BAS 4927

DOCKETED
USNRC

October 15, 2002 (1:28PM)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

| | | |
|---|---|---|
| In the Matter of: | ) | Docket No. 72-22-ISFSI |
| PRIVATE FUEL STORAGE, LLC (Independent Spent Fuel Storage Installation) | ) | ASLBP No. 97-732-02-ISFSI |
| | ) | October 7, 2002 |

# STATE OF UTAH'S REPLY TO THE PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW OF THE APPLICANT AND THE NRC STAFF ON CONTENTION UTAH K/CONFEDERATED TRIBES B

Pursuant to the Order of the Atomic Safety and Licensing Board ("Board") of July 3rd, 2002, [1] the State of Utah ("State") submits its reply to the proposed findings of fact and conclusions of law filed by the Applicant, Private Fuel Storage, LLC ("PFS"),[2] and the NRC Staff ("Staff").[3]

---

[1]Tr. (Farrar, J.) at 13519.

[2]Applicant's Proposed Findings of Fact and Conclusions of Law on Contention Utah K/Confederated Tribes B (August 30, 2002).

[3]NRC Staff's Proposed Findings of Fact and Conclusions of Law Concerning Contention Utah K/ Confederated Tribes B (Inadequate Consideration of Credible Accidents) (August 30, 2002). The State does not specifically respond to the individual proposed findings of the NRC Staff. The State notes that the Staff witnesses did not claim any expertise in aviation matters. Nor did the Staff witnesses claim prior experience in the PFS theory that crash probability can be reduced by quantifying a pilot's ability to aim a crashing aircraft. The State therefore views the Staff's Proposed Findings as adopting the theories and opinions of PFS witnesses. The Staff Findings for the most part duplicate and advocate for the Findings proposed by PFS and are generally adversarial to the State. Where the State's Reply addresses specific Findings proposed by PFS, the Reply is intended to address the equivalent Finding, if any, proposed by the Staff.

I. ORGANIZATION OF REPLY

Because there is a single issue that overwhelmingly dominates this contention, the State will focus its reply on that issue which alone determines whether the safety risks for the storage of 40,000 metric tons of nuclear waste are acceptable. Simply stated, that single issue is:

> **If the calculated probability for aircraft crashes admittedly exceeds the Commission's allowable safety threshold, can the calculated probability be substantially disregarded based solely on the subjective opinion of the Applicant's hired witnesses that pilots will prevent a crashing aircraft from striking casks holding spent nuclear fuel?**

The State will address the PFS Proposed Findings that would have the Board disregard 27 years of accumulated crash statistics that unquestionably show that the risk to the PFS storage casks exceeds the Commission's probability standard of 1 E-06. PFS would also have the Board find, based solely on the subjective opinion of the Applicant's paid witnesses, that the known probability of crashes should be disregarded 85.5% of the time because pilots will prevent the crashing aircraft from striking PFS storage casks. PFS is asking the Board to hope against the facts that the aircraft crashes which will in fact occur, will miss the PFS storage casks.

Similarly, the State will address other selected proposed findings that would have the Board disregard undisputed historical data, based solely on the subjective opinion of witnesses paid by PFS. The Board is repeatedly asked to adopt findings that elevate the subjective opinion of PFS witnesses over the actual data which their opinions contradict. This Reply demonstrates the lack of evidence to support such findings and conclusions proposed by PFS and the Staff.

## II. OVERVIEW AND CONCLUSIONS

The subjective estimate of pilot's ability to avoid the PFS facility casks.

PFS proposes that the Board find an annual probability of crashes from F-16s transiting Skull Valley to be 3.11 E-7, which is obtained by suppressing 85.5% of the numerically calculated crash rate based on the subjective opinion of PFS witnesses. PFS's numerically calculated crash rate without the subjective discount sought by PFS is 2.14 E-6, a probability which exceeds the Commission's safety threshold of 1 E-6.

PFS disregards 85.5% of the calculated probability based on the following subjective assumption of its hired witnesses:

> A pilot of an F-16 knowing his aircraft will crash within seconds, will, before the pilot ejects to save his life, divert his attention from saving his life to protecting the PFS storage casks, and will be able to locate the PFS casks and other ground sites even where not visible due to weather, and will then maneuver the aircraft so that after the pilot ejects it will not crash into any ground sites including the casks.

PFS actually estimates a near perfect 95% success rate for pilots in protecting the PFS storage casks. The lower rate of 85.5% is used because the cause of a crash often renders the aircraft uncontrollable so that the pilot could not aim the F-16 in any direction even if he desired to do so. PFS reduces its subjective estimate only by 10% (90% x 95% =85.5%) to account for this fact even though PFS witnesses found that in 42% of F-16 crashes the aircraft was uncontrollable.

