

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

COMMISSIONERS

Nils J. Diaz, Chairman  
Edward McGaffigan, Jr.  
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Private Fuel Storage, L.L.C. )  
)  
) Docket No. 72-22-ISFSI  
(Independent Spent )  
Fuel Storage Installation) )  
)  

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**CLI-03-08**

**MEMORANDUM AND ORDER**

The State of Utah (Utah) has filed with the Commission a Petition for Review of the Atomic Safety and Licensing Board's Partial Initial Decision, LBP-03-08, 58 NRC \_\_\_\_ (May 22, 2003). Both the NRC Staff and Private Fuel Storage (PFS) oppose Utah's Petition. For the reasons set forth below, we deny Utah's petition.

**I. BACKGROUND**

This case stems from PFS's application to build and operate an independent spent fuel storage installation (ISFSI) to house casks of spent fuel rods from nuclear reactors. Utah sought and received a hearing in this proceeding, and has opposed PFS's application on many grounds. Among these are six lines of argument challenging the seismic sufficiency of PFS's proposed facility. The gravamen of these seismic challenges is that the facility as currently designed would not adequately protect the spent fuel casks, given the frequency and severity of earthquakes that might affect the facility.

The Board in LBP-03-08 ruled against all six lines of argument. The Board ultimately concluded that the casks containing the spent fuel rods would not tip over during a design basis

earthquake and that, even if one or more casks did tip over, the spent fuel canisters inside the casks would still not break or melt and the Commission's regulatory dose limits would not be exceeded. Utah now seeks Commission review of three rulings in LBP-03-08. Specifically, Utah objects to:

- (a) the Board's ruling that PFS's license may be issued prior to completion of PFS's soil-cement testing program, together with the Board's refusal to impose test-related conditions on PFS's license,
- (b) the Board's approval of the NRC Staff decision exempting PFS from the deterministic standard for predicting seismic ground motions,<sup>1</sup> and
- (c) the Board's use of what Utah considers an erroneous exposure duration to compute radiation doses at the facility boundary.<sup>2</sup>

## II. DISCUSSION

At this juncture, the decision before us concerns application of the Commission's standards for granting review. Review of an initial decision such as LBP-03-8 "may be granted in the discretion of the Commission, giving due weight to the existence of:

a substantial question with respect to the following considerations:

- (i) A finding of material fact is clearly erroneous or in conflict with a finding as to the same fact in a different proceeding;
- (ii) A necessary legal conclusion is without governing precedent or is a departure from or contrary to established law;
- (iii) A substantial and important question of law, policy or discretion has been raised;
- (iv) The conduct of the proceeding involved a prejudicial procedural error; or

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<sup>1</sup> Also known as "ground acceleration," and defined as the movement of the earth's surface from earthquakes or explosions. See United States Geological Survey, "Earthquake Glossary," available at [http://earthquake.usgs.gov/image\\_glossary](http://earthquake.usgs.gov/image_glossary).

<sup>2</sup> See Utah's Petition for Review of LBP-03-08, dated June 11, 2003.

(v) Any other consideration which the Commission may deem to be in the public interest.”<sup>3</sup>

Review of an initial decision such as LBP-03-08 is purely discretionary with the Commission.<sup>4</sup>

Before reaching Utah’s three arguments, we address briefly one important omission from its petition. Utah nowhere challenges the Board’s ultimate fact finding that, even were the storage casks at the PFS Facility to tip over in a design basis seismic event, the spent fuel canisters inside the casks would not break or melt,<sup>5</sup> there would be no release of radioactive material,<sup>6</sup> and the seismic event would thus not cause an exposure at the site boundary in excess of Commission’s regulatory dose limits.<sup>7</sup> Without a challenge to this ultimate fact finding, Utah’s petition for review amounts to a request that we consider a series of Board determinations that raise no bottom-line safety concerns. This alone would justify rejecting the petition. Nonetheless, as we frequently do when denying petitions for review in complex cases,<sup>8</sup> we explain in some detail below why we find Utah’s petition unpersuasive and not warranting further briefing and plenary review under section 2.786(b)(4).

**A. Post-Licensing Completion of the Soil-Cement Testing Program; Licensing Conditions**

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<sup>3</sup> 10 C.F.R. § 2.786(b)(4).

<sup>4</sup> See *Louisiana Energy Serv. (Claiborne Enrichment Ctr.)*, CLI-97-12, 46 NRC 52, 53 (1997).

<sup>5</sup> See LBP-03-08, 58 NRC at \_\_\_\_, \_\_\_\_, \_\_\_\_, slip op. at 5, 313 (finding F.65), 315 (finding F.67(5)).

<sup>6</sup> See *id.* at \_\_\_\_, slip op. at 315 (finding F.67(5)).

<sup>7</sup> See, e.g., *id.* at \_\_\_\_, slip op. at 353 (finding G.6) (“there would be no releases of radioactivity even in the event of a postulated tip-over” of casks).

<sup>8</sup> See *Carolina Power & Light Co. (Shearon Harris Nuclear Power Plant)*, CLI-01-11, 53 NRC 370 (2001), *petition for review denied sub nom. Orange County v. NRC*, 2002 WL 31098379 (D.C. Cir. 2002).

As previously noted, Utah objects to the Board's ruling that PFS's license may be issued prior to completion of PFS's soil-cement testing program, and also to the Board's refusal to impose test-related conditions on PFS's license.

As the Board explained in LBP-03-08, sites such as that of the PFS proposed facility "require an evaluation to determine their potential for instability due to vibratory ground motions [*i.e.*, earthquakes] and site-specific investigations must be conducted to demonstrate that site soil conditions are adequate to sustain the proposed foundation loads."<sup>9</sup> PFS proposes to use mixtures of cement and local soil to improve the qualities of the soil under and around both the foundation of the Canister Transfer Building (where the fuel rod canisters would be transferred from the transportation casks to the storage casks) and the 500 concrete pads on which as many as 4000 storage casks would rest. PFS has established design requirements for these mixtures<sup>10</sup> which, if met, would protect the pads and the Canister Transfer Building from the effects of a design basis earthquake.<sup>11</sup> Indeed, all parties -- including Utah -- have agreed that

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<sup>9</sup> See LBP-03-08, 58 NRC at \_\_\_\_, slip op. at 30, *citing* 10 C.F.R. § 72.102(c)-(d). Foundation loads can be either static (the weight of the structures that the foundation supports) or dynamic (forces, such as earthquakes or tornados, that act upon the foundation).

<sup>10</sup> The Board sets forth these requirements in *id.* at \_\_-\_\_, slip op. at 145-46 (finding C.5).

<sup>11</sup> See *id.* at \_\_-\_\_, slip op. at 144-45 (finding C.3) (citation omitted):

PFS intends to use soil-cement and cement-treated soil in three different ways. In the area directly underneath the concrete pads upon which the storage casks rest, cement-treated soil is to be used as a cohesive material that will be strong enough to resist the sliding forces generated by the [design basis earthquake]. The cement-treated soil will provide bonding with the bottom of the concrete pad above it and with the clay soils beneath, so as to transfer the horizontal earthquake forces downwards from the pad and into the underlying clay soils. Soil-cement is to be used in the area around and between the cask storage pads. There, the function of the soil-cement is to support the weight of the transporter vehicle that is used to deliver storage casks to the pad area. Soil-cement was chosen for this application so that the soil materials would not need to be wasted and replaced with structural fill. Finally, soil-cement is to be placed around the

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“these design requirements can be met by the use of appropriate soil-cement mixtures[, and Utah’s] soil-cement expert testified that he knew of nothing that would preclude PFS from meeting its design objectives for the soil-cement program.”<sup>12</sup>

PFS has likewise identified the testing program that it plans to use to establish the acceptability of its mixtures, and all parties -- again including Utah -- have agreed that PFS “has developed a suitable program, based on appropriate industry standards, for testing the properties of the soil-cement,”<sup>13</sup> that “the program is based on appropriate industry standards ... and ... includes the proper tests and suitable test methodology,”<sup>14</sup> and further that “the program to which PFS has committed ... is reasonable and should lead to proper soil-cement and cement-treated soil installation.”<sup>15</sup> PFS has not, however, completed this program for testing various soil and cement mixtures to determine which one will best meet the design requirements.

