RAS 6279

March 31, 2003

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22-ISFSI
	)	
(Private Fuel Storage Facility)	)	ASLBP No. 97-732-02-ISFSI

APPLICANT'S PETITION FOR REVIEW OF LBP-03-04

Pursuant to 10 C.F.R. § 2.786, Applicant Private Fuel Storage L.L.C. ("PFS") hereby petitions the Commission for review of the Partial Initial Decision issued by the Atomic Safety and Licensing Board ("Board") on March 10, 2003, LBP-03-04, concerning whether an aircraft crash into the proposed Private Fuel Storage Facility ("PFSF") is a credible event.[1] PFS provided extensive evidence demonstrating that such an event is not credible. The Board, however, rejected PFS's assessment as well as the Staff's corroborating evaluation. In so doing, the Board erroneously interpreted the Commission's criterion for determining credible events for independent spent fuel storage installations ("ISFSIs"), failed to properly account for and evaluate critical evidence in the record, and ignored uncontested evidence showing that an F-16 crash at the site would be unlikely to penetrate a cask and cause a radioactive release. These errors mandate Commission review for they involve substantial questions of law, fact and policy going to the heart of one of the major issues in the six year licensing process for the PFSF.[2]

[1] As of this date there are still four contentions for which partial initial decisions have yet to be issued. These are Utah E (financial qualifications), Utah S (decommissioning), Utah L/QQ (seismic and geotechnical) and SUWA B (wilderness considerations of alternative rail alignments). The hearing for two of these contentions (Utah E and Utah S) was held in June 2000 with all filings related to motions concerning these contentions (motion for reopening record and motion for summary disposition on Model Service Agreement) completed by January 2001. The remaining two contentions were heard this past spring and early summer.

[2] PFS is also today filing a Motion for Reconsideration with the Board, independent of the issues raised herein, which requests the Board to authorize the licensing of a smaller sized facility, as would be allowed by its decision, even accepting its erroneous conclusions. PFS is also today filing a Joint Report with the Board requesting the initiation of the "consequences" proceeding contemplated in the Partial Initial Decision.

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SECY-02

I. SUMMARY OF LICENSING PROCEEDING AND DECISION BELOW

The Partial Initial Decision concerns the cumulative probability of an aircraft crash or jettisoned military ordnance impacting the PFSF. The central question before the Board was the likelihood of an aircraft crash at the PFS site involving U.S. Air Force F-16s transiting Skull Valley, Utah (the location of the PFSF) en route from Hill Air Force Base ("AFB") to the Utah Test and Training Range ("UTTR").

Relying upon a witness panel of highly qualified retired Air Force officers, including a former Chief of Safety of the Air Force and a former F-16 wing commander at Hill AFB,[3] PFS estimated the probability of an aircraft crash at the PFSF using a modified version of the formula given in NUREG-0800.[4] PFS's experts modified the formula by adding a risk reduction factor, *R*, to account for a pilot's ability to control an F-16 which was about to crash (for example, after an engine failure) and to direct the aircraft away from the PFSF before ejecting from the aircraft. PFS's Air Force experts determined the value of *R* based on their evaluation of all available Air Force accident reports for the F-16 over a ten year period and their extensive experience as Air Force pilots. Based on their detailed documented analyses,[5] PFS's experts concluded that there was a 90 percent probability that an F-16 involved in a mishap in Skull Valley would remain under the control of the pilot and that there was a 95 percent chance that the pilot in that situation would be able to turn the plane to avoid the PFSF before ejecting from the aircraft. Their conclusion that 95% of those pilots in control of an F-16 about to crash would avoid the PFS site was based on their expert evaluation of eight factors concerning a pilot's ability to avoid the PFSF. LBP-03-04, slip op. at 132. Their expert conclusion in turn was further substantiated by their review of the F-16 accident reports, which show that pilots of crashing aircraft do avoid fa-

[3] See Testimony of James L. Cole, Jr., Wayne O. Jefferson, Jr., and Ronald E. Fly on Aircraft Crash Hazards at the PFSF – Contention Utah K/Confederated Tribes B (Feb. 19, 2002) ("PFS Test.")