The witnesses hired by PFS gave their opinion that pilots in an emergency will protect the PFS site in spite of documented pilot error rates of 52%, weather data showing poor visibility[4] and official reports of F-16s crashing into houses and fatally injuring people after the pilot ejected. Not surprisingly, PFS has not offered any evidence of a crash where a pilot took an interest in having the aircraft avoid crashing into a window-less, door-less object such as a concrete storage cask.

Although PFS witnesses could have simply declared that 85.5% of the crash probability should be disregarded, PFS has instead chosen to inject this subjective opinion into the published NUREG-0800 formula by adding a factor PFS has named "*R*":

| | |
|---|---|
| P= C x N x A/w | Formula given in NUREG-0800 |
| P= C x N x A/w x *R* | Formula used by PFS. |

While this may give the illusion that there is a scientific or statistical basis for the value of *R*, in fact there is not. PFS witnesses chose 95% as a pure subjective estimate without performing a single mathematical or statistical computation. <u>After</u> making their subjective estimate of 95%, PFS witnesses reviewed 126 accident reports in an attempt to find statistical support.[5] Although General Jefferson (USAF retired) originally testified "[w]e

---

[4]When confronted with facts that expose the 95% estimate as obviously unattainable, PFS has simply ignored the undisputed obstacle. Weather conditions are such an obstacle. The weather data introduced by PFS itself show the pilot will not be able to see the ground at least 14.5 % of the time due to clouds and ground fog. Other cloud conditions, although not completely obscuring the sky, adversely affect the pilot's visibility of the ground 50% of the time. PFS admits in its Revised Addendum to its Crash Report that a pilot should be able to see the PFS site only "a majority of the time." PFS Exh. O, Tab FF at 24. PFS ignores these facts and clings to its subjective estimate as its sole basis to escape the known crash probability which exceeds the Commission's safety threshold.

[5]Tr. (Jefferson) 3967.

have data that would support 100 percent,"[6] after further cross-examination General Jefferson admitted that "we cannot support [our estimate] statistically."[7] General Cole (USAF retired) testified that the reports showed a statistical success rate of 12%.[8] Even more remarkable is the failure of PFS to withdraw its estimate after learning that it is contradicted by the data. Without the subjective estimate, however, the probability of a crash into the PFS facility would admittedly exceed the safety probability threshold established by the Commission.

After finding no statistical support from the accident reports, PFS witnesses made a far reaching attempt for legitimacy by testifying " we found no case where they tried to avoid something, and they didn't avoid it."[9] This flawed logic known as "absence of a negative," is revealed by the fact that only 2 of the 126 reports even mention a specific ground site observed by the pilot. Apparently hoping the Board will not scrutinize the actual accident reports, PFS makes the astonishing representation that its subjective estimate is "corroborated by 10 years of information from the Air Force F-16 accident reports." PFS Findings at 33. Fortunately, the accidents reports are in evidence.

In contrast to the subjective estimate, the facts published by the U.S. Air Force show that pilots commonly make errors in emergency situations. The U.S. Air Force Chief of Safety warned that futile attempts to restart failed engines cause pilots to eject below the safe

---

[6]Tr. (Jefferson) at 3665.

[7]Tr. (Jefferson) at 13109-10.

[8]Tr. (Cole) at 3668.

[9]Tr. (Jefferson) at 13103.

minimum altitude of 2,000 feet above ground level ("AGL"), that 73% of ejections had recently occurred below 2,000 feet AGL, and that "[e]rroneous assumptions and poor airmanship have flourished" in ejection emergencies.[10] Further, the stress of in-flight emergencies causes pilots to take "inappropriate" actions. Id.

Another U.S. Air Force publication states that pilots are not prepared for ejection 26% of the time, and that 6.8% of ejections result in fatal injuries.[11]

The most compelling evidence presented to the Board is a U.S. Air Force training video made from the actual live video recording of an F-16 during an engine failure emergency and subsequent crash. State Exh. 220. Video recordings are routinely made during F-16 training and depict the pilot's view from inside the cockpit. The training video shows Colonel Frank Bernard, a pilot with many years of experience including a prior ejection, becoming so focused on trying to restart his failed engine that he forgot to eject until 4 seconds before the crash. This actual, unbiased view of an ejection emergency, shown to train pilots who have historically performed poorly in emergencies, shows the true frailty of a pilot's ability under this life and death stress situation.

Not surprisingly, PFS and the Staff objected to admission of this video, which is the only evidence showing an actual ejection emergency. In fact, PFS has consistently avoided evidence from pilots who have actually had the experience of ejecting during an emergency. The State attempted to have Major Tom Smith, an F-16 pilot who has ejected, appear before

---

[10] A.F. ALSAFECOM 002/1996 (March 1996) (State Exh. 57).