Utah is concerned that PFS will not finish this testing until after the conclusion of the adjudicatory hearing and that this delay would preclude Utah from challenging whether the testing program succeeded in proving the seismic portion of PFS’s design concept.<sup>16</sup> According to Utah, the combination of this delay and the “extra-legal post-license discretionary Staff

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<sup>11</sup>(...continued)

[Canister Transfer Building] foundation mat, extending outward from the mat a distance equal to the associated mat dimension, to provide additional passive resistance against sliding forces in the event of a [design basis earthquake].

<sup>12</sup> *Id.* at \_\_\_, slip op. at 146 (finding C.6) (citation omitted).

<sup>13</sup> *Id.* at \_\_\_, slip op. at 44. *Accord id.* at \_\_\_-\_\_\_, slip op. at 161 (finding C.47).

<sup>14</sup> *Id.* at \_\_\_, slip op. at 161-62 (finding C.48).

<sup>15</sup> *Id.* at \_\_\_, slip op. at 162 (finding C.49).

<sup>16</sup> See Petition at 4.

evaluation” of “whether PFS’s soil testing program will prove its design concept”<sup>17</sup> would deprive Utah of its hearing rights, in violation of the District of Columbia Circuit’s ruling in *Union of Concerned Scientists v. NRC*.<sup>18</sup> The D.C. Circuit there ruled that the Atomic Energy Act’s hearing requirement<sup>19</sup> applies to NRC Staff assessments of test results if those assessments entail more than a limited determination whether a licensee’s test results met “established objective ‘acceptance criteria.’”<sup>20</sup> Utah also objects to the Board’s failure to compile PFS’s soil-cement commitments into a set of test-related license conditions.<sup>21</sup>

We disagree that Utah’s hearing rights will be curtailed. In fact, Utah has already exercised its hearing rights quite vigorously on this issue during the lengthy proceeding before the Board. Utah has had every opportunity to litigate the adequacy of both PFS’s design and the soil testing methodology to be used to demonstrate that PFS has met the design. Utah incorrectly maintains that the NRC Staff will perform a post-licensing evaluation of “whether PFS’s soil testing program will prove its design concept.”<sup>22</sup> The Staff has, in fact, already completed its review of PFS’s design and analyses, and has concluded that the design would be safe and that the material properties used in the design are achievable.<sup>23</sup> Therefore, as the Staff

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<sup>17</sup> *Id.*

<sup>18</sup> 735 F.2d 1437 (D.C. Cir. 1984), *cert. denied sub nom. Arkansas Power & Light Co. v. Union of Concerned Scientists*, 469 U.S. 1132 (1985).

<sup>19</sup> 42 U.S.C. § 2239(a).

<sup>20</sup> 735 F.2d at 1451.

<sup>21</sup> See Petition at 4-5, 6.

<sup>22</sup> *Id.* at 4.

<sup>23</sup> See Staff’s Response to Utah’s Petition for Review of LBP-03-08, dated June 26, 2003, at 5 n.5, citing Transcript (Tr.) at 11,016-17, 11,021.

points out, "PFS has already 'proven its design.'"<sup>24</sup> Any further Staff review will involve mere verification that PFS has satisfied its specified design criteria, will be "ministerial" in nature,<sup>25</sup> and will thus not deprive Utah of a required hearing opportunity.

Further, we cannot accept Utah's assertion that the Board should have combined PFS's various commitments regarding soil-cement into a set of license conditions.<sup>26</sup> Those

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<sup>24</sup> *Id.*, citing Tr. 11021 (Ofoegbu).

<sup>25</sup> See *Hydro Resources, Inc.* (2929 Coors Road, Suite 101, Albuquerque, NM 87120), CLI-00-8, 51 NRC 227, 240 (2000) ("some matters may ... be left for post-licensing action, particularly activities that are simply ministerial or by their very nature require post-licensing verification by our Staff"). See also *Accord Private Fuel Storage* (Independent Spent Fuel Storage Installation), CLI-00-13, 52 NRC 23, 33-34 (2000). See also *Public Service Co. of New Hampshire* (Seabrook Station, Units 1 and 2), ALAB-940, 32 NRC 225, 235-36 (1990). Verification that a licensee complies with pre-approval testing criteria is a highly technical inquiry not particularly suitable for hearing:

[T]he Staff approval Appendix H calls for is not the type of determination that lends itself readily to an adjudicatory hearing. Under Appendix H, the Staff evaluates a proposed withdrawal schedule in terms of objective, technical preestablished criteria . . . . Confirming compliance with a self-implementing, detailed, industry standard does not call into play the various common reasons for requiring an adjudicatory hearing under Subpart G of 10 C.F.R. Part 2, such as the need to weigh various parties' observations or the utility of cross-examination.

*Cleveland Electric Illuminating Co.* (Perry Nuclear Power Plant, Unit 1), CLI-96-13, 44 NRC 315, 330 (1996). Cf. 5 U.S.C. § 554(a)(3).

<sup>26</sup> In sum, PFS made the following commitments regarding soil cement testing. PFS has agreed to follow the procedures set up in the Engineering Services Scope of Work for Laboratory Testing of Soil-Cement Mixes (ESSOW). The ESSOW actually used Nuclear Regulatory Guide 1.138 (Laboratory Investigations of Soils and Rocks for Engineering Analysis and Design of Nuclear Power Plants) as a source of guidance with respect to laboratory procedures and standards, in addition to citing numerous standards issued by the American Society for Testing and Materials. The laboratory testing program is being conducted by Applied Geotechnical Engineering Consultants, which will fully implement QA category I requirements of the ESSOW. PFS has also committed to follow the standards, procedures, and other recommendations listed in the industry standard publication on soil cement, American Concrete Institute Report ACI 230.1R-90 (1998). Further, based on ESSOW and ACI 230, PFS has committed that its test program will include the critical and fundamental tests for soils, such as soil index property tests, moisture-density tests, durability tests, compressive strength tests, and direct shear tests. In addition, PFS has committed to ensure that sufficient bonding is achieved.

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commitments are set forth in PFS's Safety Analysis Report and are therefore already part of the licensing basis of the facility.<sup>27</sup> PFS, if granted its license, must comply with those commitments -- regardless of the fact that they do not take the form of formal license conditions.<sup>28</sup> Indeed, PFS concedes as much.<sup>29</sup> If PFS subsequently wished to change those commitments to any significant extent, it would need to file a license amendment request,<sup>30</sup> which Utah could then challenge by seeking a hearing.

**B. Staff Decision Exempting PFS from the Deterministic Standard for Predicting Seismic Ground Motions**

Utah challenges the Board's approval of the Staff's decision to exempt PFS from the regulatory requirement that it use a deterministic standard when establishing the design basis earthquake that the PFS facility must be designed to withstand. These regulatory requirements are set forth in 10 C.F.R. §§ 72.92, 72.102 and 72.122 and 10 C.F.R. Part 100, Appendix A.

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<sup>26</sup>(...continued)

In this respect, PFS plans to use the techniques described in both the ACI 230 Report and "Bonding Study on Layered Soil Cement", REC-ERC-76-16, U.S. Bureau of Reclamation, Denver, CO, Sept. 1976. These techniques include (1) minimizing the time between placement of successive layers or "lifts" of soil cement, which will have a compacted thickness of approximately six inches; (2) moisture conditioning to facilitate the proper curing of the soil cement; (3) producing a roughened surface on the soil cement prior to the placement of additional lifts or concrete foundations; and (4) using a dry cement or cement slurry to enhance the bonding of concrete or new soil-cement layers to underlying layers that have already set. See LBP-03-08, 58 NRC at \_\_\_ - \_\_\_, slip op. at 157-61 (findings C-33 to C-44).

