 72*, September 26, 2001.

Reference 8: Uniform Building Code, Vol. 2, 1997.

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Reference 10: American Petroleum Institute, API Recommended Practice 2A-WSD (RP 2A-WSD), *Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – Working Stress Design*, twentieth ed., July 1, 1993.

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Reference 18: U.S. Department of Energy, DOE-STD-1020-2001, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*, Rev. 1, 2001.

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Reference 21: U.S. Nuclear Regulatory Commission, NUREG/CR-6728, *Technical Basis for Revision of Regulatory Guidance on Design Ground Motions: Hazard- and Risk-consistent Ground Motion Spectra Guidelines*, October 2001.

Reference 22: U.S. Nuclear Regulatory Commission, SECY-00-0077, *Modifications to the Reactor Safety Goal Policy Statement*, March 30, 2000.

Reference 23: PFS Memorandum and Order, CLI-01-12, June 14, 2001.

Reference 24: Private Fuel Storage, L.L.C. (Independent Spent Fuel Storage Installation) LBP-01-03, 53 NRC 84 (2001).

Reference 25: State of Utah's Request for Admission of Late-Filed Modification to Basis 2 of Contention Utah L, November 9, 2000.

Reference 26: U.S. Department of Energy, Topical Report YMP/TR-003-NP, *Preclosure Seismic Design Methodology for a Geologic Repository at Yucca Mountain*, Rev. 2, August 1997.

Reference 27: State of Utah's Objections and Responses to Applicant's Seventh Set of Formal Discovery Requests to Intervenor State of Utah, September 28, 2001.

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Reference 28: Geomatrix Consultants, Inc., *Fault Evaluation Study and Seismic Hazard Assessment*, Rev. 1, Final Report, Vol. 1, Private Fuel Storage Facility, Skull Valley, Utah, March 2001.

Reference 29: Applicant's Objections and Responses to the State of Utah's Eleventh Set of Discovery Requests Directed to the Applicant, October 2, 2001.

Reference 30: 51 Federal Register 28,044 (1986).