[11] USAF Flying Safety Magazine (September 2001) (State Exh. 151).

the Board but PFS refused to consent to the late appearance. The State argued strenuously to the Board that this case could not be properly decided without evidence from a pilot with actual emergency ejection experience. Tr. 3230-31. PFS and the Staff argued such evidence was unnecessary. Tr. 3231–37. The Board agreed with the State and the testimony of two pilots with ejection experience was arranged.

One such witness, Colonel Michael Cosby, testified that in his emergency he erred in spending too much time trying to restart a failed engine and ejected only 50 feet above the ground, breaking his back in two places. The accident investigation board determined that Colonel Cosby's error was responsible for the loss of the aircraft and that he would have been able to land the aircraft if he had not been focused on restarting the failed engine. Colonel Cosby testified that pilots are "type A" personalities and will take "every opportunity to [save the aircraft] before they actually have to eject."[12] Colonel Cosby acknowledged that both weather conditions and the pilot's focus on other matters can prevent a pilot from giving any consideration to where the aircraft will crash.

The other witness with ejection experience, Colonel Bernard, also testified that during his emergency he became focused on attempting to restart his engine, to the point that he ejected only 4 seconds before his aircraft crashed. Colonel Bernard testified that in an emergency, a pilot's attention becomes focused on what he needs to do for survival. As mentioned above, the video recording of Colonel Bernard's emergency and subsequent crash was made into a training video by the U.S. Air Force. The video is an undisputable portrayal

---

[12]Tr. (Cosby) at 4011.

of a pilot during an emergency and the most objective piece of evidence before the Board. Its content shows an intensity during an emergency which cannot be captured with words.

The F-16 flight manual provides that "time permitting," a pilot should direct the aircraft away from populated areas and eject at no lower that 2,000 feet AGL. PFS Exh. PPP at 3-43; State Exh. 224 at 3-39. PFS witnesses suggest that this provision supports their estimate that pilots will protect the PFS casks 95% of the time. The actual evidence is that because a pilot uses all available time to save the aircraft and the pilot's life, there is likely no "time permitting" for other matters. Even less likely is that the pilot would be able to see specific ground sites 3.2 miles away (the distance the F-16 will glide after the pilot ejects) and from that distance, aim the aircraft so as to avoid all ground sites where the aircraft may impact. In fact, this step is virtually impossible at least 14.5% of the time when clouds and fog obscure the ground.[13] This task is even more difficult considering the aircraft will not fly perfectly straight but may bank and turn from its heading after ejection. Underlying all these obstacles is the unlikely assumption that the pilot would divert his focus from saving a $30 million aircraft and his life and instead dwell on whether the abandoned aircraft will impact a concrete cylinder.

It would certainly be expected in the face of all the contrary evidence that PFS would present many documented examples of the task on which its subjective estimate and its Crash Report (*Aircraft Crash Impact Hazard at the Private Fuel Storage Facility* (August 10, 2000) ("Crash Report") (PFS Exh. N)) is based and which PFS presumes a pilot can perform:

---

[13] *See* footnote 4 *supra*.

> A pilot in an emergency, must take time to see look for and see a specific ground site 3.2 miles away from the aircraft which the pilot determines he should try to avoid, aim the powerless aircraft so to avoid that ground site and all other populated areas, then eject above 2,000 ft AGL while the aircraft continues to fly pilotless for 3.2 miles until it crashes without impacting the selected ground site or other populated areas.

*See e.g.*, State Findings ¶¶ 61-62. In fact, PFS has not presented a single accident report or other document, not even hearsay testimony, that such a feat has ever been performed. What the accident reports do clearly show is a crash involving engine failure where the F-16 remained controllable by the pilot, but after the pilot ejected, the aircraft hit and destroyed a house even though it was in a sparely populated area, like the Skull Valley area.[14] Another report shows that after the pilot ejected, the F-16 destroyed two houses killing a child and injuring the mother.[15] Incredibly, PFS claims both of these reports support its subjective estimate that pilots will be able to avoid the PFS casks.

The undisputed facts include pilot errors documented by the U.S. Air Force, visibility problems due to weather documented by the National Climatic Data Center, U.S. Air Force accident reports showing crashes into ground sites after the pilot ejects, a U.S. Air Force training video of a live ejection emergency showing the common pilot error of focusing on restarting a failed engine and a rushed ejection at an unsafe altitude, and the glaring absence in this proceeding of any documented case of a pilot ever performing the very task that PFS relies on for the safety of stored nuclear fuel.

One would expect a witness opining a theory of pilot behavior never before studied,

---

[14]Aircraft Accident Investigation Report (January 13, 1992) (PFS Exh. 134).