[4] The formula is $P = N \times C \times A / w$, where P is the probability of a crash impact, N is the number of aircraft per year that fly through a defined air corridor, C is the aircraft crash rate per mile of flight, A is the effective area of the facility, and w is the effective width of the corridor. NUREG-0800 at 3.5.1.6-3 & 4.

[5] See "Aircraft Crash Impact Hazard at the Private Fuel Storage Facility" (As Amended Per Licensing Board Orders – PFS Hearing Exhibit N), August 10, 2000 (Rev. 4) ("Aircraft Report"); Revised Addendum to Aircraft Crash Impact Hazard at the Private Fuel Storage Facility" (As Amended Per Licensing Board Orders – PFS Hearing Exhibit O) July 20, 2001 ("Revised Addendum").

cilities on the ground before ejecting and which showed no cases of a pilot in control of an aircraft who had an opportunity to avoid a site on the ground failing to do so.[6]

Taking pilot avoidance into account, PFS's experts conservatively calculated the probability of an aircraft or jettisoned ordnance impacting the PFS facility to be less than 4.17×10^{-7} (PFS Test. at 109-10), well below the 1×10^{-6} per year standard for credible accidents at ISFSIs.[7] The Staff, after an extensive review and consultation with Air Force officials at Hill AFB, provided a lengthy analysis in its Safety Evaluation Report, agreeing that the probability was well below the 1×10^{-6} criterion and in fact calculating a lower probability than PFS's of 3.7 to 4.3×10^{-7}. Staff Exh. C at 15-41 to 15-99.

In its decision, the Board ruled against PFS and the Staff principally on the grounds that PFS had not carried its burden of proving that 95 percent of the time a pilot in control of an F-16 that was going to crash would turn the plane away from the PFSF before ejecting. Slip op. at. 30-42. The Board's rejection of PFS's position was not based on findings of fact on the eight factors relied upon by PFS's experts, but rather on the Board's perception of "the totality of the evidence" regarding pilot avoidance. Slip op. at 117; see also id. at 92, 175. That evidence included piecemeal and often contradictory evidence presented by the State. It also included the Board's selective extraction from the accident reports, without the benefit of expert testimony from PFS, the State, or the NRC Staff, of examples of pilot error irrelevant to a pilot's avoidance of a facility on the ground. See id. at 146-50. Based on this arbitrary selection of some evidence, and exclusion of other evidence, the Board rejected PFS's analysis and the Staff's corroboration, in favor of its general conclusion that pilots could not be counted on to avoid the PFSF because pilots, or more generally people, make mistakes under stress. Even the State's

[6] PFS Test. at 17; PFS Exh. 100A; Tr. at 8663-66, 13009-011 (Jefferson).

[7] See Private Fuel Storage, L.L.C. (Independent Spent Fuel Storage Installation), CLI-01-22, 54 NRC 255 (2001). In addition, PFS identified numerous conservatisms in its analysis. Taking into account just those conservatisms that could be quantified, the average probability over the planned 40-year life of the PFS facility would be reduced to roughly 1.9×10^{-7} (a figure that does not consider evidence improperly excluded by the Board that an F-16 or jettisoned ordnance would be unlikely to penetrate the casks and cause a radiological release, discussed in Section II.C below). PFS Test. at 110-14. Non-quantifiable conservatisms, for example, that F-16s predominantly fly east of Skull Valley Road, miles away from the PFSF site, would further reduce the probability. Id.

witness agreed that for "a large body" of accidents, pilots would avoid the PFSF.[8] Nonetheless, the Board gave no credit to pilot avoidance and set the pilot avoidance factor at zero. Slip op. at 45.

The Board's treatment of the pilot avoidance issue was dispositive of the credible accident issue.[9] But the Board's analysis was seriously flawed, and therefore cannot be allowed to stand. The Board also made other errors in its decision, discussed below, compounding the effect of its mistreatment of pilot avoidance.

