RAS 10075

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OFFICE OF THE ATTORNEY GENERAL

DOCKETED
USNRC

June 14, 2005 (11:12am)

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June 13, 2005

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U.S. Nuclear Regulatory Commission
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Re: Private Fuel Storage, LLC, Docket 72-22 – Safeguards and Non-Safeguards Filing

Dear Mr. Julian:

Enclosed for filing is "State of Utah's Petition for Review of Contention Utah K (Aircraft Crashes)." The State is filing two versions of this document, one safeguards, served by express mail on those entitled to view safeguards information, and a redacted – non-safeguards – version, served via e-mail and first class mail, on the general service list. The redactions are bracketed, with the letter "x" replacing the deleted text. In an abundance of caution, the State has been over-broad in it redactions, for example, redacting information contained in the public version of Board orders and decisions. Therefore, the State does not claim that the redacted version is the entirety of the information that should be made public.

Please contact me at (801) 366-0286 if you have any questions.

Sincerely,

Denise Chancellor
Assistant Attorney General

Enclosure: as stated
cc: PFS Docket 72-22-ISFSI Service List

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REDACTED NON-SAFEGUARDS VERSION

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSIONERS

In the Matter of:	)	Docket No. 72-22-ISFSI
PRIVATE FUEL STORAGE, LLC (Independent Spent Fuel Storage Installation)	)	ASLBP No. 97-732-02-ISFSI
	)	June 13, 2005

STATE OF UTAH'S PETITION FOR REVIEW OF CONTENTION UTAH K (Aircraft Crashes)

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REDACTED - NON-SAFEGUARDS - VERSION

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSIONERS

In the Matter of:	)	Docket No. 72-22-ISFSI
	)	
PRIVATE FUEL STORAGE, LLC	)	ASLBP No. 97-732-02-ISFSI
(Independent Spent Fuel	)	
Storage Installation)	)	June 13, 2005

STATE OF UTAH'S PETITION FOR REVIEW OF CONTENTION UTAH K
(Aircraft Crashes)

On May 24, 2005 the Board issued its reconsideration ruling, LBP-05-12. Pursuant to 10 C.F.R. § 2.786 and CLI-00-24, 52 NRC 351, 353 (2000), the State of Utah petitions the Commission for review of all issues relating to Contention Utah K (Aircraft Crashes).

I. SUMMARY OF THE PROCEEDINGS, ISSUES RAISED, AND THE DECISIONS BELOW FOR WHICH REVIEW IS SOUGHT

First raised as part of the State's initially filed contentions, Utah K contends:

> The Applicant has inadequately considered credible accidents caused by external events and facilities affecting the ISFSI, intermodal transfer site, and transportation corridor along Skull Valley Road, including the cumulative effects of the nearby hazardous waste and military testing facilities in the vicinity.

LBP-98-7, 47 NRC 142, 190 (1997). The contention's admissible bases included accidents involving materials or activities at or emanating from Hill Air Force Base, Utah Test and Training Range (UTTR), Dugway Proving Ground (DPG), and Salt Lake City International Airport. Id. In the Applicant's first motion for summary disposition, the Board denied dismissal of the bases relating to Salt Lake City Airport, UTTR, military aircraft crashes, aircraft accident cumulative impacts, and military testing and training in the firing of conventional ground weapons at Dugway Proving Ground. LBP-99-35, 50 NRC 180, 200-201 (1999).[1] In a second

[1]The Board dismissed flights into and out of DPG Michael Army Airfield, including aircraft landing with "hung bombs" and landing of the X-33 experimental space plane. Id. at 194.

motion for summary disposition, the Board dismissed military ordnance at DPG, cruise missiles crashes and general aviation crashes. LBP-01-19, 53 NRC 416, 455-56 (2001). The Board also granted PFS's motion to set the regulatory standard for Part 72 aircraft crashes at one-in-a-million and certified that issue to the Commission. Id. at 456. The Commission, Dicus dissenting, affirmed the standard announced by the Board. CLI-01-22, 54 NRC 255 (2001).

The issues that initially went to hearing were limited to establishing the probability of an F-16 or ordnance impacting the PFS site. A three week hearing (Hearing I) was held in 2002 to determine whether there was a credible risk (*i.e.*, one-in-a-million probability) of such an impact to the site. The Board found that probability to be 4.29 x 10^{-6}, LBP-03-04, 57 NRC 69, 122 (2003), PFS having failed by over a fourfold margin to meet the 10^{-6} standard. The parties then undertook preparations for the consequences portion of Utah K, when, at the urging of PFS and the Staff, the Board narrowed the scope of the second hearing to the probability of cask breach by eliminating the issue of radiation doses. Tr. 14659-14664 (Apr. 8, 2004 pre-hearing teleconference). The final partial initial decision dated February 24, 2005 (Utah K PID) on hearings held in August and September 2004 (Hearing II) was in favor of PFS, and the Board rejected Utah's Motion for Reconsideration of that decision. *See* LBP-05-12.

II. REQUEST FOR COMMISSION REVIEW OF ERRONEOUS NRC DECISIONS AND ACTIONS RELATING TO CONTENTION UTAH K

A. The Commission Arbitrarily Set the Aircraft Crash Standard for an ISFSI at 10^{-6} Without a Hearing and with Reference to Only Two Possible Standards: 10^{-7} or 10^{-6}.

The long-established design standard for aircraft crashes at nuclear power plant (NPP) sites is one-in-ten million (1 x 10^{-7}). *See* CLI-01-22, 54 NRC 255, 260 and n. 14 (2001) and citations therein. As described in the preamble to amendment of Part 60 regulations (Dec. 1996), the design basis accident standard for Category 2 events at the Geologic Repository Operations

Area (GROA) is one-in-a-million.[2] Unlike nuclear power plants and the GROA, neither NRC guidance nor regulations establishes a design basis standard for credible accidents at Part 72 facilities. In CLI-01-22 the Commission established 10^{-6} as the probability standard for aircraft crashes at an ISFSI. It did so without the benefit of a hearing or technical support and, without addressing counter arguments, concluded that an ISFSI is more similar to the GROA than it is to an NPP. Id. at 265. However, Commissioner Dicus dissented on the basis that the matter should be sent back to the Board "for a factual determination whether the consequences of a potential accident at an ISFSI are more similar to those of an accident at a GROA or those of an accident at a nuclear power reactor as a basis for setting the threshold probability." Id. at 266. To fully exhaust its administrative remedies as to CLI-01-22 (which has not been reviewed), the State petitions for review.

The Commission has discretion to determine whether a particular issue should be decided through rulemaking or adjudication.[3] Attached to that discretion, however, comes the obligation to formulate and articulate the criteria for its decision. As one court said: "We cannot assume, in the absence of adequate explanation, that proper standards are implicit in every exercise of administrative discretion."[4] In CLI-01-22, the Commission chose to develop a legal standard for Part 72 facilities through adjudication. But it did so arbitrarily and without

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[2]*See* 54 NRC at 261 and citations therein.

[3]Consumers Power Co. (Midland Plant, Units 1 and 2), LBP-82-118, 16 NRC 2034, 2038 (1982).

[4]Environmental Defense Fund, Inc. v. Ruckleshaus, 439 F.2d 584, 596 (D.C. Cir. 1971). In a case involving the Secretary's refusal to suspend registration of certain pesticides, the Court's remand required the Secretary to "consider whether the information presently available to him calls for suspension of any registrations of products containing DDT, identifying the factors relevant to that determination, and relating the evidence to those factors in a statement of the reasons for his decision." Id. at 596.

technical support for its determination. Accordingly, the Commission should exercise review of this legally unsupportable standard.