[15]Aircraft Accident Investigation (July 11, 1996) (Joint Exh. 10).

tested or peer reviewed, yet so important as to nullify calculated crash probability, would possess years of personal study and experience in this specific pilot task and the variables upon which it depends. No scholar would seriously contend that general military officers are experts in all subjects related to the military, nor that a pilot is expert at a task he has not performed. PFS, however, hopes to impress the Board with the fact that two of its witnesses are retired general officers so that the Board will accept their rank as a substitute for the fact that neither has even flown an F-16, ejected from any aircraft, or has studied the issue on which they opine. PFS eventually added former F-16 pilot Colonel Fly (USAF retired) to its chorus of subjective opinions, but he also has no ejection experience and also has not previously studied this issue. Rather, this is the first attempt by each of the three PFS witnesses to quantify a pilot's ability to steer a crashing F-16 away from a ground site. Remarkably, each reached the same conclusion without making a single calculation: F-16 pilots will avoid the PFS casks 95% of the time. They each rendered this first-time opinion in the course of doing part-time work as a professional witness, furnished to PFS by Burdeshaw Associates, an agency that supplies military officers as witnesses. The PFS witnesses were paid $1,000 per day for their part-time work.[16] This opinion is not science, it is not substantial evidence, it is not a basis to ignore the published F-16 crash rate. If the Board were to approve the PFS application based on this subjective theory, it will signal a new standard for licensing nuclear facilities where known safety risks can be disregarded on the thinnest of subjective, self-serving opinions from an applicant.

[16]Tr. (Cole) at 3152-53.

Subjective opinion in other areas

Using subjective opinion to avoid the documented facts is a recurring theme in the findings proposed by PFS. A glaring example is the manner in which PFS determined the annual number of flights through Skull Valley used in computing the probability of a crash. The PFS Crash Report shows the annual number of flights for three years:

| | Sevier B | Sevier D |
|---|---|---|
| FY98 | 3,871 | 215 |
| FY99 | 4,250 | 336 |
| FY00 | 5,757 | 240 |

Even though the FY00 data is the most recent and shows the highest number of flights, PFS witnesses again gave their subjective opinion that a lower number of flights should be used. PFS witnesses arbitrarily conclude that the average of FY99 and FY00 should be used, thereby reducing the calculated crash probability a full 13% rather than using the documented FY00 data to obtain an objective crash probability. No explanation is even attempted for the odd conclusion that two years of data should be averaged. PFS suggests in strained testimony that there will be less flights in the future "[b]ased on past history and the current war on terrorism."[17] Past history, however, is shown by the data itself and any effect from the unspecific "war on terrorism" or other future world events is admittedly a guess. PFS witness General Jefferson acknowledged that the number of future flights cannot be

---

[17]Cole/Jefferson/Fly Tstmy, Post Tr.___ at 20.

predicted because they will be determined by national policy and budgets.[18] PFS is again hoping the Board will consider retired military officers to have credibility on all matters military, even when their opinion is simply a guess. As with its other subjective opinions, PFS proclaims the result to be reasonable and conservative, as if the mantra of these words will mask the reality that the crash probability has been artificially reduced.

Even more blatant is the PFS selection of data used in computing the F-16 crash rate. The F-16 crash rate is published by the U.S. Air Force for years 1975 through 2001. Rather than use the available data for all years, PFS witnesses opined that only the ten year period FY89-FY98 should be used. PFS offers no reason whatsoever for selecting these particular 10 years from the available data, but not surprisingly they produce the lowest crash rate of any ten year period in the F-16's history. PFS witness General Jefferson admits that the lifetime crash rate for the F-16 is 23% higher than the 10 year period selected by PFS.[19] Hoping the Board will overlook this basic statistical violation of selecting the most favorable data, PFS issues its standard proclamation that selecting the lowest historical crash rate is conservative.

In yet another example, the opinion of the PFS witnesses was shown to be simply impossible. PFS witnesses opined that flights above the PFS site are in an airspace 10 miles wide, and are at an altitude of 3,000 to 4,000 feet AGL.[20] As shown in State Exhibit 156B,

---

[18]Tr. (Jefferson) at 3352.

[19]Tr. (Jefferson) at 8870.

[20]Cole/Jefferson/Fly Tstmy, Post Tr.___ at 44, 88.

an illustration taken from PFS's own Crash Report, the airspace claimed by PFS to be 10 miles wide has physical boundaries of 8 to 9 miles in width.[21] PFS nevertheless uses a 10 miles width for the factor *w* in calculating crash probability, again understating the resulting probability and proclaiming the use of 10 miles to be conservative. PFS proposes that the Board find that it is reasonable to use 10 miles as the width of the flight path above the PFS site even though it does not exist.