II. STATEMENT WHY THE COMMISSION SHOULD TAKE REVIEW

As set forth below, the Board committed a series of interrelated errors, raising substantial questions of fact, law and policy which mandate Commission review. 10 C.F.R. § 2.786(b)(4).

A. Board Erroneously Interpreted and Applied the 1 x 10^{-6} Criterion

The Board held that the 10^{-6} threshold probability for determining credible events for ISFSI design is to be applied as a "rigid" criterion as opposed to being "flexible" in its application. Slip. op. at 76-79. The Board interpreted NUREG-0800 to require conservative upper bound calculations of aircraft crash probabilities and reasoned that any flexibility in applying the 10^{-6} criterion would "overrid[e] the conservatism" deliberately built into the NUREG–0800 formula for calculating aircraft crash probability. Id. The Board's holding is clearly contrary to NUREG-0800 as well as to the applicable case law, including the Commission's decision in this case establishing the 10^{-6} threshold probability for ISFSIs.

NUREG-0800 establishes a threshold probability of 10^{-7} for determining credible events for reactor design. NUREG-0800 at 2.2.3-2. NUREG-0800 and CLI-01-22 both describe this threshold probability for reactors as a flexible standard. See 54 NRC at 260. Section 2.2.3 of the NUREG ("Evaluation of Potential Accidents") describes the 10^{-7} criterion for reactor design as a "staff objective of approximately 10^{-7} per year." NUREG-0800 at 2.2.3-2 (emphasis added).

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[8] Tr. at 8503 (Horstman); see also id. at 8432.

[9] Giving no weight to pilot avoidance, the Board found the probability that an F-16 transiting Skull Valley would crash into the PFSF to be 4.29 x 10^{-6} per year. Slip op. at 60.

Similarly, NUREG-0800 describes the applicable reactor standard for aircraft hazards as "about 10^{-7} per year." Id. at 3.5.1.6-2 (emphasis added). The NUREG further provides that a calculated probability of "approximately 10^{-6} per year is acceptable if, when combined with reasonable qualitative arguments, the realistic probability can be shown to be lower." Id. at 2.2.3-2 (emphasis added). Thus, NUREG-0800 provides a flexible standard to account for the difficulty in precisely calculating probabilities of occurrence for infrequent events. As summarized in CLI-01-22:

> Estimating the probability of extremely unlikely events involves considerable uncertainty when sufficient data are not available to plug into the formula. Therefore, the Standard Review Plan for reactors deems a threshold probability of one in a million (1×10^{-6}) to be acceptable where, "when combined with reasonable qualitative arguments, the realistic probability can be shown to be lower." That is, where a conservative estimate shows an event has no greater than a one-in-a-million probability, that event may be ignored in facility design if reasonable estimates result in a lower probability when conservative margins are not factored in.

54 NRC at 260 (footnote omitted).

In CLI-01-22, the Commission held that 10^{-6} should be used as the threshold standard for ISFSIs instead of the 10^{-7} reactor standard. 54 NRC at 265. Thus, the 10^{-6} threshold criterion for ISFSIs is analogous to the 10^{-7} reactor criterion, which both the NUREG and CLI-01-22 establish is a "realistic probability," i.e., where "conservative margins are not factored in." 54 NRC at 260. Where conservatisms are shown to exist, a higher calculated probability for reactors of 10^{-6} is acceptable, and therefore, following the same analogy, a higher calculated probability for ISFSIs, presumably 10^{-5}, would also be acceptable where conservatisms are shown to exist. Here, PFS showed substantial conservatisms in its calculated probability, see note 7 supra, to which the Board gave no weight. Moreover, not accounting for pilot avoidance in calculating the aircraft hazard introduces large conservatisms given the uncontested testimony that, for a "large body" of accidents, pilots will avoid the site. Thus, a calculated probability greater than 10^{-6} should clearly be acceptable here.