<sup>27</sup> See generally *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 NRC 3, 9 (2001).

<sup>28</sup> See generally *Private Fuel Storage* (Independent Spent Fuel Storage Installation), CLI-01-9, 53 NRC 232, 235-36 (2001) (ruling that not all license commitments must be converted into license conditions in order to be enforceable, and declining to impose a license condition requiring the licensee to follow its NRC-approved emergency plan).

<sup>29</sup> See PFS's Response in Opposition to Utah's Petition for Review of LBP-03-08, dated June 23, 2003, at 6.

<sup>30</sup> See 10 C.F.R. § 72.48(c)(1), (2).

## **1. Background**

Section 72.92 of our regulations contains a general requirement that all ISFSI applicants must evaluate the “[n]atural phenomena that may exist or that can occur in the region of the proposed [ISFSI] site” and must also determine those phenomena’s “potential effects on the safe operation of the ISFSI ....”<sup>31</sup> Another provision, section 72.122, more particularly requires applicants to design their safety-significant structures, systems and components “to withstand the effects of natural phenomena such as ... earthquakes.”<sup>32</sup>

And yet another provision, section 72.102, sets forth quite specific requirements which applicants must satisfy to assure the Commission that their proposed facilities could withstand earthquakes. Under 10 C.F.R. §§ 72.102(b) and (f), an ISFSI located west of the Rocky Mountain Front (an area that includes the proposed location of the PFS facility at issue in this proceeding) must meet the same seismic evaluation and design standards -- found in Appendix A of 10 C.F.R. Part 100 -- as apply to nuclear power facilities. Appendix A requires a nuclear power facility applicant to use a *deterministic* seismic hazard analysis when calculating the maximum credible earthquake (or “Safe Shutdown Earthquake”); Appendix A then requires the applicant to design the facility to withstand an earthquake of such intensity. This deterministic approach does not consider the earthquake’s probability, or the uncertainties associated with the identification and characterization of an earthquake at the site, or the uncertainties in ground motion modeling.<sup>33</sup>

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<sup>31</sup> 10 C.F.R. § 72.92(a).

<sup>32</sup> 10 C.F.R. § 72.122(b)(2)(i).

<sup>33</sup> See LBP-03-08, 58 NRC at \_\_\_\_, slip op. at 291-92 (finding F.10). See *also id.*, 58 NRC at \_\_\_\_, slip op. at 325-26 (finding F.87) (unlike a deterministic analysis, a probabilistic analysis “incorporates the contribution of all potential seismic sources and considers the range of source-to-site distances, earthquake magnitudes, and the randomness of earthquake ground motion modeling.”) (continued...)

In 1996, however, the Commission amended Part 100 (though not Appendix A) to allow nuclear power reactor licensees to use a *probabilistic* (or risk-informed) analysis that accounts not only for the intensity of a potential seismic event but also for the probability that a seismic event of a particular intensity will occur within a given time.<sup>34</sup> The Commission similarly amended Part 60 (applicable to high-level waste repositories) to allow the use of a probabilistic analysis.<sup>35</sup>

Because Part 72 has not been amended to permit ISFSI applicants to use the probabilistic approach allowed in Parts 100 and 60,<sup>36</sup> PFS submitted a request for an exemption from the requirement of section 72.102 that an applicant use a deterministic seismic hazard analysis.<sup>37</sup> PFS sought permission to use instead the probabilistic analysis described above. PFS initially sought an exemption that would permit it to calculate the magnitude of a seismic

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<sup>33</sup>(...continued)  
motions ... [and also] evaluates uncertainty in the assessment of seismic hazards”).

<sup>34</sup> See Final Rule, “Reactor Site Criteria Including Seismic and Earthquake Engineering Criteria for Nuclear Power Plants,” 61 Fed. Reg. 65,157 (Dec. 11, 1996); 10 C.F.R. § 100.23(d)(1).

<sup>35</sup> See Final Rule, “Disposal of High Level Radioactive Wastes in Geological Repositories; Design Basis Events,” 61 Fed. Reg. 64,257 (Dec. 4, 1996). See also *Private Fuel Storage*, CLI-01-12, 53 NRC 459, 461-62 (2001).

<sup>36</sup> The Commission is currently considering promulgation of a rule that would likewise permit Part 72 ISFSI applicants to use probabilistic rather than deterministic seismic hazard analyses. See Proposed Rule, “Geological and Seismological Characteristics for Siting and Design of Dry Cask Independent Spent Fuel Storage Installations and Monitored Retrievable Storage Installations,” 67 Fed. Reg. 47,745 (July 22, 2002). Under the proposed new Part 72 rules, the applicant would use a seismic hazard analysis to determine the maximum intensity of a potential earthquake likely to occur with a 2000-year “return period,” *i.e.*, the largest earthquake that would be expected to occur at a particular site every 2000 years.

<sup>37</sup> PFS submitted its exemption request pursuant to 10 C.F.R. § 72.7, which provides for exemptions from requirements of Part 72 so long as the exemption is “authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest.”

event with a recurrence interval of 1000 years.<sup>38</sup> However, in response to the NRC staff's suggestion, PFS amended its request to use a 2000-year return period for all structures.<sup>39</sup> The NRC Staff, in its Safety Evaluation Report, subsequently approved PFS's amended request for an exemption.<sup>40</sup> The Staff's approval of a risk-informed approach reflected the Commission's -- and Utah's own expert's -- view that the consequences of failure at ISFSIs are far less severe than those at operating nuclear power plants.<sup>41</sup>

In this adjudication, the Commission granted Utah permission to challenge the staff's approval of the exemption.<sup>42</sup> Utah's contention went to hearing, with the Board ultimately upholding the Staff's approval.<sup>43</sup> The Board accepted PFS's two-pronged justification for the exemption:

The first principle of a risk-informed seismic design is the use of a risk-graded approach to the design. The risk-graded approach imposes graded requirements on a safety structure. Under this approach, facilities and structures with more severe failure consequences are required to have low probabilities of failure, while facilities and structures with lesser failure consequences can have larger probabilities of failure. In other words, more important facilities and structures are designed to fail less frequently, while less important facilities and structures are allowed to have a higher failure probability.<sup>44</sup>

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<sup>38</sup> See *Private Fuel Storage*, CLI-01-12, 53 NRC at 463, citing PFS Exemption Request at 1-2.

<sup>39</sup> See *id.* at 463; LBP-03-08, 58 NRC at \_\_\_, slip op. at 289 (finding F.5).

<sup>40</sup> See LBP-03-08, 58 NRC at \_\_\_, slip op. at 289 (finding F.5). The Staff's action does not, however, mean that the exemption is now in effect. As the Staff points out, the exemption will be incorporated into the PFS license and will become effective only if and when the staff issues the license. See NRC Staff's Response at 9 n.10.

<sup>41</sup> See LBP-03-08, 58 NRC at \_\_\_, slip op. at 301 (findings F.34 - F.35).

<sup>42</sup> *Private Fuel Storage*, CLI-01-12, 53 NRC 459.

<sup>43</sup> LBP-03-08, 58 NRC at \_\_\_, slip op. at 99.

<sup>44</sup> *Id.* at \_\_\_, slip op. at 88-89. See also *id.* at \_\_\_, slip op. at 300-01 (finding F.33).