Overall view of air crash safety

The overall view of whether the PFS site is safe from aircraft crashes is neither complicated nor is the calculation of crash probability difficult. The one fact that cannot be hidden is that PFS has chosen to locate spent reactor fuel adjacent to the nation's largest bombing range, and the narrow airspace directly over the site is used as the entrance to the bombing range. The fact is, many thousands of F-16 fighters are annually funneled through this narrow space en route to the bombing range. A location more at risk from aircraft crashes is difficult to imagine. The basic input factors to calculate crash probability are the number of flights, the crash rate, and the width of the overhead airspace. These input factors for this location are extremely high, and are documented and readily available. The documented input factors result in a calculated probability that is fatal to the PFS application. PFS has thus used hired witnesses to offer opinions that the known number of

[21] Because F-16s fly in formations and because pilots will not use the full available width to avoid straying into the bordering restricted airspace, most of the F-16s actually fly in a path less than five miles wide. Without even considering those factors, a cursory look at the physical boundaries shown in State Exh. 156B reveals that the PFS claim of a 10 mile width simply cannot be true.

flights should not be used, but rather a lower, arbitrary number. These witnesses have opined that the crash rate based on the lifetime history of the F-16 should not be used, but rather chose the ten year period with the lowest crash rate. These witnesses have opined that an airway 10 miles wide should be used when the physical boundaries permit a flight path of only 8 to 9 miles in width. Even after taking these subjective discounts from the documented input factors, PFS's calculated probability still exceeds the Commission's 1 E - 06 safety threshold probability.

The PFS witnesses therefore make their grandest subjective opinion of all, that the calculated impact probability can be disregarded because pilots will prevent a crashing aircraft from striking spent nuclear fuel ("SNF") casks. PFS injects this subjective opinion into the NUREG-0800 formula in a transparent effort to impart the appearance of science. There has never been any study conducted with respect to whether a pilot would or could protect ground facilities, such as the PFS casks. Not a single NRC or DOE publication even mentions the subject of a pilot's ability to avoid a nuclear facility, or lack of such an ability. The PFS witnesses themselves have no prior experience in the study of a pilot's ability or inability to avoid a spent fuel storage cask or any other ground site. The subjective claim that pilots can avoid a ground site 95% of the time is in all respects, the first and only claim of its kind.

Because there are no data to support the claim of pilot avoidance, PFS devotes 117 Proposed Findings of Fact to general and simplistic statements, such as "the presence of clouds. . . would not necessarily obstruct the pilot's view of the PFSF,"[22] hoping that a drawn-out discussion of possibilities will overcome that fact that there is no confirmation of the PFS theory. In this way PFS has made the findings a maze of assumptions of how a pilot should be able to see and avoid PFS casks, why pilot stress and error will not occur, how the pilot may be able to perform this task when he cannot see due to weather, how the Air Force is expected to warn pilots about the PFS site, why pilots should consider door-less, window-less storage casks to be "populated areas," and other hopeful predictions that the Board is asked to find will all occur with certainty. Similarly, PFS proposes lengthy findings concerning accident reports, none of which show a pilot in an engine-out emergency, aiming the aircraft to avoid a specific ground site 3.2 miles or more away and ejecting above 2,000 feet AGL. The PFS Proposed Findings, therefore, focus on a phrase or sentence lifted from a report from which the Board is asked to divine what the pilot's thoughts and actions would be if he were attempting to avoid the PFS storage casks. Those reports are in evidence. No amount of verbal gloss can conceal from the Board that there is no evidence that a pilot has ever aimed a crashing F-16 away from a specific ground object from a distance of 3.2 miles or more. If it were otherwise, PFS would not submit 117 Proposed Findings trying to side step the many impediments that would prevent a pilot from performing or even attempting the speculative avoidance task.

The Commission's Threshold Standard

During the hearing there was some suggestion that the standard of 1 E-06 set by the

[22]PFS Findings ¶ 131.

Commission should be viewed as an "order of magnitude" standard. This notion is based on the tolerance allowed under the 1 E-07 standard for reactors, whereby a higher calculated probability of 1 E-06 may be acceptable in certain cases when qualitative arguments show the realistic probability is lower.[23] The maximum tolerance thus allowed is 9 E-07, changing the reactor threshold from 1 E-07 to 1 E-06. (1 E-07 + 9 E-07 = 10 E-07 = 1 E-06). The guidance in NUREG-0800 does not, however, allow a tolerance of "an order of magnitude" or even refer to that phrase. Although the tolerance of 9 E-07 (0.9 E-06) appears to change the reactor threshold by an "order of magnitude," that same tolerance, assuming it was appropriate to allow, would change the ISFSI threshold from 1 E-06 to 1.9 E-06. (1 E-06 + 0.9E-06 = 1.9 E-06).