The design standard for aircraft crashes at NPPs and Category 2 events at the GROA are supported by risk assessments specific to those facilities.[5] In its Part 60 rulemaking, the Commission initially proposed 1×10^{-9} as the lower bound probability of occurrence at the GROA.[6] In order to find the 10^{-9} probability too low and unjustified, the Commission had before it evidence from DOE's preliminary risk assessment for the conceptual repository design at Yucca Mountain. In that assessment DOE considered the radiation consequences of 149 events for a variety of internally and externally initiated events. From its review of DOE's analysis, the Commission determined that the 10^{-6} standard and a dose limit of 5 rem would provide an appropriate design basis and safety margin. 61 Fed. Reg. at 64,265. No similar analysis or evidence was before the Commission when it determined the design basis accident standard for ISFSIs to be 10^{-6}.

The whole focus of the Commission's standard-setting in the PFS case started with the assumption that the standard must be either one-in-a million or one-in-ten million. Nowhere did the Commission contemplate that the safety standard should be set at some intermediate probability – for example, one-in-five million. From this construct, the Commission proceeded to compare and contrast ISFSIs with the GROA and NPPs. The Commission accepted the Staff's view that a potential crash into an ISFSI would not have consequences as dire as a crash into an NPP, the reasoning asserted by the Staff in its Safety Evaluation Report. 54 NRC at

[5] *See* 61 Fed. Reg. at 64,266, *citing to* DOE "Site Characterization Plan, Yucca Mountain Site, Nevada Research and Development Area, Nevada," DOE/RW-0199, Dec. 1988, and NUREG -1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants," Dec. 1990.

[6] 61 Fed. Reg. 64,257, 64,265 (1996) and 60 Fed. Reg. 15,180, 15,186 (1995) (proposed rule).

262. The Commission also accepted PFS's position that the Commission intended to establish consistent standards for the GROA and ISFSIs. Id. at 262-63. Acceptance of PFS's position, however, runs counter to the Commission's statement of considerations for the GROA design basis rule: "[C]onsistency alone does not necessarily ensure that there would be no unreasonable risk to the health and safety of the public associated with the proposed . . . dose limit as the design basis for protection of public health and safety from Category 2 design basis events." 61 Fed. Reg. at 64,265. The Commission then turned to DOE's risk assessment to determine whether 10^{-6} was sufficiently protective for activities at the GROA.

The Commission dismissed all of Utah's arguments. The State first noted that PFS initially used 10^{-7} as the measure it must meet, but in the August 2000 iteration of its Aircraft Crash Report (Rev. 4), PFS could not meet the 10^{-7} standard.[7] Utah Brief (July 13, 2001) at 6-7. The issue of the 10^{-6} standard first arose on PFS's motion for summary disposition. In granting summary disposition to PFS, the Board, with the Commission's endorsement, committed reversible error because PFS provided no technical supporting evidence that 10^{-6} will be sufficiently protective of public health and safety at the PFS site.[8]

The GROA and the PFS facility are two distinctly different targets for aircraft crashes with risks and consequences particular to each. PFS will store fuel in concrete casks whose walls are less than 27 inches thick, sitting in the open on storage pads, whereas at the GROA, fuel will be

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[7]That standard, said the State, should apply because if PFS uses the methodology from NUREG-0800 to compute the crash rate, it should also use the NUREG-0800 standard, which only allows a standard lower than 10^{-7} "when combined with reasonable qualitative arguments, the realistic probability can be shown to be lower." Utah Brief at 8, *citing to* NUREG-0800 § 2.2.3-2. Further, unlike the PFS site, almost all ISFSIs are located at or near a reactor; thus, the site suitability for those ISFSIs has been analyzed for credible accidents under the 10^{-7} standard.

[8]*See* LBP-01-19, 53 NRC 416, 430-31 (2001); and 54 NRC at 265.

protected by being in a building whose walls are 5 feet thick and 10 meters high.[9] The PFS site sits directly under Military Operating Areas where the military flights may operate in airspace as low as 100 feet above ground level.[10] Unlike PFS's absolute inability to control air space above its facility, the same is not true for DOE at the Yucca Mountain site, where there is an absolute prohibition on military overflights when special nuclear material is present, and at other times, only medium to high altitude military overflights are permitted at the Nevada Test Site.[11]

Commissioner Dicus's dissenting opinion was correct because the Commission lacked substantial evidence to determine whether the consequences of aircraft crashes at the PFS site were more similar to those at a GROA or at an NPP. Further, to limit the probability choice to either 10^{-6} or 10^{-7} is arbitrary and capricious.

B. The Board's Decision Dismissing Cruise Missile Testing as a Contested Issue on the Basis That it Presented an Unspecified Low Probability of Impacting the PFS Site is Clearly Erroneous, Contrary to Law and Outcome Determinative.

The issue in Contention Utah K is whether crashes from military and other aircraft, including bombs and cruise missiles, constitute a credible event, *i.e.* have a cumulative probability exceeding 1 E-6.[12] To that end, the probabilities that have been determined for each category of aircraft and weapons impact have been totaled and compared to the 1 E-6 standard in each of the Board's aircraft and weapons crashes hearing decisions on Utah K.[13] The

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[9]Utah Resp. PFS Mo. Sum. Disp. (Jan. 30, 2001), Resnikoff Dec. ¶ 14; Utah Brief at 17.

[10]LBP-03-4, 57 NRC 69, 157 (¶ A.58) (2003).

[11]Resnikoff Dec ¶ 14; Utah Reply Brief (July 23, 2001) at 8-9.

[12]The wording of Utah K is: "The Applicant has inadequately considered credible accidents caused by external events and facilities affecting the ISFSI, including the cumulative effects of military testing facilities in the vicinity." LBP-99-39, 50 NRC 232, 240 (1999) (*emphasis added*).

[13]LBP-03-04, 57 NRC 69 (2003); Utah K PID (Feb. 24, 2005).

cumulative probability found by the Board in each of those decisions did not include the probability of a cruise missile crash and is therefore understated as a matter of law.

The omission of the cruise missile crash probability stems from the Board's Order, LBP-01-19, on PFS's Motion for Summary Disposition.[14] The PFS motion requested the following relief from the Board:

> PFS moves for summary disposition of Utah K on the grounds that no genuine issue exists concerning any facts material to whether the use of the Army rocket system on DPG, aircraft accident hazards, or cruise missile hazards would credibly threaten to cause a release of radioactive material from the PFSF. Therefore PFS is entitled to a judgment as a matter of law.

PFS Mot. Sum. Disp. at 3 (*emphasis added*). The ten "material facts" filed by PFS in support of this motion, while suggesting that a cruise missile crash at the PFS site is unlikely, do not contain any statistical probability value for a crash, nor do any of the material facts claim a zero probability. The Board, in its order as to the cruise missile portion of the motion, found: "there is no genuine dispute of material fact and, therefore, grant the PFS summary disposition motion with regard to this portion of the contention." LBP-01-19, 53 NRC 416, 428-29 (2001).

Thus, the Board granted PFS's request that "no genuine issue exists concerning any facts material to whether . . . cruise missile hazards would credibly threaten to cause a release of radioactive material from the PFSF,"[15] *i.e.*, the Board granted precisely the relief that was requested by PFS in its motion. However, the Board's order that cruise missile testing does not alone constitute a credible event, *i.e.*, that cruise missile testing does not alone have a probability exceeding 1 E-6, does not provide a legal basis to exclude the probability of cruise missile

[14]Applicant's Motion for Summary Disposition of Utah Contention K and Confederated Tribes Contention B (Dec. 30, 2000).

[15]PFS Mot. Sum. Disp. at 3; LBP-01-19, 53 NRC at 418, 428-29.

testing from the cumulative effects of aircraft and weapons crashes.[16]

The undisputed facts presented regarding PFS's motion for summary disposition include:

1. The 36 page *Risk Assessment of Cruise Missile Accidents Impacting Private Fuel Storage LLC Independent Spent Fuel Storage Installation*, submitted by PFS, which concludes that "any flight failure of a cruise missile under test on the UTTR is highly unlikely to encroach on the ISFSI site" and states "ASSESSMENT: Extremely low risk to the ISFSI from a cruise missile test on the UTTR." PFS Mot. Sum. Disp., Exh. 3, Wagner/Girman Dec. at 36 (*underlining added*).