The second principle of the risk-informed seismic safety analysis is to apply a “two-handed approach” to assess seismic safety. This “two-handed approach” involves the consideration of both the mean annual probability of exceedance (MAPE [that is, the inverse of the mean “return period” described in footnote 36, *supra*]) of the [design basis earthquake] and the level of conservatism incorporated in the design codes, standards and procedures (also referred to as “risk reduction factors”). Under this “two-handed approach” if there is significant conservatism in the second hand (risk reduction factors), then a lower standard can be permitted to be set by the first hand (MAPE).<sup>45</sup>

The Board concluded that “the significant safety margins embedded in the ‘two handed approach’ provide reasonable assurance that the 2000-year mean return period is not only adequate, but is in practice more stringent than ... Utah[‘s own] 2500-year [earthquake] standard [as applied to certain buildings and bridges in the state]. Thus, the Utah standard provides no basis for disapproval of the seismic exemption request.”<sup>46</sup>

The Board also accepted the Staff’s independent reasons for approving the exemption,<sup>47</sup> *i.e.*, (1) previous Commission actions demonstrated the agency’s approval of the use of a probabilistic hazards analysis of the kind PFS conducted; (2) the Department of Energy, in its DOE-STD-1020-94, used a similar 2000-year return period when examining ISFSIs,<sup>48</sup> (3) the Commission in 1998 approved a 2000-year return period earthquake as a design basis ground motion for the TMI-2 ISFSI,<sup>49</sup> and (4) the Staff concluded that PFS had provided “an overly

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<sup>45</sup> *Id.* at \_\_\_\_, slip op. at 89 (citation and footnote omitted). See also *id.* at \_\_\_\_, slip op. at 302 (finding F.36). Utah “‘emphatically’ agreed on the appropriateness of applying this ... two-handed ... approach to evaluating the seismic safety of the PFS facility.” *Id.* at \_\_\_\_, slip op. at 304 (finding F.44).

<sup>46</sup> *Id.* at \_\_\_\_, slip op. at 99. See also *id.* at \_\_\_\_-\_\_\_\_, slip op. at 297-98 (findings F.21 - F.24) regarding Utah’s proposed 2500-year return period earthquake.

<sup>47</sup> See *id.* at \_\_\_\_-\_\_\_\_, slip op. at 95-99.

<sup>48</sup> See *id.* at \_\_\_\_-\_\_\_\_, slip op. at 336-38 (findings F.110 - F.114).

<sup>49</sup> See *id.* at \_\_\_\_-\_\_\_\_, slip op. at 338-341 (findings F.115 - F.120).

conservative seismic hazard assessment, which added an additional margin of safety to [PFS's] design."<sup>50</sup>

## **2. Discussion**

Utah now seeks Commission review of the Board's rulings on the exemption request.<sup>51</sup> However, Utah challenges only the final of the Staff's four grounds for approving the exemption request -- *i.e.*, the Staff's finding that PFS had provided "an overly conservative seismic hazard assessment."<sup>52</sup> But Utah does not explain why a finding in Utah's favor on this point would outweigh the three unchallenged bases and thereby yield a result different from the one the Board reached regarding the Staff's approval of PFS's exemption request. Without a showing that a Commission acceptance of Utah's "conservatism" argument would necessitate an overturning of the Board's ruling on the "exemption" issue, Utah's argument cannot be considered a "substantial question" under 10 C.F.R. § 2.786(b)(4). We are, in any event, unpersuaded that the Staff and the Board erred in concluding that PFS had provided a conservative seismic hazard assessment.<sup>53</sup>

### *a. Witness Credibility*

Utah's petition questions the Board's reliance on the testimony of a Staff witness (Dr. John A. Stamatakos), rather than on Utah's "more credentialed and ... more knowledgeable" witness<sup>54</sup> (Dr. Walter J. Arabasz) and juxtaposes the arguments and evidence sponsored by

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<sup>50</sup> See *id.* at \_\_\_\_, slip op. at 95-96, 325-26 (findings F.87 - F.88).

<sup>51</sup> See Petition for Review at 7-17.

<sup>52</sup> *Id.* Utah's Petition refers to, but does not challenge, grounds (2) and (3). *Id.* at 8.

<sup>53</sup> See LBP-03-08, 58 NRC at \_\_\_\_, slip op. at 95-96.

<sup>54</sup> Petition at 8-9.

these two witnesses in an attempt to show that Utah's witness was more persuasive than the staff's witness.<sup>55</sup>

Although the Commission certainly has authority to make its own *de novo* findings of fact,<sup>56</sup> we generally do not exercise that authority where a Licensing Board has issued a plausible decision that rests on carefully rendered findings of fact.<sup>57</sup> Our standard of "clear error" for overturning a Board's factual finding is quite high. As we stated when denying an NRC Staff petition for review in *Kenneth G. Pierce*:

The Staff's position ... demonstrates only that the record evidence in this case may be understood to support a view sharply different from that of the Board. The Staff's petition [for review] does not show that the Board's own view of the evidence was "clearly erroneous" – *i.e.*, that its findings were not even "plausible in light of the record viewed in its entirety." *Anderson v. Bessemer*, 470 U.S. 564, 573-76 (1985). This is fatal to a petition for review resting solely on the "clearly erroneous" standard.<sup>58</sup>

The Board in the instant case offered an intricate, 76-page discussion of the exemption issue; it obviously weighed with great care and in great detail all the evidence and testimony.<sup>59</sup>

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<sup>55</sup> *Id.* at 11-14.

<sup>56</sup> See, e.g., *Louisiana Power and Light Co.* (Waterford Steam Elec. Station, Unit 3), ALAB-732, 17 NRC 1076, 1087 n.12 (1983); *Duke Power Co.* (Catawba Nuclear Station, Units 1 and 2), ALAB-355, 4 NRC 397, 403-04, *reconsid'n denied*, ALAB-359, 4 NRC 619 (1976).

<sup>57</sup> See, e.g., *Shearon Harris*, *supra* n.8, CLI-01-11, 53 NRC at 382; *Hydro Resources* (P.O. Box 15910, Rio Rancho NM 87174), CLI-01-4, 53 NRC 31, 45 (2001); *Louisiana Energy Serv.* (Claiborne Enrichment Ctr.), CLI-98-3, 47 NRC 77, 93 (1998); *Kenneth G. Pierce* (Shorewood, IL), CLI-95-6, 41 NRC 381, 382 (1995). See generally *Dominion Nuclear Conn.* (Millstone Power Station, Unit 3), CLI-02-22, 56 NRC 213, 222 (2002) ("We ordinarily do not review fact-specific Board decisions, absent obvious error").

<sup>58</sup> CLI-95-6, 41 NRC at 382. See also *Aharon Ben-Haim, Ph.D.*, CLI-99-14, 49 NRC 361, 364 (1999) (rejecting the Staff's petition for review despite the Commission's conclusion that "the Staff presents colorable arguments").

<sup>59</sup> See LBP-03-08, 58 NRC at \_\_\_-\_\_\_, \_\_\_-\_\_\_, slip op. at 87-99, 287-350 (findings F.1 - F.137). Compare *Shearon Harris*, CLI-01-11, 53 NRC at 388 (ruling that the Commission would not "redo the Board's work" where the Board had issued an "intricate and well-supported findings (continued...)

Our deference to the Board as factfinder is particularly great where, as here, the Board bases its findings of fact in significant part on the credibility of the witnesses.<sup>60</sup> The Board's determinations regarding the exemption request turned at least in part on the Board's consideration of the two expert witnesses' demeanor, credentials and testimony.<sup>61</sup> Under these circumstances, we see no reason to second-guess the Board's credibility determinations or to find them "clearly erroneous."

*b. Staff's Reliance on Design Basis Earthquakes for Western Power Plants*

One of several baselines that the Staff used in determining the appropriate design basis earthquake for the proposed PFS facility was the design basis earthquake for a hypothetical nuclear power plant located at the same PFS site.<sup>62</sup> The Staff first calculated that the average design basis earthquake for five nuclear power plants in the Western United States (specifically in California, Arizona and Washington state) was a 5000-year quake.<sup>63</sup> Based on this

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<sup>59</sup>(...continued)  
in a 42-page opinion").

<sup>60</sup> See, e.g., *Shearon Harris*, CLI-01-11, 53 NRC at 388; *Hydro Resources*, CLI-01-4, 53 NRC at 46, 45; *Aharon Ben-Haim, Ph.D*, CLI-99-14, 49 NRC at 364.