In addition, there is no suggestion in the Commission's decision determining the 1 E -06 ISFSI threshold that any tolerance was intended to be allowed.[24] In any event, the reactor tolerance of 9 E-07, lowering the threshold to 1 E-06, is allowed only where qualitative arguments show the realistic probability is lower. PFS has based in entire case on qualitative arguments that reduce the calculated probability by 85.5%. The result is so lacking in any hint of conservatism that any claim for a lowered standard is unimaginable.

---

[23]*See* CLI-01-22, 54 NRC 255, 263 & n. 31 (2001), referring to *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants*, NUREG-0800 (Rev. 2, July 1981), § 2.2.3 (II), "Evaluation of Potential Accidents."

[24]CLI-01-22, 54 NRC 255 (2001).

III. ASSERTIONS REGARDING PFS METHODOLOGY

PFS asserts that it has calculated crash impact probabilities "using the methodologies of the DOE standard, *Accident Analysis for Aircraft Crash into Hazardous Facilities*, DOE-STD-3014-96 (Oct. 1996), and the NRC Standard Review Plan for Nuclear Power Plants, NUREG-0800, as modified to reflect the particular circumstances at the PFS site." PFS Findings ¶ 9. By far the largest factor in PFS's probability determination is the subjective claim that pilots will prevent an F-16 from crashing into storage casks. PFS uses this single factor, a totally subjective estimate, to disregard 85.5% of the calculated probability.[25] Both the Staff and PFS admit that the notion of a pilot's ability to avoid a nuclear facility is not even mentioned in the DOE and NRC documents. Tr. (Jefferson) 3207-3211; (Campe) 4101,4103. Since the PFS probability is largely determined by estimate, PFS is asking the Board to distort the basis for the PFS result, giving the appearance it is the product of standard methodology. PFS added the phrase "as modified to reflect the particular circumstances at the PFS site," giving a faint suggestion that DOE and NRC methodology were not followed in some unspecified manner. This phrase serves to further hide the mammoth 85.5% subjective reduction by implying it is a detail regularly adjusted for each site. PFS would have the Board aid in masking the actual basis for the PFS probability

---

[25]PFS takes this 85.5% subjective discount by labeling it as *R*, and inserting it into the NUREG-0800 formula for calculating crash probability, giving the false appearance that it is based on math, science or NRC methodology:

$P = C \times N \times A/w$ Formula given in NUREG-0800
$P = C \times N \times A/w \times R$ Formula used by PFS.

determination.

While PFS Proposed Finding ¶ 9 claims PFS's result is legitimate because it is based on NRC guidance documents, Proposed Findings ¶¶ 16 through 24 attempt to justify PFS's failure to use NUREG-0800 methodology: "NUREG-0800 itself states that the formula is only "[o]ne way of calculating" crash probability. PFS Findings ¶ 19. PSF also proposes: "Furthermore, NUREG-0800 states explicitly that an applicant may propose an alternative method of analysis in lieu of NUREG-0800." PFS Findings ¶ 20. And finally, PFS proposes: "NUREG-0800 does not bar the addition of the *R* factor." PFS Findings ¶ 23. It is quite obvious PFS has not used NRC or DOE methodology, neither of which make any reference to a pilot's ability to avoid a nuclear facility. Tr. (Campe) at 4101, 4103; (Ghosh) at 4114-14.

Essentially conceding that NRC methodology was neither followed nor supports the methodology used, PFS proposes that the Board nevertheless find that there is other support for PFS's subjective determination of crash probability.

<u>The U.K. Method for Assessment of Aircraft Crash Hazards</u>

PFS proposes that the Board find that a 1987 publication[26] of the United Kingdom Atomic Energy Authority is precedent for the PFS opinion that pilots will avoid the PFS site. PFS Findings ¶ 21. The document referred to was provided to PFS by the State. Not only does it not support PFS, it shows PFS has understated the probability of a crash.

---

[26]Roberts, T.M., *A Method for the Site-specific Assessment of Aircraft Crash Hazards*, SRD, Safety and Reliability Directorate, United Kingdom Atomic Energy Authority (July 1987) (excerpts included as PFS Exh. TTT).

According to the U.K. document, adjustments are made to the calculated crash probability in regions of two types: 1) areas of intensive military training, and 2) restricted flying zones. PFS Exh. TTT at 7.

"Areas of intensive military training" in the U.K. are "due to military manoeuvres, such as pilot training, low flying practice,[27] etc. These areas are termed 'areas of intense air activity' (AIAA)." Id. at 7. "[T]he procedure is to calculate the crash rate for each cell . . . and then if the cell is contained within an AIAA, the calculated rate is increased according to the figures in table 2." Id. (*emphasis supplied*). The narrow airspace above the PFS site is without question an area of intense air activity used for pilot training and low level flying. Not only is pilot avoidance not mentioned for such an area, the U.K. methodology would increase the calculated probability solely on account of its constant use by military training flights.