The Board's errors in interpreting and applying the 10^{-6} criterion directly concern the standard for determining credible design basis events and thus raise substantial questions of law and policy mandating Commission review under 10 C.F.R. § 2.786(b)(4)(ii) & (iii).

B. Board Did Not Properly Account for and Evaluate Critical Evidence

The Board failed in numerous respects to properly account for and evaluate critical evidence in the record. First, the Board required PFS to meet a higher burden of proof than the preponderance of evidence standard required in NRC licensing proceedings.[10] This error was based at least in part on the Board's erroneous premise, discussed above, that the 10^{-6} crash hazard criterion is a conservative upper bound probability and therefore must be met using conservative input parameters. See, e.g., slip op. at 55, 76-79, 193. Further, the Board's repeated application of a higher standard of proof for determining pilot avoidance[11] appears to have been driven in part by the Board's policy preference for engineered safety features over reliance on human behavior.[12] However, the issue here is not what the Board might desire from a policy perspective, but what the preponderance of the evidence shows regarding crash impact probability. Each of the six Air Force pilots who appeared and testified before the Board firmly attested to the fundamental proposition that pilots can and will avoid sites on the ground when able to do so.[13] This proposition is further established by the fact that the F-16 accident reports over a 10-year

[10] See, e.g., Advanced Medical Systems, Inc., CLI-94-6, 39 NRC 285, 302 & n. 22 (1994).

[11] See, e.g., slip op. at 32 (emphasis added) ("[e]vidence supporting a high value" for pilot avoidance "is too uncertain to be relied upon to make safety-related decisions for nuclear facility licensing purposes."); Id. at 41 (emphasis added in part) (We are "far from certain, in a nuclear regulatory safety context, that pilots can be counted on – to the degree necessary for us to make the findings the Applicant would have us make – not to take improper action, or to fail to take proper action, where this one particular facet of their flight activity is concerned."). See also id. at 31.

[12] For example, the Board opined that it had been pointed to no instance in which the nuclear licensing basis is solely dependent upon reliability of human behavior without the added protection of engineered safety features. Slip op. at 42. See also id. at 41 n.62 (emphasis added) ("[F]or purposes of pilots' combat endeavors, the country must count on them to perform as trained, for there is no other choice in that regard. For purposes of nuclear safety regulation, however, there are other choices, including designing the proposed facility [to withstand the effects of an accident].") The Board, however, cited no legal support for what it implies –that one cannot rely on human behavior as part of the licensing basis in an NRC proceeding. In this respect, the safety of the facility, from the perspective of an F-16 crash, is primarily a function of the low probability of a crash, not the reliability of human behavior, as evident by the Board's calculating a probability of less than 5 E-6 taking no account for pilot avoidance whatsoever.

[13] Tr. at 3199 (Jefferson), 3774-77 (Cole), 3777 (Fly), 3989 (Bernard), 3992-93 (Cosby), 4512-14, 8546 (Horstman).

period show no instance where a pilot failed to avoid a site on the ground when he had the ability to do so.

Second, the Board erred on the critical issue of pilot avoidance by ostensibly relying on "the totality of the evidence" without making specific findings as required by 10 C.F.R. 2.760(c), which requires a board to provide reasons and bases for its findings and conclusions on all material issues of fact. See slip op. at 92, 117, 175. As the Board recognized, PFS's conclusion as to pilot avoidance was based on its experts' evaluation of the eight specified factors, supported further by their evaluation of the accident reports. In its specific findings of fact, the Board merely set out the evidence on issues related to pilot avoidance, but never came to conclusions (other than on pilot error discussed below) on the eight factors relied upon by PFS's experts. See id. at 135-68. By failing to analyze and rule on the individual issues underlying pilot avoidance, the Board failed to make the logical connection between the pieces of evidence it cited and findings on the individual factual issues that are necessary to support its conclusion.