2. Cruise missiles depend on a Flight Termination System (FTS) to terminate an out-of-control missile. The FTS is required to have a reliability of 99.9% at a confidence level of 95%, the reciprocal being the failure possibility of one in one-thousand. Wagner/Girman Dec. ¶ 15.

3. From 1983 to 1999, there were 23 cruise missile crashes as a result of testing on the UTTR. At least two of those crashes were outside Department of Defense boundaries. Only two of the 23 crashes were terminated using the FTS safety system; the remaining 21 were uncontrolled crashes. Utah Resp. PFS Mot. Sum. Disp., Utah Mat. Facts, Exh. 5, USAF Letter (23 Aug. 99).

4. In the last ten years, 13 of the 80 (16%) cruise missiles tested on the UTTR have crashed. Six cruise missiles will be tested on the UTTR annually. Wagner/Girman Dec. ¶¶ 24, 26.

5. On March 23, 2000 an out-of-control cruise missile crashed near the Ibapah Goshute

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[16]The State notes that in denying the cumulative probability portion of PFS's motion, the Board's slip opinion states: "PFS has summed the probability for all types of incidents described in this decision, including cruise missile testing; F-16 aircraft transiting Skull Valley; [six other crash events]; and concludes that the total facility aircraft hazard probability is 6.27 E-07 per year." LBP-01-19, slip op. at 30 (*emphasis added*). In a June 11, 2001 Order, the Board then revised its slip opinion by striking the phrase "cruise missile testing," which does not appear in the final published decision. 53 NRC at 453. This express revision highlights the fact that no statistical probability for cruise missile testing was proffered by PFS nor found by the Board. *See* PFS Mot. Sum. Disp., Cole, Jefferson, Fly Dec. (Tab C) at 25 (cruise missile probability not included in cumulative table).

Reservation in western Tooele County, Utah. The "inexplicable" crash was not intentionally caused by activation of the FTS safety system. Utah Mat. Facts ¶ 3, and Exh. 6.

These undisputed facts establish that cruise missiles have a known out-of-control crash rate, and further, the FTS safety system has not been activated in the majority of the crashes. In fact, the Board expressly found no factual dispute as to whether such a crash was "extremely unlikely," thereby establishing the existence of a probability of such a crash, but not quantifying that probability except to conclude that cruise missile testing is not by itself a credible event:

> Further, PFS has declared, . . . that being aware of inhabited areas around the PFS facility, Air Force planners will not establish cruise missile flight paths any closer than 10 nautical miles from the facility, thus providing a significant temporal buffer for FTS activation if a cruise missile should suddenly go awry during a test, thereby making such an incident extremely unlikely. Nothing provided by the State creates a material factual dispute with this conclusion.

53 NRC 416, 427-428 (*emphasis added*). Since cumulative accident events that exceed one-in-a-million are prohibited by the NRC standard of 1 E-06, the individual events may, in fact, be "extremely unlikely" but nevertheless have a cumulative total exceeding the allowable standard. Further, in determining a cruise missile crash is "extremely unlikely," the Board relied on the assertion that cruise missile paths will be no closer that 10 nautical miles from the facility, a fact that establishes one of the input values used in the NUREG-0800 formula for the calculation of crash probability,[17] *i.e.* the width of the airway over the facility. The fact that the path may be 10 miles from the facility does not dictate that an acceptably low cumulative probability will be calculated. For example, PFS calculates the crash probability of F-16s transiting Skull Valley to be 3.11 E-07, a significant contributor to cumulative probability, using an airway width of 10

[17]The NUREG-0800 § 3.5.1.6-3 formula is: $P = C \times N \times A/w$, where C = crash rate per mile for aircraft type; N = annual number of flights; A = effective area of the site (square miles); and w = width of airway (miles). Id. at n. 6; *see also* LBP-03-04, 57 NRC at 160.

miles. 53 NRC at 435.

Although PFS did not calculate the probability of a cruise missile crash at the PFS site, the State's evidence presented to the Board shows a calculated probability in the range of 2.95 E-07 to 5.9 E-07.[18] The Board stated its belief that this calculation "overestimates the impact probability," but did not determine the extent of the overestimation. 53 NRC at 428, n. 3. Whether overestimated or not, even the low end of the range (2.95 E-07), when added to the probability found by the Board for other events,[19] results in a cumulative crash probability ranging from 1.03 E-06 to 1.105 E-6, thereby exceeding the NRC standard of 1 E-06.

Granting PFS's motion for summary disposition which requested a finding that cruise missile testing does not constitute a credible event, leaves unresolved the statistical probability of a cruise missile impact at the PFS facility. The State offered the only evidence of the calculated cruise missile crash probability. When added to the other Utah K events, the resulting cumulative probability exceeds the NRC 1 E-06 threshold. This issue has not yet been reviewed (CLI-01-22, 54 NRC at 257) but review should be granted because the Board's summary disposition decision is clearly erroneous, contrary to law, and outcome determinative.

C. The Board's Decision from Hearing II Is Based on Prejudicial Error, Is Without Governing Precedent, and Is Contrary to Law.

If the Board had employed the DOE Standard in its entirety as the technical standard for Hearing II, the evidence shows the failure strains in the multi-purpose canister (MPC) would not meet that Standard. Instead, the Board employed no standard whatsoever to find PFS

[18]Utah Mat. Facts ¶ 5, and Exh. F. The Staff took no position as to cruise missile testing. Staff's Response to PFS's Mot. Sum. Disp. (Jan. 30, 2001) at 2.

[19]In PID at B-36 the Board found PFS computed the cumulative probability to be 7.37 E-07; after taking Utah concerns into account, it found the resulting UEP to be 8.7 E-07 (id. at B-37).

prevailed in Hearing II. From a decision devoid of any standards, the Board exacerbated its substantive error by committing prejudicial procedural error when it insisted during the second probability phase of the hearings that the State had failed to raise loss of shielding to the overpack. The Board thereby eliminated any further consideration of whether the PFS facility would be safe in a credible accident event from rupture of the overpack (storage cask), in spite of the State's urging not to bifurcate consequences from Hearing II. LBP-05-12, slip op at 10. These actions by the Board are clearly erroneous, contrary to law, and are grounds for review.

1. The Board Committed Reversible Error by Foreclosing the Issue of Excessive Radiation Consequences as a Result of Overpack Damage from Credible Accidents.

The very issue raised by Contention Utah K is whether the radiological consequences from aircraft crashes exceed NRC standards.[20] However, at no point during the two hearings on Utah K has Utah been afforded the opportunity to present its case on radiation consequences. First, during oral argument on *in limine* motions prior to Hearing I, the Board ruled that consequences would not be a part of that hearing. *See* LBP-05-12, slip op. at 4-5. When PFS did not prevail in Hearing I, the Board went ahead with the second phase of the proceeding[21] which it initially termed the "consequences"[22] phase and later the "cask breach"[23] phase.

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[20]PFS and the Staff readily admit that consequences are encompassed in Contention Utah K. Second Joint Report on "Consequences" Proceeding (Apr. 30, 2003) at 2-4, 7.

[21]The State took the position that the next phase of the proceeding should follow NRC established procedure of an amended license application, Staff review, new contention, discovery, and hearing. Joint Report on "Consequences" Proceeding (Mar. 31, 2003) at 2-3.

[22]*See e.g.*, Scheduling Memorandum and Report (July 31, 2003) at 1.