A second type of area referred to in the U.K. document, "restricted flying zones" are areas where "a restriction or prohibition of flying in the area" has been imposed. Id. Restricted flying zones are essentially cities:

> In this context, an urban area also corresponds to a restricted area. Flying over such built-up areas is governed by general flight rules which prohibit dangerous flying, low flying, flying closer than 500 ft. of any object on the ground, and flying within 1500 ft. of the highest fixed object in a built-up area.

---

[27]The NRC Staff notified the Board and the parties on August 13, 2002, that the U.S. Air Force had lowered the minimum altitude for flights in Sevier B MOA from 1,000 feet to100 feet above ground level ("AGL") at the location of the PFS site. This change, allowing very low altitude flights, represents the continuing change in training activities by the U.S. Air Force. The Applicant's Aircraft Crash Report relies on the previous minimum altitude of 1,000 feet AGL over the PFS site. Crash Report (PFS Exh. N) at 6.

Id. at 8. The crash rate applicable to regions below a restricted flying area is multiplied by a factor $F_c$. "There are several pieces of evidence which suggest that a value of 0.5 would be a reasonable estimate for $F_c$, i.e. that an average urban area in the UK is about half as likely to suffer an aircraft impact as an average rural area of equal size." Id. Those reasons are given:

1. "[I]n roughly 50% of non-airfield related crashes the pilot retains enough control of the aircraft to have some influence over the crash-landing site. . . . It does not seem realistic at this stage to use a value of $F_c$ lower than 0.5 because it appears that about half the military aircraft crashes arise from causes which effectively prevent any pilot control" (*i.e.*, a pilot may be able to avoid crashing in an urban area where flying is restricted or prohibited 50% of the time).

2. "[F]lying activity for light aircraft which fly generally at low altitudes is reduced over built-up areas (because of the General Flight Rules) to roughly 50% of the average over other regions."

3. "The distribution of airfields in the UK implies that the majority of flying (and hence crashing) in the UK takes place over England and Wales, so we would therefore expect to get about 10% of 66 = 6.6 crashes onto urban areas in this period of time. Since only 3 appear to have been recorded, this lends further weight to the case for using $F_c$ = 0.5."

Id. Two features of the U.K. methodology have relevance to the PFS application. Neither supports PFS's use of pilot avoidance to disregard crash probability at the PFS site, but rather show it is unacceptable:

First, the PFS location would be considered an "area of intense air activity" and the calculated probability of a crash would be increased as a result. There is no mention of a pilot's ability to avoid with respect to such an area.

Second, a 50% reduction in crash probability is applied under the U.K. methodology, but only for urban areas where flying is either prohibited, or restricted to no dangerous flying nor flights within 1,500 feet of the highest object. As one of the supporting reasons, the

U.K. document concludes "in roughly 50% of non-airfield related crashes the pilots retain enough control of the aircraft to have some influence over the crash-landing site." Id. (*emphasis supplied*). That is to say, the pilot retains enough control to avoid an urban area, *i.e.*, a city, as opposed to a specific object, 50 % of the time. Even for this limited use in urban areas, it is recognized that more than a 50% reduction would be "unrealistic" "because it appears that about half the military aircraft crashes arise from causes which effectively prevent any pilot control." Id. Further, if the prohibition of flying or restrictions are in effect only part of the time, less than a 50% reduction would be allowed. Id. Thus, the reduction in probability is completely dependent on flying prohibitions. The PFS site is obviously not within an urban area but is sparsely populated, and rather than prohibited or restricted flying, the PFS site is below constant military training flights which may be as low as 100 feet above ground.

In summary, the U.K. methodology confirms that reliance on pilot avoidance is not acceptable methodology for military training areas, and also confirms that pilots only have "some influence" over a crash landing site so that they can at most be relied on to avoid a flight- restricted urban area 50% of the time. A plain reading of the U.K. crash assessment document shows it provides no support for the PFS's "methodology" but rather reveals its unreliability.

The pilot's desire not to crash into buildings

PFS asserts that all pilots that testified agreed that "time and circumstances permitting, a pilot of a crashing F-16 would attempt to avoid a facility like the PFSF." PFS Findings ¶ 22. It is difficult to imagine that a pilot, or for that matter the driver of any vehicle, would want to crash into anyone or anything "time and circumstances permitting." Such a general statement, however, does nothing to support the claim that a pilot in an emergency can select a specific crash landing sight from 3.2 miles away before he ejects, so that the pilotless aircraft would neither impact the PFS site nor a ranch or village. The various factors that are obstacles to performing such a task are addressed specifically in this Reply and the State's Proposed Findings. *See* State's Findings ¶¶ 77-96.