Third, the Board erred by disregarding critical evidence on pertinent factual issues that would have changed the outcome of the decision. Foremost, the Board assumed that no pilot would avoid a site on the ground, i.e., applying an R factor of zero, despite evidence even from the State's witness that, for "a large body" of accidents, pilots would avoid the site in the event of an accident. A determination that R is not zero, even if less than the 95 percent established by PFS's experts, would result in the calculated hazard being much closer to the 10^{-6} threshold criterion.[14] When considered with the conservatisms identified by PFS's experts, ignored or dismissed by the Board, the Commission could readily conclude that the 10^{-6} criterion is met. Other examples of critical evidence disregarded in the Partial Initial Decision include the following:

- The Board found PFS's expert evidence on pilot avoidance to be "subjective evidence not borne out by events," slip op. at 43, despite the F-16 accident reports

[14] For example, assuming a pilot avoidance R2 factor of only 50% and accepting everything else as found by the Board, the calculated probability would have been reduced to 2.36 E-6 for F-16s transiting Skull Valley and the Board's cumulative probability would have been 2.71 E-6.

revealing no instance where a pilot failed to avoid a site on the ground where he had the ability to do so.

- To support its view that pilots make mistakes, the Board relied heavily on an Air Force video depicting an F-16 engine failure and low-altitude pilot ejection during a combat training exercise. Slip op. at 36-37. The Board, however, acknowledged that that it did so despite PFS's experts having demonstrated that "the problem [in the video] took place in, and was caused by, conditions not akin to those encountered in Skull Valley." Id. at 37 n.57 (emphasis added). .
- The Board cited the potential for pilot injury upon ejection as supporting its belief that a pilot may spend time attempting to restart his aircraft's engine rather than looking to avoid a site on the ground, slip op. at 34 & n. 53, but ignored the accident reports which showed no serious injuries (and in most cases no injury at all) under the conditions a pilot would face in Skull Valley, as well as the time a pilot would need to await restart. Tr. at 13012-17 (Jefferson).
- Based on evidence provided by the State, the Board held that the effective width of Skull Valley used by the F-16s was six miles, rather than the 10 miles testified to by PFS's experts, but ignored contradictory testimony from the State's own witness that the actual flight pattern through the Valley was greater than six miles. See slip op. at 60, 199; Tr. at 8571, 8613-14 (Horstman).
- Further, in determining the effective width of the Valley to be six miles, the Board totally ignored testimony by PFS's expert panel, corroborated by the State's witness, that the predominant route of flight of the F-16s through Skull Valley was east of the PFS site, see PFS Test. at 16, 44; Tr. at 4344-45 (Horstman).which effectively shows that the 10 mile width used by PFS encompassing the site is a conservative estimate.

Other critical evidence ignored or improperly evaluated by the Board cannot be summarized here because of the limitations on the length of a petition for review.

Fourth, the Board's decision rests on faulty logic and irrelevant evidence. The Board improperly reasoned, without factual support, that because pilots make errors generally they will necessarily make errors in avoiding the PFSF. See, e.g., slip op. at 31-43. To support its conclusion on pilot avoidance, the Board reviewed the F-16 accident reports itself and identified numerous purported instances of pilot error. Id. at 146-150. The Board, however, conducted this analysis on its own without the benefit of any testimony or analysis by any of the expert witnesses and without any apparent consideration of the circumstances of each accident. Indeed, many of the accidents cited by the Board occurred during combat training and thus were irrele-

vant to the type of flying in Skull Valley.[15] Of equal importance, the errors cited by the Board were not failures to avoid sites or areas on the ground. The evidence shows no examples of relevant pilot error – that of failing to avoid a site on the ground in the event of an accident – in any of the F-16 accidents that took place in a 10 year period for which accident reports were available.

The above errors concerning the Board's failure to properly account for and evaluate critical evidence in the record raises substantial questions of fact, law and policy mandating Commission review under 10 C.F.R. § 2.786(b)(4) (i), (ii) & (iii).