[23]*See e.g.*, Memorandum Concerning Scheduling (April 15, 2004) at 1-4. The Board distinguished cask penetration as constituting, on the one hand, part of the "accident probability" question (defined as cask breach by a crashing aircraft) and, on the other, as part of "dose consequences" evaluation (defined as cask impact by such an aircraft). Id. at n. 1. The Board ordered that radiation consequences would not be part of Hearing II. Id at 3.

Utah, as intervenor, met its burden of going forward, by producing in fall 2003, expert reports on canister and cask breach, radiation dose consequences, and criticality.[24] PFS's chosen strategy was not to address radiation consequences at all but to simply screen out those events where its analysis showed the confinement integrity of the cask is maintained, and attempted to show that the remaining unanalyzed event probability (UEP) would be less than 10^{-6}.[25]

The majority's opinion on Hearing II stated: "[t]he issue before us involves the limited safety question of whether the canister will, in a crash situation, maintain its integrity as a radiation boundary. . . ." PID at B-2 (*emphasis omitted*). The legal standard for credible accidents – which cannot be waived by any party – is that an aircraft crash must not result in radiological consequences greater than the exposure standard in 10 C.F.R. §72.106(b), regardless of whether that standard is exceeded due to release of radioactive byproducts contained in the MPC, or the loss of radiation shielding without the release of radioactive byproducts. The Board committed legal error by concluding, without any supporting evidence, that crashes that damage casks but do not result in the release of radioactive byproducts contained in the MPC "are not at issue here." Id. at B-2.[26] In doing so the majority merely restated PFS's litigation strategy rather than articulate the legal standard to determine credible accidents.[27] Utah, in its reconsideration

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[24]State of Utah Expert Reports Relating to Contention Utah K Consequences Proceeding (Sept. 18, 2003) and attachments thereto.

[25]Cornell Prefiled Tstmy, Post Tr. 18672 at A.19; *see also* Tr. 14520-21 (Gaukler).

[26]The Board thus considered only impacts which caused a release of byproducts contained in the MPC, noting "the sole consideration for this analysis becomes whether or not the MPC retains its integrity as a containment vessel." Id. at B-3, n. 59 (*emphasis omitted*).

[27]After noting that "the Applicant – which had the burden of proof – eventually indicated that it wished to attempt to demonstrate only that a crash into the site would be highly unlikely to have the intermediate physical consequence of puncturing a spent-fuel-containing canister," the Board adopted the Applicant's approach. LBP-05-12, slip op. at 6-7. The Board then takes

motion, pointed out the majority's error of considering only the release of byproduct is contrary to the Board's seismic decision: "The greatest potential for increase in radiological doses at the boundary would not be due to damage to the cask or the MPC, but to the possibility that the bottom of the cask, which has less radiation shielding, might face the OCA boundary."[28]

Rather than address Utah's legal and substantive argument, the Board resorted to procedure to avoid the issue. In its reconsideration decision the Board attempts to impute that the "cask breach" issue in Hearing II was "recognized by all to mean a puncture of the internal canister"[29]

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the pre-hearing term "cask breach" and remolds it into "canister puncture" and, instead of the second probability phase (*see* n. 23 *supra*), the Board *post hoc* contrives an "intermediate physical consequence" hearing phase. Id. at 6.

[28]LBP-03-8, 57 NRC 293, 533 (2003). Noting that an aircraft crash may, to a far greater extent, result in loss of shielding provided by the overpack, and cause exceedence of the § 72.106(b) exposure limits without release of radioactive byproducts from the MPC, the State pointed out that the MPC simply provides a confinement boundary for the fuel and that it is the overpack, not the MPC, that provides the necessary neutron and gamma shielding to comply with Part 72. Utah Reconsideration Motion (Mar. 7, 2005) at 2.

[29]Tellingly, Chairman Farrar's questions at the hearing show that "cask breach" was not understood by all to mean "canister puncture":

> CHAIRMAN FARRAR: And if you want to win at this stage -- to win at this stage you have to show something. And that, come to find out, it may be a legal answer, it may be a factual answer. If you lose at this stage, you may or may not -- and we had a pre-hearing conference --
> MR. GAUKLER: I understand that.
> CHAIRMAN FARRAR: -- have the right to do the issue you talk about.
> MR. GAUKLER: The same thing. My point of view, from the legal point of view, if there's no breech [breach], there cannot be any --
> CHAIRMAN FARRAR: Okay, but what I want to know, what I'm trying to get at is what's a breech [breach]? We've all talked about breech [breach]. And I want to know what a breech [breach] is.
> I understand a breech is when there's a discontinuity. That's a breech [breach]. Dr. Soler's question you were discussing before about as a designer, move forward in time. Now you're not a designer. Now you're out on the site after the plane has hit.

Tr. at 15681-82.

and, referring to a tort doctrine, said the State "should have taken that 'last clear chance' opportunity" to proclaim that Hearing II was not limited to canister puncture.[30] LBP-05-12, slip op. at 12. The phrase "canister puncture" does not appear in any pre-trial document nor in the hearing record. Moreover, if the Board and the parties had meant cask breach to refer only to breach of the canister (MPC), they certainly knew how to make that distinction.[31] Further, the certainty by which the Board now pronounces that "cask breach" was "recognized by all to mean a puncture of the internal canister," LBP-05-12, slip op. at 11, was anything but certain in the Board's questioning during oral argument relating to reconsideration (Tr. 19739-40):

> CHAIRMAN FARRAR: But, in our April 15th [2004] Order, . . . we refer to

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[30]The Board erroneously refers to how "counsel for the Applicant argued forcefully" that the issue in Hearing II was limited to canister breach. LBP-05-12, slip op. at 12 (*citing* Tr. 15674-84). The substance of testimony at Tr. 15674-84 was the Board's questions directed to PFS witness Dr. Soler; counsel for Applicant interjected, over the State's objection (Tr. 15680), that the ultimate licensing issue was whether radiation dose at the boundary exceeds regulatory limits (still an unknown question); and the Chairman raised the uncertainty as to the meaning of "breach" (Tr. at 15681-82).

[31]Such a distinction specific to MPC breach occurred in discussing criticality during the February 24, 2004 pre-hearing conference call:

> JUDGE ABRAMSON: <u>The moderator is only in the case of a breach, but the canister itself</u> --
> MR. GAUKLER: It would have to be inside the canister.
> MR. TURK: . . . You first have to get to <u>a breach of the MPC</u> before you can introduce the moderator.
> . . . .
> MR. SOPER: . . . PFS' analysis excludes the bounding events. It does not look at the high speed crashes, does not look at impacts that are likely to breach the cask, so they've excluded any analysis on that. We have not recognized– in fact, <u>we show that there's a number of scenarios where the cask is breached, including the MPC</u>, and that there is a likelihood, in fact, of criticality.

Tr. 14530 (*emphasis added*). Also, PFS's own website acknowledges that the term "cask" refers to the overpack, distinguishes between canisters and casks, and recognizes that the cask overpack is essential to shielding against radiation release. *See* http://www.privatefuelstorage.com/faqs/faq-earthquakes.html.

> rupturing a casks [*sic*]. Could they -- first off, I wish we hadn't said that. But, when you go back to the pre-hearing conference that we were talking about, that's the language everybody used. No one said hey, wait a minute, we're talking about the internal canister.
> I think we were using cask as the whole unit . . . Everybody at that conference talked about cask. Now, could the state not have concluded from that we're talking about that they read rupture of a cask differently than we meant it.[32]

The issue at Hearing II was not "canister puncture" but whether aircraft or munitions would cause a "cask breach." Significantly, all parties performed structural analyses which calculated the strains in both the cask overpack and MPC, showing without doubt that overpack failure, *i.e.* excessive strains or breach, was not only raised as an issue, but vigorously addressed by all parties.[33] The resulting radiation dose from the breach of either the MPC or overpack was not an issue before the Board and was thus not addressed. The issue of failure of the overpack by excessive strains and the issue of failure of the MPC by excessive strains were treated in the same manner in the hearing with the expectation that further proceedings to determine increased radiation doses would be held if a breach of either cask component were found.