<sup>61</sup> Regarding general findings of credibility, see LBP-03-08, 58 NRC at \_\_\_\_, \_\_\_\_ - \_\_\_\_, \_\_\_\_ - \_\_\_\_, \_\_\_\_, slip op. at 98 ("The Staff's explanations that the slip rate for the Wasatch Fault near Salt Lake City is likely to be 3 to 10 times larger than that of the Stansbury Fault near the PFS site is supported by expert testimony with appropriate analysis and available data"), 294-300 (findings F.16 - F.31) (describing Drs. Stamatakos's and Arabasz's expert testimony regarding the classification of hazardous curves, and then explaining the Board's preference for Dr. Stamatakos's results), 341-48 (findings F.121 - F.132) (describing Drs. Stamatakos's and Arabasz's expert testimony regarding probabilistic seismic analysis, and then explaining why the Board gave greater credence to the position espoused by Dr. Stamatakos), 348 (finding F.132) (addressing Dr. Stamatakos's credibility by ruling that "we do not share the State's misgivings about the usefulness of Dr. Stamatakos' comparison of the seismic hazard curves produced by these three PSHA studies").

<sup>62</sup> See *id.* at \_\_\_\_, slip op. at 95-96.

<sup>63</sup> See *id.* at \_\_\_\_, \_\_\_\_, slip op. at 293 (finding F.14), 333 (finding F.104).

conclusion, the Staff indicated that the NRC would require the hypothetical nuclear power plant at the PFS site to be likewise designed to withstand a 5000-year earthquake.<sup>64</sup> Then, based on the uncontested assumption that the consequences of failure at ISFSIs are far less severe than those at operating nuclear power plants, the Staff concluded that the design basis earthquake for the PFS facility could likewise be considerably less severe than the 5000-year quake that the hypothetical nuclear power plant would be designed to withstand.<sup>65</sup> The Staff established the earthquake severity level for the proposed PFS facility at 2000 years.<sup>66</sup>

Utah challenges both the Staff's conclusion that a hypothetical nuclear power plant located at the PFS site would be designed to withstand a 5000-year earthquake and also the Staff's underlying reliance on the average 5000-year design basis earthquakes used for the five Western nuclear power plants.<sup>67</sup> Utah asserts that the Staff (and the Board) should have instead used a 10,000-year design basis earthquake benchmark for the hypothetical power plant.<sup>68</sup>

We do not believe Utah's challenge shows a "clear error" of fact as required by 10 C.F.R. § 2.786(b)(4)(i) and *Kenneth R. Pierce, supra*. Utah agrees that the issue whether to assume a 5000-year or a 10,000-year earthquake turns on whether the PFS site can be described as "high-seismicity."<sup>69</sup> This latter question is, in turn, an issue on which the record contains conflicting evidence -- the seismic study performed by Geomatrix (on which the Staff and PFS

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<sup>64</sup> See *id.* at \_\_\_\_, slip op. at 293 (finding F.14).

<sup>65</sup> See *id.* at \_\_\_\_, \_\_\_\_, slip op. at 301 (findings F.34 - F.35), 333 (finding F.102).

<sup>66</sup> See *id.* at \_\_\_\_, \_\_\_\_, slip op. at 87, 335 (finding F.109).

<sup>67</sup> See Petition at 9-11. See also LBP-03-08, 58 NRC at \_\_\_\_, slip op. at 293-94 (finding F.14).

<sup>68</sup> See LBP-03-08, 58 NRC at \_\_\_\_, \_\_\_\_, slip op. at 297 (finding F.21), 298 (finding F.25).

<sup>69</sup> See *id.* at \_\_\_\_, slip op. at 298 (finding F.25).

rely) and a set of four pieces of evidence (on which Utah relies).<sup>70</sup> Given that the record contains significant evidence supporting the Staff's view of the "high seismicity" issue -- namely, the Geomatrix study -- we cannot conclude that, under 10 C.F.R. § 2.786(b)(4)(i), the Staff was wrong in using a 5000-year earthquake as a baseline, or that the Board clearly erred in approving the Staff's decision to grant an exemption based in part on the Geomatrix analysis and the 5000-year earthquake.<sup>71</sup>

Our reluctance to second-guess a Board factual finding under these circumstances is heightened by an additional factor: Utah itself "acknowledges that the Geomatrix investigators who conducted the [study] for the PFS site ... are highly competent [and] that Geomatrix conducted an adequate [study] to depict the potential hazard at the PFS site."<sup>72</sup>

*c. Safety Margins*

Utah also challenges directly both the Staff's and the Board's conclusion that Geomatrix's (*i.e.*, PFS's) probabilistic seismic hazard assessment for its site was "conservative"<sup>73</sup> (As noted at page 11 above, "the level of conservatism incorporated in the design codes, standards and procedures" is a key element of the second principle of risk informed seismic safety analysis.) Utah first questions the Staff expert's slip tendency analysis ("a modeling technique designed to assess stress states and potential fault activity")<sup>74</sup> and his

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<sup>70</sup> See Petition at 10.

<sup>71</sup> To be sure, Utah's expert sees the situation differently. But this is not decisive. See *Kenneth G. Pierce*, CLI-95-6, 41 NRC at 382, quoted *supra* at 14. See also *Aharon Ben-Haim, Ph.D.*, CLI-99-14, 49 NRC at 364; *Claiborne Enrichment Ctr.*, CLI-98-3, 47 NRC at 93.

<sup>72</sup> LBP-03-08, 58 NRC at \_\_\_\_, slip op. at 299 (finding F.28).

<sup>73</sup> See Petition at 11-15. Utah does, however, agree that PFS's assessment is adequate. See LBP-03-08, 58 NRC at \_\_\_\_, slip op. at 346 (finding F.129).

<sup>74</sup> See LBP-03-08, 58 NRC at \_\_\_\_, slip op. at 342 (finding F.123).

comparison of ground motions at the PFS site with the sites in and around Salt Lake City.<sup>75</sup> Utah then goes on to question PFS's decision to design its facility to withstand only a 2000-year earthquake.

Slip Tendency Analysis. Utah asserts that staff expert Dr. Stamatakos, in his slip tendency analysis, extrapolated from inapposite data when positing the stress state in Skull Valley (the location of the proposed PFS facility). According to Utah, Dr. Stamatakos's extrapolation is flawed because he misrepresented some data, ignored other data, and inappropriately relied on two disparate methodologies of measuring and comparing slip rates for three different faults. From this, Utah concludes that both the Staff and the Board erred in relying on Dr. Stamatakos's analysis as support for their conclusion that PFS's hazard analysis was conservative.<sup>76</sup>

Utah's argument is, however, undercut by its own statements that "the Staff's interpretation of the stress state in Skull Valley would be one competing opinion in a [probabilistic seismic hazard analysis], subject to challenge by other experts ... [and that] corresponding inferences the Staff makes from the slip tendency analysis about conservatism ... are also arguable and not established conclusions."<sup>77</sup> With these words, Utah essentially concedes that Dr. Stamatakos's views on this issue are neither fact nor fallacy. They are instead merely what they purport to be -- expert opinion -- and are thus fairly susceptible to a factual determination based on the Board's assessment of both the credibility of Dr. Stamatakos and the substance of his comments. For the reasons already set forth above, and also for the reasons provided by

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<sup>75</sup> See Petition at 11-14.

<sup>76</sup> See *id.* 12-13.

<sup>77</sup> Utah's Proposed Findings of Fact and Conclusions of Law on United Contention Utah L/QQ, dated Sept. 5, 2002, at 206. *Accord* LBP-03-08, 58 NRC at \_\_\_\_, slip op. at 343-44 (finding F.124).

the Board,<sup>78</sup> we decline to second-guess the credibility determinations and fact findings of the Board on this matter.