C. The Board Improperly Excluded Critical Evidence From the Record

The Board improperly excluded PFS testimony that an F-16 which hypothetically crashed at the site would be unlikely to penetrate a storage cask or cause a release of radioactive material. At the hearing, the Board rejected the testimony because of "the way the contention was framed, it just dealt with [accident] probability," and not consequences. Tr. at 3008 (Farrar). But the Partial Initial Decision stated that a crash's consequences were not outside the scope of the contention, in that the issue of credible accidents – the subject of the contention – necessarily concerns both the probability of an accident and its consequences. Slip op. at 80; see id. at 84 (citing LBP-01-19, 53 NRC at 431 n.5). Rather, the Board stated that it had excluded PFS's testimony because 1) the NRC Staff had proffered no testimony and had performed no analysis of cask penetration or dose consequences, id. at 85-86, and 2) based on the testimony offered by PFS on penetration and the State on doses, the matter "had not been fully developed," id. at 87.

PFS's testimony should not have been excluded. First, the testimony went to the probability of a release of radioactive material and thus was within the scope of the contention even if it were limited to probability. Tr. at 2986-90 (Barnett); see LBP-03-04, slip op. at 82 & n.114; PFS Test. at 110-12 (not admitted). Second, the NRC Staff does not need to proffer similar evi-

[15] For example, the Board placed particular importance on four accident reports. See Slip op. at 39 n.59. However, all four of these accidents concerned combat operations and maneuvers of the type that would not take place in Skull Valley. See Aircraft Crash Report, Tab H, Table 1.

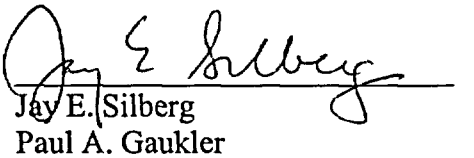
dence or otherwise analyze an applicant's evidence for the applicant's evidence to be admissible. It is the applicant's application, not the Staff's review, that is the subject of the licensing proceeding. The Curators of the University of Missouri, CLI-95-1, 41 NRC 71, 121-22 & n.67 (1995). Third, the Board had no basis for rejecting the testimony as not fully developed. The State never challenged PFS's testimony as unreliable, and indeed, State witness Dr. Resnikoff applied PFS's methodology in another contention.[16] Nor did the Board ever look at the testimony's factual support to evaluate its reliability. See LBP-03-04, slip op. at 84-87.

Thus, the testimony was improperly excluded, and Commission review is proper under 10 C.F.R. § 2.786(b)(iv).[17] Moreover, exclusion of this testimony was highly prejudicial given the Board's ruling on pilot avoidance. Had this evidence been admitted, the Board's concern about whether a pilot in control of an aircraft would in fact avoid the PFSF would be mooted, for even assuming a pilot failed to avoid the site, the aircraft would be going far too slow to penetrate a cask and cause a radioactive release.[18]

III. CONCLUSION

For the reasons set forth above, the Commission should accept review of LBP-03-04.

Respectfully submitted,



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March 31, 2003

[16] Declaration of Marvin Resnikoff in Support of Utah Contention RR (Oct. 10, 2001) ¶¶ 9-10; id. Exh. C (citing Jeffrey Johns Decl. in support of PFS Utah K summary disposition, dated December 30, 2000).

[17] Likewise the Board improperly excluded evidence that the large majority of jettisoned ordnance would not be able to penetrate the cask and cause a release of radioactivity. See Board Order Regarding Evidentiary Record and Timing of Decision (Dec. 11, 2002), at 5; PFS Test. at 112 (not admitted).

[18] Compare, e.g., Aircraft Report at 21 (typical impact speed of aircraft following engine failure) with PFS Exh Z (not admitted) (calculation of speeds below which an F-16 could not penetrate a cask).

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CERTIFICATE OF SERVICE

I hereby certify that copies of the Applicant's Petition for Review of LBP-03-04 were served on the persons listed below (unless otherwise noted) by e-mail with conforming copies by U.S. Mail, first class, postage prepaid, this 31st day of March, 2003.

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