The Board recognizes that PFS would not meet the 10^{-6} standard if loss of shielding were considered in Hearing II: "[I]f you read between the lines of our opinion, there is greater than a

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[32]The MPC or canister in this proceeding has never been referred to as a "cask." Illustrative of this fact is the description of PFS's cask system in the Consolidated Safety Evaluation Report (March 2002) at 1-2, which distinguishes the "cask" from the "MPC":

> The dry cask storage system that has been identified for use at the Facility is the HI-STORM 100 Cask System (the cask system). The cask system is a canister-based storage system that stores spent fuel in a vertical orientation. It consists of three discrete components: the multi-purpose canister (MPC), the HI-TRAC transfer cask, and the HI-STORM 100 storage overpack. The MPC is the confinement system for the stored fuel. The HI-TRAC transfer cask provides radiation shielding and structural protection of the MPC during transfer operations. The storage overpack provides radiation shielding and structural protection of the MPC during storage.

[33]Utah Reconsideration Reply (Mar. 29, 2005) at 4 and citations therein.

one in a million possibility that the shielding is damaged to some extent." Tr. 19727 (Farrar); *see* Utah K PID at B-2. In addition, the Board recognizes that loss of shielding from credible accidents under consideration in Hearing II is an unknown safety question and of lingering concern. LBP-05-12, slip op. at 14-15. But the Board dismissed its failure to consider damage to the overpack by suggesting that the State did not raise the issue. Id. at 9, and n. 11. In support, the Board states that the hearing record does not show that the State focused on "site-boundary radiation doses arising out of a reduction in shielding." Id. at 11, n. 13. This is neither surprising nor probative since radiation doses at the boundary is the very subject that was expressly removed as an issue at the hearing. Id. at 6-8. Indeed, the hearing record contains no reference to site-boundary radiation doses arising out of any type of damage to the storage cask, whether to its overpack or MPC.[34] No basis whatsoever exists to find the State failed to raise the issue of increased radiation resulting from a breached overpack.[35] The

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[34]Moreover, the Board saw no need to cite to specific radiation regulatory dose standards in its Hearing II decision. In response to the State's criticism that the February 24, 2005 PID did not reference specific Part 72 regulations, the Board said:

> Given the probability-driven result we reached on February 24, there was no need to apply the dose-consequences content of those standards, and thus no need to cite them more specifically at that point.

Id. at n. 4. The Board is attempting to have it both ways: issue a probability-driven result yet insist that Utah address the consequences-related issue of loss of shielding. By this action the Board violated its duty to conduct a fair and impartial hearing. 10 C.F.R. § 2.718.

[35]The Board points to the State's offer of proof, prepared prior to the hearing, as "confirming" that the State did not raise the issue of overpack breach. LBP-05-12, slip op. at 12. First, the offer of proof addressed only that level of detail needed to show excessive boundary doses, and expressly stated it was not the full development of radiation dose evidence. Second, the State introduced its offer of proof (Sept. 12, 2004) thus:

> Had the State been permitted to try consequences, it would have integrated the results of the cask breach probability phase to show there is greater than a one in a million probability that there will be a breach of the barriers between the spent fuel and the

Board's ruling is clearly erroneous as a legal, procedural, and factual matter and warrants review.

2. The Board Arbitrarily Rejected All Published Standards, Including the Only Published Standard for Aircraft Crashes at Nuclear Facilities, and Failed to Adopt Any Strain Limit as the Appropriate Measure of the Failure Strain in the MPC or Overpack.

   a. The Board Arbitrarily Rejected the DOE Standard.

While the Board notes that application of the DOE Standard[36] has merit on its face, it found "three things are clear" which render the DOE Standard (based on a ductility ratio) unrelated to the issue in this case. The three points relied upon by the Board (PID at B-12 - 13) overlook critical evidence which shows the DOE Standard expressly applies to the issue here.

The first point relied on by the Board is "the standard set forth in Table Q1.5.8.1 of the ANSI/AISC Standard and referenced in the DOE Standard is inapplicable, by its own terms, to 'pressure vessels.'"[37] PID at B-12. While pressure vessels are excluded from the ANSI/AISC

> environment (*i.e.*, the overpack, the canister, or the fuel cladding) and that the strains endured by the canister produce damage to the fuel, or a reasonable prospect that the fuel cannot be retrieved.

Offer at 3 (*emphasis added*). Third, the Board, having rejected the offer of proof, cannot now selectively use it against the State to determine what issues were within the scope of the hearing – a purpose the offer was not intended to address. Finally, it cannot seriously be contended that the Board and parties addressed overpack failure at the 2004 hearing believing it had no bearing whatsoever on radiation doses at the site boundary.

[36]U.S. Department of Energy, *Accident Analysis For Aircraft Crash Into Hazardous Facilities*, DOE Standard, DOE-STD-3014-96, October, 1996

[37]The corollary to the Board finding the DOE Standard inapplicable to "pressure vessels" is that pressure vessels are subject to a less rigorous ductility ratio standard than other nuclear facility safety related structures which are the subject of the ANSI/AISC Standard. There is no evidence to support this supposition. To the contrary, the unchallenged evidence is that if a different evaluation criterion were to apply to pressure vessels, it would be higher than for other steel components. Tr. 16249-50 (Sozen).

Standard, they are not excluded from the DOE Standard.[38] As described in the DOE text itself (and not in the ANSI/AISC Standard), pressure vessels (like the HI-STORM 100 MPC) which consist of welded steel plates are subject to the DOE Standard ductility ratio of ten for plate structures. State Exhs. 247, 231, and 254 at 76. Thus, the fact that pressure vessels are excluded from the ANSI/AISC Standard is not in conflict with the DOE Standard's express coverage of pressure vessels, and provides no basis for the Board to reject the DOE Standard in this case.

The majority's second point is that "the DOE standard was developed with a clear focus upon 'structural' members, which are made of carbon steel, not stainless steel." PID at B-12 and n. 93. The majority cites no evidence that shows the DOE Standard excludes objects made from steel, and to the contrary, PFS's evidence confirms the common understanding that "pressure vessels . . . tend to be constructed of ductile materials, such as stainless steel." Soler/McMahon Reb., Post Tr. 15228 at 15. The DOE Standard states it is applicable to "all facilities containing significant quantities of radioactive or hazardous chemical materials." State Exh. 254 at 8. The Board's finding that the DOE Standard (adopted by the U.S. government to address aircraft crashes into facilities containing radioactive and hazardous chemicals) does not apply to stainless steel vessels, has no support in evidence or logic and is clearly erroneous.[39]

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[38] *See* Utah Reconsid. at 3-4 (*citing to* State Exh. 254, DOE-STD 3014-96, App. D at D-5) where the text of the DOE Standard providing an example of how a crash scenario should be analyzed, clearly shows that pressure vessels are covered by the Standard.

[39] The Board's finding that the DOE Standard does not apply to pressure vessels or stainless steel, but only to structural members made of carbon steel, invalidates PFS's structural analyses (which the Staff adopts) because those analyses "draw on the information provided in the previously cited references, particularly [the DOE Standard and its supporting document]." PFS Exh. 257 at 2-6. Moreover, only when the DOE Standard is applied as a complete approach will the methodologies in the Standard result in a technically justified, conservative analysis. *See* Utah Reconsid. Reply at 6-8. PFS and the Staff merely cherry-pick from the DOE Standard. Id.