Ground Motion Comparisons. Utah next challenges Dr. Stamatakos's peak ground motion (peak ground acceleration) comparisons to both the Salt Lake City area and to nine other sites in the Salt Lake Valley's I-15 corridor. Utah asserts that these comparisons are flawed and asks the Commission to reverse the Board's ruling that upheld them.<sup>79</sup>

Dr. Stamatakos compared Geomatrix's hazard analysis for the PFS site with the USGS's national earthquake hazard map for the Salt Lake City area, and he concluded that the PFS site would be 1.5 times more likely than Salt Lake City to experience an earthquake in which the ground would move at a particular rate of acceleration (here 0.5 g).<sup>80</sup> Utah asserts that the Staff's failure to "independently perform site-specific [probabilistic seismic hazard analysis] for the two sites"<sup>81</sup> renders the Staff's "conservatism" finding "pure speculation." Although this argument is not a model of clarity, it appears to boil down to this: the Staff's comparison of the highly site-specific data in the PFS analysis with the far more approximate data in the USGS's Salt Lake City mapping is equivalent to comparing apples and oranges,<sup>82</sup> only a site-specific

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<sup>78</sup> See LBP-03-08, 58 NRC at \_\_\_\_, \_\_\_\_, slip op. at 98-99, 347 (findings F.130 - F.131).

<sup>79</sup> See Petition at 13-14. See also LBP-03-08, 58 NRC at \_\_\_\_, slip op. at 346 (finding F.127).

<sup>80</sup> "g" is a unit of measurement for acceleration. 0.5g equates to an acceleration of 4.9 meters per second per second (m/s<sup>2</sup>).

<sup>81</sup> Petition at 13.

<sup>82</sup> Site-specific earthquake hazard analyses include more details than regional analyses. For example, a site-specific analysis would normally include a detailed profile of the site's soil. By contrast, regional analyses like those of USGS do not require specific soil profiles but instead use only a generic soil in their hazard analysis.

analysis of the Salt Lake City area would provide the data necessary for a valid apples-to-apples comparison; and the Staff has not performed such an analysis.

We find Utah's argument unconvincing. Utah fails to recognize that neither the Staff nor the Board was considering this comparison to be a dispositive set of data that would, without more, fully support the Staff's conclusion that the Geomatrix analysis was conservative. Rather the Staff was looking at this merely as a rough comparison that was only one of many pieces of information that the Staff used in reaching its conclusion that PFS's analysis was conservative. The Board likewise recognized this to be no more than a "crude" comparison<sup>83</sup> and consequently treated it as only one of a number of factors that together justified the conclusion that the PFS's hazard analysis was conservative.

We agree with the Staff and the Board that, up to a point, the comparison is fruitful. Admittedly, the USGS mapping appears to lack a specific nodule (measuring point) located the same distance from the Wasatch Fault (the major active fault near Salt Lake City)<sup>84</sup> as the PFS site is located from the East Fault (the fault nearest the PFS site) -- 0.7 km. The USGS mapping therefore cannot, for purposes of calculating earthquake hazard, provide data that is, strictly speaking, comparable to the data that Geomatrix provided for the PFS site located 0.7 km from the East Fault. Still, the USGS mapping includes the entire area surrounding the Wasatch Fault and encompasses many points 0.7 km from that Fault. Therefore, the quantified value of the earthquake hazard for the portions of the area containing these points can be considered at least

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<sup>83</sup> See LBP-03-08, 58 NRC at \_\_\_\_, slip op. at 348 (finding F.132) (citations omitted).

<sup>84</sup> USGS's earthquake hazard maps take into account all major active faults in the country but do not, except by chance, reflect data relevant to every location or site on those maps. Moreover, in preparing those maps, the USGS did not consider the soil conditions at individual sites but instead assumed the presence of a generic "B/C boundary" soil (*i.e.*, a soil through which a particular kind of seismic wave would travel at a specific speed, 760 m/s).

a rough proxy for the more site-specific earthquake hazard value which Utah states is lacking in the USGS mapping.

Utah also complains about the Board's reliance on another comparison -- Dr. Stamatakos's purportedly invalid comparison of the Geomatrix study with a study of nine sites along the I-15 corridor by Dames & Moore (an engineering consulting firm). Dr. Stamatakos concluded (and the Board agreed) that the peak ground motion for a 2000-year design basis earthquake at the PFS site is actually higher than the peak ground motion for the 2500-year earthquake used in the design basis for certain buildings in the I-15 corridor.<sup>85</sup> Utah describes this comparison as "meaningless" because the Staff did not "strip[] off the site responses at the PFS and I-15 sites,"<sup>86</sup> *i.e.*, the Staff did not remove from its hazard calculations the effect which the soil overlaying these two rock bases would have on seismic waves as they go through the soil. According to Utah, this error precluded the Staff from focusing solely on the remainder of the hazard calculations (*i.e.*, the peak ground acceleration at the topmost levels of the two rock bases).

We see this second comparison as similar to the first in that it is only a "crude" comparison. The Staff apparently viewed it so.<sup>87</sup> Moreover, even assuming that the Staff (and the Board) should not have relied in part on this particular comparison in reaching its general conclusion regarding the overly conservative nature of Geomatrix's analysis, the rejection of this

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<sup>85</sup> See LBP-03-08, 58 NRC at \_\_\_\_, slip op. at 99, 348-350 (findings F.133 - F.136), for an explanation of this paradoxical conclusion (which is unchallenged on appeal).

<sup>86</sup> See Petition at 13. See *also* Utah's Proposed Findings of Fact at 210.

<sup>87</sup> See Staff's Reply [to Utah's Proposed] Findings of Fact and Conclusions of Law Concerning Unified Contention Utah L/QQ (Geotechnical Issues), Oct. 16, 2002, at 59 ("we find no reason why a valid comparison of the resulting seismic hazard curves cannot be made, at least for purposes of examining, *even on a crude basis*, whether on of those analyses produced seismic hazard curve results which are palpably greater than expected" (emphasis added)).

source of support for the Staff's conclusion would not justify our rejecting the Staff's general conclusion outright. The record contains significant additional support for the Staff's and the Board's conservatism finding<sup>88</sup> -- support which Utah has challenged either unsuccessfully or not at all.

PFS's Design Basis Earthquake. Utah does not, however, limit its challenge to the Staff's and the Board's seismic analyses. Utah also challenges PFS's analysis, and the Board's reliance on it. Utah asserts that, by "designing only to a 2000-year [design basis earthquake, as compared with a more severe design basis earthquake], the absolute margins of safety are greatly diminished."<sup>89</sup> In support, Utah cites the following mathematically-obvious statement from its own Proposed Findings of Fact and Conclusions of Law:

Although a factor of safety may be the same for different [design basis earthquakes], the amount of actual design margin is different. A factor of safety is a function of the capacity divided by the demand.... Thus, if the factor of safety is kept constant and the demand is reduced from a 10,000-year [design basis earthquake] to a 2000-year [design basis earthquake], then the capacity is also ... reduced.... Although the factor of safety is the same for both earthquakes, the

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<sup>88</sup> See LBP-03-08, 58 NRC at \_\_\_\_, slip op. at 300:

[W]e note that the Staff has identified what it considers to be many conservatisms in the Geomatrix PSHA [probabilistic seismic hazard analysis]. Therefore, the 2000-year DBE [design basis earthquake] constitutes a conservative prediction of the seismic hazard at the PFS facility. This conservatism is above and beyond the inherent conservatisms embodied in the PFS facility design, and provides additional confidence that the 2000-year DBE for the PFS facility provides sufficient protection of public health and safety.

For specific examples of such conservatisms, see LBP-03-08, 58 NRC at \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, slip op. at 98-99, 115 (finding A.19), 298 (finding F.26), 324 (finding F.83), 327 (findings F.90 - F.91), 329 (finding F.94), 347 (finding F.130 - F.131).

<sup>89</sup> Petition at 14. See also *id.* ("PFS's ... concepts ... severely minimize safety margins"); *id.* at 15 ("severely reduces safety margins by relying on concepts contrary to earthquake engineering practices").

actual capacity – the design margin – is larger for the 10,000-year earthquake compared to the 2000-year earthquake....<sup>90</sup>

Based on the mathematics set forth above, Utah had asked the Board to find “that PFS’s 2000-year [design basis earthquake] design does not have the same design margin as a 10,000-year [design basis earthquake] design for a [nuclear power plant].”<sup>91</sup>

Utah is of course correct that a design that protects against a 2000-year earthquake necessarily provides somewhat less of a safety margin than a design that protects against a 10,000-year earthquake. But the correctness of Utah’s comparison of design margins does not, as a matter of logic, support Utah’s position before us that the Board’s approval of diminished safety margins raised so “substantial [a] question” of fact and presented so clear a case of factual error as to require the Commission’s review and correction. The mere assertion that safety margins will be “greatly diminished” does not, without more, equate to an assertion that the Board made a “clearly erroneous” finding of fact.<sup>92</sup> After all, a safety margin at an ISFSI could be “greatly diminished” yet still provide a level of protection sufficient to satisfy our Part 72 safety requirements.

Moreover, when we issued CLI-01-12 two years ago sending the seismic issue to the Board for hearing, we were well aware of the inherently obvious fact that a facility designed to withstand a 2000-year return period earthquake would provide a smaller margin of safety than a building designed to withstand a 10,000-year return period earthquake.<sup>93</sup> In that decision, we did not hold, as Utah urged, that PFS must use a 10,000-year return period earthquake in the design

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<sup>90</sup> Utah’s Proposed Findings of Fact at 228 (citations omitted).

<sup>91</sup> *Id.* at 228.

<sup>92</sup> 10 C.F.R. § 2.786(b)(4)(i).

<sup>93</sup> See CLI-01-12, 53 NRC 459.

basis for its critical structures.<sup>94</sup> Instead, we asked the Board to determine whether, as a factual matter, the proposed 2000-year return period would protect the public health and safety.<sup>95</sup>

*d. The Public Interest*

Utah criticizes the Board for not considering “the public interest” when ruling on the exemption request, as required under 10 C.F.R. § 72.7.<sup>96</sup> The Board did not ignore the public interest. To the contrary, the Board not only twice quoted the entire requirements of that regulation - including the public interest factor<sup>97</sup> - but also made an explicit finding that:

Pursuant to 10 C.F.R. § 72.7, both the Applicant and the Staff have provided adequate justification to support the conclusion that the Staff’s grant of the Applicant’s exemption request -- *i.e.*, to use a PSHA methodology and a 2000-year design basis earthquake -- was authorized by law, will not endanger life or property or the common defense and security, and is otherwise in the public interest.<sup>98</sup>

**C. Exposure Duration for Computing Radiation Dosages at the Site Boundary**

According to Utah, the Board erred in concluding that, for purposes of determining PFS’s compliance with the Commission’s 5-rem accidental dose limit for an ISFSI, PFS appropriately assumed that the person receiving the dose was present at the site boundary only during the ISFSI’s operational hours (40 hours a week for 50 weeks a year).

**1. Background**

Section 72.106(b) of our ISFSI regulations provides, in significant part, that “[a]ny individual located on or beyond the nearest boundary of the control area may not receive from

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<sup>94</sup> See *id.* at 472.

<sup>95</sup> See *id.* at 467.

<sup>96</sup> See note 37, *supra*.

<sup>97</sup> LBP-03-08, 58 NRC at \_\_\_\_, \_\_\_\_, slip op. at 88, 292 (finding F.11).

<sup>98</sup> *Id.* at \_\_\_\_, slip op. at 371.

any *design basis accident* a total effective dose equivalent of ... 5 rem.”<sup>99</sup> Section 72.104(a) provides, in pertinent part, that “[d]uring *normal operations and anticipated occurrences*, the annual dose equivalent to any real individual who is located beyond the control area must not exceed ... 25 mrem ... to the whole body.”<sup>100</sup>

PFS assumed in its application that, because there is no one now living or likely to live near the facility, PFS’s average site worker would be both the “real individual” referenced in section 72.104(a) *and* the “individual” referenced in section 72.106(b). PFS then relied on the cask manufacturer’s dose consequences analysis which assumed that this average site worker would be on the site boundary 40 hours a week for 50 weeks a year.<sup>101</sup> The analysis yielded a maximum dose rate of 5.85 mrem per year under normal operating conditions, and further determined that a multiple-cask-tipover accident would not result in any significant aggregate increase of radiological doses at the facility boundary.<sup>102</sup> From this information, PFS concluded that its “individuals” would not experience accident dose levels in excess of the limits specified in section 72.106(b).<sup>103</sup>

The Board accepted PFS’s approach and analysis,<sup>104</sup> ruled that the 5-rem accident limit of section 72.106(b) would apply to “real individuals” based on site-specific circumstances,<sup>105</sup>

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<sup>99</sup> 10 C.F.R. § 72.106(b) (emphasis added).

<sup>100</sup> 10 C.F.R. § 72.104(a) (emphasis added).

<sup>101</sup> See LBP-03-08, 58 NRC at \_\_\_\_, slip op. at 101 n.33.

<sup>102</sup> See *id.* at \_\_\_\_, slip op. at 100-01.

<sup>103</sup> See *id.* at \_\_\_\_, slip op. at 101.

<sup>104</sup> See *id.* at \_\_\_\_, slip op. at 101-02.

<sup>105</sup> See *id.* at \_\_\_\_, slip op. at 356-57 (findings G.13: “for accident conditions, the 5 rem limit [in section 72.106(b)] would apply to *real individuals*, and site-specific circumstances would similarly need to be taken into account, including any remedial measures that may be taken

(continued...)

and concluded that the 5.85 mrem maximum dose rate was well within the limits permitted under both sections 72.104(a) and 72.106(b) for normal operations and accidental conditions, respectively.<sup>106</sup>

## **2. Discussion**

In arguing that the Board erred in interpreting the 5-rem accident dose limit in 10 C.F.R. § 72.106(b) as applying only during the site's operational hours, Utah claims that the Board ignored the difference in the wording of section 72.104(a)'s operating conditions ("a real individual") and section 72.106(b)'s accident conditions ("any individual"). According to Utah, this error led to the Board's failure to consider that the "individual" would be located at the site boundary 24 hours a day for 365 days – an approach that, if considered, would have increased the accident dose limit at the site boundary from 2000 to 8760 hours per year.<sup>107</sup> Utah further claims that the Board's use of a 2000-hour annual exposure duration disregards the fact that the certificate of compliance for the HI-STORM 100 storage casks which PFS proposes to use is supported by an analysis using an 8,760-hour annual exposure duration.<sup>108</sup>

Utah's argument regarding the difference between the terms "any individual" and "any real individual" has some linguistic force. It is, however, at odds with our current reality-based

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<sup>105</sup>(...continued)  
during extended accident conditions"). See also *id.* at \_\_\_\_, slip op. at 358 (findings G.17 - G.18).

<sup>106</sup> See *id.* at \_\_\_\_, slip op. at 352 (finding G.5). See also *id.* at \_\_\_\_, slip op. at 355 (finding G.11) ("there are approximately three orders of magnitude of margin between the expected dose rate at the [site] boundary for 4000 casks in a tipped-over condition compared to the 5 rem accident dose limit in 10 C.F.R. § 72.106(b)").

<sup>107</sup> See Petition at 17-18.

<sup>108</sup> See *id.* at 18.

risk-informed regulatory philosophy.<sup>109</sup> It is also unsupported by this agency's regulatory interpretations of sections 72.104(a) and 72.106(b). In 1995, the Commission rejected a rulemaking petition that we amend section 72.104(a) along the same lines as Utah now suggests for interpreting section 72.106(b). The petitioner there had essentially suggested that we set dose limits in a way that would protect "an imaginary individual ... continually present at the boundary of the controlled area" of an ISFSI. In declining, we enunciated the general principle that "[t]he NRC regulates radiation doses on the basis of real people in proximity to the boundary of the controlled area."<sup>110</sup> We see no more reason to vary from this general principle when interpreting section 72.106(b) than when interpreting 72.104(a).