The majority's third point is that "the DOE Standard was intended to be used as a tool to assess whether or not a particular structural member would fail to be able to continue to perform its structural function when subjected to the load at issue, not for use to assess the point at which a steel component would fail by stretching to the point that it ruptures (or that a hole was created as a result of tensile loads)." PID at B-12 to 13 (*emphasis in original*). Expressly contradicting this point is the DOE Standard itself that illustrates ten examples of crashes into free-standing vessels; four of those scenarios explicitly state that the vessel fails by rupture, not by buckling. State Exh. 254 at D-14, 16. In contrast, the evidence relied on by the majority assumes that "I" beams or structural components used in buildings are the only subjects of the DOE Standard, leading to the unsupported finding that failure by bucking is the only failure mode contemplated by the DOE Standard. Soler/McMahon Reb., Post Tr. 15228 at 13-14. Moreover, the majority's reliance on Staff witness Bjorkman's testimony that the DOE Standard does not apply to a rupture failure (PID at nn. 95-96) overlooks his testimony that the DOE standard does contain a ductility ratio for tension members which does, in fact, address failure by rupture, not buckling. Tr. 16849 (Bjorkman); Utah Findings ¶ 31.

The Board's arbitrary and capricious rejection of the DOE Standard, which, if applied in this case, shows that PFS fails the 10^{-6} safety standard, is grounds for Commission review.

b. The Board Arbitrarily Sets No Standard to Evaluate Failure Strains.

The majority now admits it "foreswore reliance upon any Code-delineated" determination of cask failure, including the DOE Standard 3014-96. LBP-05-12, slip op. at 16. However, the rejection of all published standards does not justify the majority's failure to articulate any standard, and instead to arbitrarily approve the high calculated strains found by all parties.

The majority adopted no strain limit as appropriate to judge the failure of the MPC or cask

overpack. Thus, the margin by which the majority found the HI-STORM 100 (Rev. 0) cask system not to fail is unknown. The majority apparently justifies its refusal to use any set criterion by noting that evidence was produced showing failure strains of 90% for stainless steel (used in the MPC) and 69% for carbon steel (used in the overpack). LBP-05-12, slip op. at 17; Utah Findings at 36-51. These strain limits, whose status is not elevated by the majority's label "laboratory data" and "experimental evidence" (LBP-05-12, slip op. at 18; PID at B-18), come from textbook tables based on static "coupon tests"– the slow pulling of a 4" steel specimen in one direction until it breaks. *See* Utah Findings at 33-47. However, the Board recognized that static coupon test data for a small specimen of metal could not seriously be used as a standard for the instantaneous loading from aircraft crashes when considering a cask manufactured by welded steel plates. PID at B-18. The majority relied on Staff witness Mr. Gwinn (erroneously referred to as "Dr." Gwinn), who admitted he was "speculating a bit" but nevertheless testified that only 30% to 50% of the coupon test strains should be used to take account of flaws, welds, holes, "and stuff that is not bulk."[40] Thus, the greatest factor relied on by the Board as a basis for its decision was not textbook tables for static tests, but the admitted speculation of one witness who suggested a reduction of those values by 50% to 70% to account for welds and flaws. The Board accepted this speculative assumption without consideration of instantaneous loading from aircraft crashes in spite of expert testimony to the contrary. Tr. 19525-27 (Sozen).

Although the majority opinion discussed various evidence which it appeared to generally adopt, it failed to articulate the strain limit it found to be applicable to components of the MPC and overpack. This failure, the speculative nature of the evidence generally relied on, and the fact that majority rejected without basis the published DOE Standard specifically for the aircraft

[40]Tr. (Gwinn) 15987-88, 15995; Utah Findings at 39; PID at B-18 and n. 120.

crash analysis (criteria which PFS fails to meet) render the Utah K PID arbitrary and capricious and is grounds for Commission review.

3. The Majority's Factual Determination Is Clearly Erroneous Because it Failed to Consider Relevant and Reliable Evidence That Shows PFS Exceeds the 10^{-6} Standard.

Even if the Commission does not overturn the Board's legal standard that exposure limits can only be exceeded by a release of radioactive byproducts contained in the MPC, and rejects application of the DOE Standard, the majority's action is clearly erroneous because it relies on speculation and ignores credible evidence showing the UEP exceeds 10^{-6}.

a. Substituting Subjective Judgment for Record Evidence, the Board Arbitrarily Made a Critical Finding That Certain "Above Bounding Speed" Crashes Will Not Cause HI-STORM 100 Casks to Lose Their Integrity as a Radiation Boundary.

The Board determined the MPC will not fail when a cask is impacted on its side by an F-16 traveling at a [xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx]. PID at B-18. Using this so-called "bounding speed and angle" the Board approved PFS's probability analysis under which crashes not within those parameters are "unanalyzed events," *i.e.*, those which may cause a breach. PID at B-40. Contrary to the bounding speed and angle found as a fact, the PFS analysis assigns a zero probability of a cask breach for an F-16 impact to the top of a cask [xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx]. PFS Exh. 265 at 48. As a result, the Board has implicitly found that an F-16 squarely impacting the cask storage area of the PFS facility [xxxxxxxxxxxxxxxxxxxx

mph. This finding is not supported by analysis, is contrary to common sense, is not subject to reasoning by intuitive hunch,[41] and is therefore clearly erroneous, and warrants review.

The Board acknowledges that top impacts present a flaw in the PFS analysis adopted by the Board. LBP-05-12, slip op. at 25. Simply stated, the error results from the fact that PFS counted F-16 impacts either as an impact to the top of a cask or as an impact to the side of a cask based on whether an F-16 first strikes a cask top or a cask side. Id. In the PFS analysis, top impacts are essentially disregarded by the assumption that [xxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx].[42] This analysis flaw allows countless high impact crashes to escape any contribution towards the probability of breach because the F-16 first strikes a cask top and the fact that it could continue on at speeds sufficient to breach is disregarded. For example, a [xxxxxxxxxxxxxxxxxxxx] is analyzed by PFS as having no potential for a cask breach, even though it may continue on to impact the side of a second cask only 5 feet away at a [xxxxxxxxxxxxxxxxxxxxxxxxx], thereby breaching the second cask. The Board attempts to justify this gaping oversight by resorting to its own subjective reasoning on how the geometry of the aircraft and the 11 foot diameter cask top would combine to slow or redirect the aircraft to save a second cask from being struck and breached.[43] LBP-05-12, slip op. at 25-27. This speculation merely highlights that there is no

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[41]Public Service Co. of New Hampshire (Seabrook Station, Units 1 and 2), ALAB-422, 6 NRC 33, 41 (1977)(a Licensing Board must clearly state the basis for its decision and, in particular, state reasons for rejecting contrary evidence in reaching the decision). *See also* 10 CFR § 2.760(c) and Pacific Gas and Electric Co. (Diablo Canyon Nuclear Power Plant, No. Unit 2) ALAB-254, 8 AEC 1184, 1187 (1975).

[42]PFS Exh. 265, p 48, Tables V-3, V-4.

[43]Pacific Gas & Electric Co. (Diablo Canyon Nuclear Power Plant, Units 1 & 2), ALAB-580, 11 NRC 227, 230 (1980) (adjudicatory decisions must be supported by evidence properly in the record); Virginia Electric and Power Co. (North Anna Nuclear Power Station, Units 1 and 2),

analysis in the record. An NRC license based on lay supposition of how a crashing [xxxxxx] military aircraft with ample speed to breach a cask, will not do so because its crash behavior has been "reasoned out" by the majority, is the antithesis of an impartial "on the record" hearing.

Because the State raised this analysis error, both PFS and the Staff made calculations as to the increase in UEP that as a result had been overlooked. The majority asserts that PFS's estimate of the resulting UEP increase is "very conservative" and that the Staff's estimate of a lower UEP increase is more reasonable and "could not materially" affect the Board's ruling.[44] However, a review of the Staff's estimate shows that it did not address the issue raised here. The Staff's estimate considered only those "events in which the F-16 barely grazes the top edge of the cask" and "counted all grazing impacts as side impacts." Damon Tstmy, Post Tr. 18790 at 10-11. The Staff determined that the UEP obtained in the PFS analysis would be increased for side impacts and decreased for top impacts, with a slight net increase. However, the issue raised by the State was not addressed in the Staff's estimate of increased UEP.

The State's issue to be addressed is that under the PFS analysis, all top impacts are disregarded, grazing or otherwise, regardless of having an impact speed far exceeding the speed necessary to breach a cask side. The Staff's estimate, like the PFS analysis which contains the flaw, considers that a given impact is either a top impact or a side impact, and reallocated a small portion of top impacts ("grazing impacts") to be counted as side impacts.

ALAB-555, 10 NRC 23, 26 (1979) (a Licensing Board decision which rests significant findings on expert opinion not susceptible of being tested on examination of the witness is a fit candidate for reversal). The PID is notable for its lack of specific factual findings (*see* PID Part II, "The Merits"), misuse of judicial notice (*see* PID at n. 186), and dearth of citations to the record to support substantive findings (*see e.g.*, PID at n. 63, B-35, B-37, and B-41 to 42). This is clear error and warrants reversal.

[44]LBP-05-12, slip op. at 27, 28.

PFS's estimate did, however, calculate the amount that the UEP under its analysis would be increased due to the issue raised by the State, by counting as a breach those top impacts which had a horizontal speed capable of breaching the side of an adjacent cask.[45] PFS calculated the increased UEP due to such impacts as 1.94 E-7.[46] PFS Exh. 324. Using the majority's 8.7 E-7 UEP from the PID at B-37 and adding 1.94 E-7 for omitted top impacts, yield a cumulative probability of 1.06 E-6. If the additional 1.94 E-7 UEP for omitted top impacts is added to the 7.37 E-7 UEP calculated by PFS, it yields a total UEP of 9.31 E-7. When the additional 1.03 E-7 UEP from section C.3.b *infra* is added, the resulting total UEP is 1.03 E-6 (*i.e.*, 1.03 x 10^{-6}). In either case, the cumulative probability exceeds the NRC threshold and to exclude this probability from the total UEP based on the majority's speculation is clearly erroneous, is an outcome determinative finding, and is grounds for review.

b. <u>The Board's Failure to Exclude Seven Accidents from the F-16 Crash Data is Clear Error, Corrupts the Data Set, and Misrepresents the Probability of Cask Breach.</u>

Utah moved the Board to reconsider that data from 7 takeoff and landing accidents should be excluded from the data set used to predict F-16 impact speed.[47] While the Board excluded

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[45]As no analysis for subsequently impacted casks has been done, the only evidence is that the F-16 is assumed to continue on after a shallow top impact to damage one or more of the other 3,999 casks which may be in its trajectory. Tr. 19521-25 (Sozen). Since PFS uses (and the Board adopts) a [xxxxxxxxxxxx] as the analyzed event for its calculation of side impact probability, top impacts with a horizontal component in excess of this speed must be considered as "unanalyzed" side impacts to other casks. Id. at 19524.

[46]This is the only evidence of the increased UEP as a result of the events omitted by the PFS analysis. Dr. Cornell testified that this calculation "would be a new table [to his cumulative probability analysis], we would call it V-5, it would be results of impacts on cask tops that subsequently hit sides of other casks." Tr. 19067 (Cornell).

[47]Utah Reconsid. (Mar. 7, 2005) at 7-8; Utah Reconsid. Reply (Mar. 29, 2005) 9-10.

four accidents that occurred on the runway[48] and reduced the mishap data set to 57, it did not exclude these additional 7 crashes, notwithstanding that Utah and PFS experts – former F-16 pilots – both agreed that these takeoff and landing accidents could not occur in Skull Valley.[49]

The Board attempts to resolve the merits of this issue by simply noting that the Applicant did not agree to remove these data from its probability analysis, which the Board approved. LBP-05-12, slip op. at 20. This misses the point raised by the State and only emphasizes the error made by the Board. The Applicant has, of course, not agreed to remove these slow speed impacts from the data used in its analysis because the resulting UEP would be increased from that shown in the analysis. The error being raised by the State is that all evidence is in agreement that the data relied on by the Board are not predictive of impact speeds at the PFS site, and thus not bounding. The Board's approval and adoption of the PFS probability analysis is therefore contrary to the evidence.

Applicant's F-16 pilot expert testified, as did Utah's F-16 pilot expert, that the 7 takeoff and landing accidents at issue could not occur in Skull Valley,[50] a fact which is determinative of the appropriateness of including the data in the database. It is a simple, undisputed, and

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[48] *See* PID at B-31 to B-32 (data from F-16 accidents that occurred "near a runway" or where the "aircraft lost power before it reached . . . [xxxxxxxxx]" during takeoff should not be considered in the probability analysis.).

[49] PFS Exhibit 319 Table is PFS's "reassessment" of 13 accidents claimed by the State to be unrepresentative because they could not reasonably occur in Skull Valley. The exhibit shows PFS's assessment that 7 of the 13 accidents could not reasonably occur in Skull Valley, with supporting reasoning. *See* Exh. 319; PFS Findings ¶ 89; *see also* Utah Reconsid. at 7.

[50] PFS Exh. 319 (prepared by Col. Fly and Dr. Cornell); PFS Findings ¶ 89 ("some of the [takeoff and landing] accidents, because they involved pilot ejection at very low altitude and low speed, are unlikely to occur in Skull Valley" and "including them in the impact speed and angle frequency distribution data set could overestimate the likelihood of low speed crash impacts."). The NRC Staff did not call a pilot expert to testify on this issue.

obvious proposition that statistical data used to determine crash impact speeds at the PFS site in Skull Valley must be data from crashes that could in fact occur in Skull Valley.[51] Inclusion of this slower impact data underestimates the expected impact speed which in turn underestimates the probability of cask breach, constitutes clear error, and is grounds for Commission review.

The Board's error in allowing the seven unrepresentative crashes to remain in the crash data is significant because, as the Board recognized, it corrupts the data set. *See* PID at B-21 ("inclusion of irrelevant or unrepresentative data . . . will corrupt the dataset and lead to misleading results."). The impact speed for six of the excluded accidents is below [xxxxx], while the seventh is below [xxxxx]. PFS Exh. 319. By excluding these seven events, the probability of an impact speed [xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx]. PFS Exh. 321. The 7.37 x 10^{-7} UEP advocated by PFS and adopted by the Board thus would increase by 1.03 x 10^{-7} to a total UEP of 8.39 x 10^{-7} per year. *See* Utah Reconsid. at 8. When combined with the additional UEP of 1.94 x 10^{-7} from evidence the Board ignored (*see* Section C.3.a *supra*), the total UEP reaches 1.03 x 10^{-6}, exceeding the NRC threshold for credible accidents.

D. <u>The Board's Use of Subjective Judgment, Speculation, and Lack of Evidentiary Support, Renders its Decision Unconservative, Unreliable and a Departure from Established Law.</u>

Perhaps the most alarming feature of the Utah K PID, which purports to assure the safety of the PFS site, is the majority's own acknowledgment that its decision is based on limited data with material uncertainties.[52] PID at B-37. Because of this, the majority states it would have

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[51]PFS Exh. 265, Appendix A at 3 ("The idea is to model as closely as possible the flight that occurs in Skull Valley.").