Utah's interpretation likewise fails to take into account the NRC Staff's reality-based interpretation of the accident dose standard in section 72.106(b). The Staff guidance in NUREG-1567 assumes that the "individual" remains at the site boundary for 30 days, not 365 days.<sup>111</sup> This assumption is based on common sense – that protective actions would assure that any person so close to the boundary would be evacuated or otherwise protected if the casks

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<sup>109</sup> See generally Part II.B.1 of this Memorandum and Order, *supra*.

<sup>110</sup> *Maryland Safe Energy Coalition; Denial of Petition for Rulemaking*, 60 Fed. Reg. 38,286, 38,288 (July 26, 1995).

<sup>111</sup> See NUREG-1567, "Standard Review Plan for Spent Fuel Dry Storage Facilities," at page 9-15 (March 2000):

For hypothetical accident conditions, the duration of the release is assumed to be 30 days (720 hours). The bounding exposure duration assumes that an individual is also present at the controlled area boundary for 30 days. This time period ... provides good defense in depth since recovery actions to limit releases are not expected to exceed 30 days.

cannot be “righted” within 30 days (720 hours). Considered in this light, the Board’s decision to accept PFS’s 2000-hour occupancy time<sup>112</sup> was actually generous to Utah.

Further, the record fully supports the Board’s related factual finding that the only individuals likely to be present at the site boundary would be PFS workers who would presumably be present only 40 hours a week for 50 weeks a year.<sup>113</sup> As the Staff points out regarding future use of the land adjoining the PFS site:

the nearest residence ... is two miles away; only about 30 persons live on the Reservation, and only 36 persons live within a 5-mile radius of the facility; there are no transient or institutional populations within 5 miles of the site, and no public facilities are located or planned within that radius; Dr. Resnikoff [Utah’s expert witness] was not familiar with any potential future land use development in the area; and PFS witness John Donnell testified concerning the low potential for future land development close to the site.<sup>114</sup>

We see no relevance to this proceeding in Utah’s argument regarding the assumptions underlying the analysis for the HI-STORM cask certificate of compliance. Because those casks may be used at a variety of sites (and not just at PFS), the generic dose calculations for those casks necessarily assumed full-time occupancy at the site boundaries.

Utah’s position regarding dose limits is further undermined by the Board’s general findings that the spent fuel canisters will not tip over during a design basis earthquake,<sup>115</sup> that even were any canisters to tip over, they would still not break or leak,<sup>116</sup> and that the NRC’s

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<sup>112</sup> See LBP-03-08, 58 NRC at \_\_-\_\_, \_\_-\_\_, slip op. at 101-02, 356-58 (findings G.13-18).

<sup>113</sup> See *id.* at \_\_-\_\_, slip op. at 358 (finding G.17).

<sup>114</sup> Staff’s Response at 15 n.21.

<sup>115</sup> See LBP-03-08, 58 NRC at \_\_\_\_, slip op. at 353 (finding G.6: “it has been demonstrated that the casks will not tip over”).

<sup>116</sup> See *id.* at \_\_\_\_, slip op. at 353 (finding G.6: “The results of this analysis show that all stresses on the storage cask remain within the allowable values ..., assuring the integrity of the  
(continued...)”)

accidental dose limit would therefore not be exceeded as a result of an earthquake.<sup>117</sup> Indeed, the Board even went so far as to conclude that

in the event of a beyond-design-basis accident that caused the tip-over of all, or a significant portion of the 4000 casks at the PFS site, the radiological dose levels at the OCA boundary would not be increased from the 5.85 mrem per year for normal operations which had previously been calculated. Thus, there are approximately three orders of magnitude of margin between the expected dose rate at the OCA boundary for 4000 casks in a tipped-over condition compared to the 5 rem accident dose limit in 10 C.F.R. § 72.106(b).<sup>118</sup>

The Board's findings are well supported by the record and its conclusions are founded on solid reasoning. Such findings are not "clearly erroneous" and therefore do not qualify for Commission review under 10 C.F.R. § 2.786(b)(4)(i). We also find persuasive the Board's conclusions that PFS included additional conservative assumptions in its dose calculations and that the use of more realistic assumptions would have reduced still further the dose levels and dose consequences of a hypothetical tip-over of all 4000 casks.<sup>119</sup>

Utah naturally objects to the Board's factual findings in this particular respect. Utah specifically criticizes the Board for relying on testimony of witnesses who purportedly had no

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<sup>116</sup>(...continued)  
[multipurpose canister] confinement boundary with large margins of safety").

<sup>117</sup> See *id.* at \_\_\_\_, slip op. at 353 (finding G.6: "there would be no releases of radioactivity even in the event of a postulated tip-over"). See *also id.* at \_\_\_\_, slip op. at 354-55 (findings G.9 - G.11).

<sup>118</sup> See *id.* at \_\_\_\_, slip op. at 355 (finding G.11).

<sup>119</sup> See *id.* at \_\_\_\_, slip op. at 355-56 (finding G.12). The cited conservatisms were assumptions that (1) all 4000 casks contain fuel with a burnup of 40,000 MWT/MTU and a cooling time of 10 years, whereas a more realistic scenario would be 35,000 MWT/MTU and 20 years, reducing the normal dose at the site boundary from 5.85 mrem/year to 2.10 mrem/year; (2) the fuel assemblies inside the casks have the highest gamma and neutron radiation source term in all fuel storage location, thereby maximizing radiological doses; and (3) the fuel had been subject to a single radiation cycle in calculating the source term, despite the fact that this assumption ignores reactor operation down time which would reduce the source term by effectively increasing the cooling time.

familiarity with the site or the land use in Skull Valley and also for ignoring testimony regarding possible future residential land use in Skull Valley.<sup>120</sup> This argument, however, goes to the credibility of the parties' witnesses. For the reasons set forth earlier in this memorandum and order, we decline to second-guess the Board's assessment of the witnesses' credibility. The Board's credibility discussion appears to us both reasonable and well supported by record evidence,<sup>121</sup> and we will not overturn it. Our deference to and our more general agreement with the Board on this issue is particularly appropriate, given the admission by Utah's expert witness Dr. Resnikoff that:

taking into account radioactive decay[,] the 5 rem accident limit specified in 10 C.F.R. § 72.106(b) would not be reached ... no matter how long one assumes that the casks remain in the worst case tip-over and total loss of hydrogen shielding condition, and disregarding any remedial actions that might take place in the intervening period by PFS or others.<sup>122</sup>

### III. CONCLUSION

We have reviewed all challenged sections of the Board's order in their entirety and conclude that they are well reasoned and amply supported by the record. The Commission therefore *denies* Utah's Petition for Review of LBP-03-08.

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<sup>120</sup> See Petition at 18.

<sup>121</sup> See LBP-03-08, 58 NRC at \_\_, \_\_, slip op. at 367 (findings G.44 - G.45: "Dr. Resnikoff made a total of nine different corrections or changes in his overall dose calculation at four different points in the proceeding.... [t]he number and nature of those changes undercuts confidence in the accuracy of his analyses"), 368 (finding G.46: "An important error in Dr. Resnikoff's dose calculations is that he did not consider the effect of radioactive decay").

<sup>122</sup> *Id.* at \_\_, slip op. at 368 (finding G.47). See also *id.* at \_\_, \_\_, slip op. at 105 ("due to discovered errors [in his] own testimony..., it is unlikely that the accidental dose rate at the facility would ever reach the 5 rem limit"), 366 (finding G.40: even "assuming that the casks remained on the ground indefinitely with no remedial actions taken, the 5 rem limit would not be exceeded for a person continuously stationed at the [site] boundary").

It is so ORDERED.

For the Commission

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Annette L. Vietti-Cook  
Secretary of the Commission

Dated at Rockville, Maryland  
this 15<sup>th</sup> day of August, 2003.