[52]Note also that the majority rejected the State's calculated UEP by using numerical values that were misstated from the record. The majority reasoned that only one-third of crashes could cause a breach because they impact [xxxxxxxxxxxxxxx]; therefore, total UEP could be no greater than 0.333 x (4.29 E-6) or 1.5 E-6. PID at B-37. In fact, a careful examination of the source cited by the majority (<u>id</u>. at n. 179) reveals that [xxxxxxxxxxxxxxxxxxxxxxxxx]

"considerable discomfort" finding aircraft crashes were not a credible event if it were not for four "large conservatisms" built into the analysis. Id. However, the first such "conservatism" is the supposition that non-radial impacts (those not along the centerline or axis of the cask) will cause less cask damage than radial impacts. Id. at B-38. As to this, the majority states "[w]hile no evidence or computations were presented" regarding radial versus non-radial impacts, "we find there is reason to believe" non-radial impacts cause less damage. Id. Not only did the majority err by making a subjective finding of "conservatism" without supporting evidence, the record affirmatively shows there is no basis for such a finding. Utah expert, Dr. Sozen, testified that an eccentric impact which transmits less energy to the cask may cause more damage because of the complex dynamic interaction of the fuel basket and MPC. Tr. 19525-26. He further testified that even if a cask was not damaged by an impact away from its center, the F-16 may impact and damage a second cask. Id.

Secondly, the majority claims as a "conservatism" the fact that all parties used a "skid area" to account for the fact that an F-16 making a shallow impact[53] directly in front of the cask will nevertheless continue on to impact the cask. PID at B-38 - 39. As the record shows, all parties included the skid area because the DOE Std. 3014-96 formula, specifically tailored for the skid distance of an F-16 fighter aircraft, requires such a computation for calculating effective area.

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mph, yielding 0.45 x (4.29 E-6) = 1.93 E-6. PFS Exh. 265 (Cornell Report) at Fig. A-1. Further erring, the value of 4.29 E-6 used by the majority is the probability found for F-16 Skull Valley transits only (*see* LBP-03-04 at § C.62); an additional probability of 0.42 E-6 (total probability for all events of 4.71 E-6 minus 4.29 E-6 = 0.42 E-6) was found for other events. *See* PFS Exh. 265 at 51. Thus, the total UEP using the majority's reasoning is 1.93 E-6 + 0.42 E-6 = 2.35 E-6, well within the total UEP range of 2.0 E-6 and 4.08 E-6 proposed by the State, thereby supporting the State's UEP calculation and offering no grounds to reject same.

[53][xxxx

See e.g., PFS Exh. N at 14a-16. An F-16 traveling at a cask-breaching speed of [xxxxx] travels the skid distance of [xxxxxxxxxxxxxxxxxxxx]. Id. In order to prop up its decision, the majority attempts to subjectively reason, without any supporting reference in the record, how an F-16 will behave during the milliseconds it skids prior to impacting a cask, concluding that the use of a skid area must be a large conservatism. This is clear error.

As a third "conservatism" the majority relies on the factor the Board rejected in LBP-03-04 (Hearing I), so-called pilot avoidance. PID at B-39 to B-40. As noted in its earlier decision, pilots cannot be counted on, in a nuclear regulatory safety context, to take the proper action under emergency conditions. LBP-03-04, 57 NRC at 106-108. No nuclear license has ever been based on taking credit for avoiding human error, id. at 108, and the majority's action is a departure from established law and the Board's own ruling in LBP-03-04.

Finally, the majority counts as a "conservatism" the PFS "computations" that a [xxxx] impact would not cause an MPC breach. PID at B-40. This evidence is remarkable for the opposite reason. The PFS calculations actually show lower strains from a [xxxx] F-16 impact than from a [xxxxxx] impact. State Findings ¶¶ 67-70, 77. The fact that the PFS strain computations are lower for a higher impact speed casts doubt on all of the PFS calculations and leads to the conclusion that even lower impact speeds may result in greater likelihood of breach.

The majority cannot relieve its discomfort by the four asserted "conservatisms." Those "conservatisms" are themselves uncertain, based on speculation, and based on the majority acting as its own "expert witness." Rather than being conservative, there is substantial evidence which renders the PID non-conservative. For example, the majority relies on a pilot's ability to steer a crashing F-16 away from the PFS facility to claim its decision is conservative, but refuses to rely on a pilot's ability to follow the written Air Force directive to eject above 2,000 ft. As a

result, the majority includes data from low speed crashes where the pilot ejected below the proscribed 2,000 ft. limit and which unconservatively underestimates breach probability.[54]

Another example is the majority's decision to approve the PFS probability analysis of 57 crash events, even though it contains data from 7 slow speed take off and landing crashes that would not occur in Skull Valley. It thereby understates breach probability.[55] To justify the inclusion of this unrepresentative data, the majority refers to a lower probability obtained in a separate PFS sensitivity analysis using weighted data from only 29 crash events[56] – even though the majority found the full 57 event analysis suffered from limited data. Whatever results are obtained from weighting such a small data set with corresponding high standard error does not change the fact that the analysis approved by the majority as the basis for its decision is non-conservative and understates breach probability.

Perhaps the greatest non-conservative factor is revealed by the majority's rejection of the DOE Std. 3014-96 – the Department's standard specifically for the analysis of aircraft crashes into nuclear facilities, including storage casks – and the NRC's Reg Guide 7.6.[57] The strains

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[54]Utah Motion In Limine (to preclude flight data evidence) (June 28, 2004).

[55]Even PFS admits these take-off and landing events would not happen in Skull Valley and that its analysis therefore overestimates the likelihood of slow speed (and underestimates the high speed breach-causing) crashes. PFS Findings at ¶ 89.

[56]The 29 events are comprised of the 7 takeoff and landings and 22 other events.

[57]The majority's decision is non-conservative for many other reasons. As Judge Lam pointed out, the fact that of the 57 crash reports used as the database to predict impact speed, only 15 reports actually contained an impact speed thus 74% of the data relied on is not actual reported data but merely estimates made by PFS. PID at D-2. Judge Lam also notes that PFS's statistical analysis is so frail that the choice of curve-fitting methods can increase the UEP to over 1 E-6. Id. at D-3. Further, no consideration has been given to increased future military activity in the Sevier B and D MOA airspace over the PFS site even though this air-space serves as ingress to the largest U.S. test and bombing range. Changes in military training in the UTTR and MOAs cannot be anticipated and are completely outside the regulatory loop. The F-16 fighter

calculated by PFS for its bounding analysis, a 360 mph F-16 impact at 10°, fail the DOE Standard criteria by a factor of 11 (Staff's calculated strains fail the Standard by a factor of 16). Utah Findings at 108-109. The DOE Standard uses ductility ratio criteria to require that strain levels do not greatly exceed the yield point or elastic region of the material, the same principle as the elastic analysis required by Reg. Guide 7.6 for licensing transportation casks. Id. ¶¶ 97-102. When directly asked by Judge Lam, the NRC Staff did not know if the analyzed strains for the HI-STORM 100 cask would cause it to fail the NRC's own transportation cask requirements. Tr.19956. It is certainly unconservative to license a facility using storage casks that fail the DOE aircraft crash-specific standard by a wide margin, cannot be shown to pass the NRC's own standard for transportation casks, and are only found acceptable by comparison to textbook failure strains obtained by slowly stretching a small metal specimen. Utah Findings ¶¶ 109-125.

The majority's use of subjective judgment, speculation, and lack of evidentiary support, renders its decision unconservative, unreliable and a departure from established law. For the foregoing reasons, the State requests the Commission accept review of its petition on Utah K.

DATED this 13th day of June, 2005.

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will be replaced by year 2010. Tr. (Cole) at 3372; Tr. at 3367 (Jefferson). Thus, for the majority of the proposed 20 year ISFSI license period, no evidence is available to calculate the risk to the PFS site from military aircraft crashes and weapons testing. Utah Findings (Hearing I) at 17,19.

CERTIFICATE OF SERVICE
(Non-Safeguards Version)

I hereby certify that a copy of STATE OF UTAH'S PETITION FOR REVIEW OF CONTENTION UTAH K (Aircraft Crashes) *(Redacted – Non-Safeguards – Version)* was served on the persons listed below by electronic mail (unless otherwise noted) with conforming copies by United States mail first class, this 13th day of June, 2005:

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