The implication that PFS determined pilot avoidance from data

PFS has repeatedly admitted that its opinion that pilots will avoid the PFS casks 85.5% of the time is a purely subjective estimate, involving no calculations. Tr. (Jefferson) at 3215-16; 3966-67; 3972-73; 8882; 13118-13122. Astonishingly, PFS would have the Board find that Staff witness Dr. Campe has concluded that the *R* factor is based on historical or actuarial data from which future projections can be made. PFS Findings ¶ 24. To the contrary, Dr. Campe testified regarding the determination of *R*:

> The use of the *R* factor we, I think, recognized throughout our evaluation was one of the parts of the evaluation that needs to be looked at more closely [sic, closer[28]] than any other part because of that, because of the way it was derived. It wasn't something that was hard data, it involved judgment and opinion.

Tr. (Campe) at 8912 (*emphasis supplied*). The PFS findings intended to elevate the subjective opinion to the level of an authoritative methodology are without basis in the record.

[28]Quotations from the hearing transcript with obvious transcription errors are handled by putting the correct wording in the quotation followed by a bracket with "sic" plus the incorrect transcript wording.

## IV. ASSERTIONS REGARDING F-16 FLIGHT PATH AND AIRWAY WIDTH

PFS claims that F-16 fighters transiting Skull Valley typically pass approximately five miles to the east of the PFS site. PFS Findings ¶ 11. This assertion is obviously false. Virtually all F-16 flights through Skull Valley are in two or four ship formations, which fact is predominately set forth in PFS's own Crash Report. PFS Exh. N, Tab E; Tr. (Jefferson) at 3430. In fact, the U.S. Air Force states that it would be a rare exception for a solo flight to transit Skull Valley. Campe, Ghosh Tstmy, Post Tr. 4078 at 11. The PFS Crash Report states that F-16 formations are 2.5 to 3.5 miles across. PFS Exh. N, Tab E. For every flight passing through Skull Valley there are one or more other flights at other locations and no "typical" single route can develop.

In addition to the fact that formation flights make a "typical" route impossible, PFS is not able to provide a basis for such a claim. General Cole, PFS's sole source relied on for this information, testified he was unsure of where he heard the statement suggesting a "typical" route five miles east of the PFS facility: "It was mentioned either at the conference call or when I was at Hill. I can't specifically recall which time." Tr. (Cole) at 3398. On further cross examination, General Cole admitted that the statement lacked accuracy and that the mention of five miles may not even have been in reference to the proposed PFS site:

> And the discussion was around the PFS site. So I believe he was talking about five miles east [sic, west] of the PFS site. But it was a notion, an approximate distance. It wasn't a firm thing.

Tr. (Cole) at 3402; State Findings ¶ 30, n.12. This is the sole basis for PFS's claim that F-16s "typically" pass five miles to the east of the PFS site. General Cole further admitted that there was no mention of what percentage of flights or the type of formations flown in connection with the "notion." Tr. (Cole) at 3404. Incredibly, PFS proposes that from this single, vague, off-hand remark, the Board should find that "[t]he Air Force has consistently advised PFS that the predominant or preferred route of flight for F-16s transiting Skull Valley is approximately five miles to the east of the proposed PFSF site." PFS Findings ¶ 42.

PFS witness Colonel Fly gives the contrary testimony that most flights are down "the middle to the eastern side" of Skull Valley. Tr. (Fly) at 3415-16. Similarly, Lt. Col. Horstman (USAF retired) testified that "F-16 formation[s] essentially [fly] down the middle of Skull Valley with part of the formation flying over or near the proposed PFS site." Horstman Tstmy, Post Tr. ___ at 6. This testimony from pilots who have actually flown in Skull Valley, together with the undisputed evidence that F-16s virtually always fly in 2 or 4 ship formations, shows that the proposed finding that F-16s "typically" pass five miles to the east of the PFS site is grossly unsupportable by the evidence.

PFS's strained effort to suggest that the "preferred" route for F-16s is five miles to east of the PFS site is part of a simplistic and incorrect assertion: if F-16s do not fly directly over the PFS site, they would not be "in a position to potentially hit the PFSF in the event of a crash." PFS Findings ¶ 43. The notion that after an engine failure, an F-16 simply continues in a straight line until it crashes ignores the great bulk of evidence concerning engine failure emergencies. After an engine fails, the pilot will leave the formation and zoom the aircraft (raising the nose and climbing) to gain altitude, during which time he will jettison fuel tanks and bombs which may require a change in the aircraft's direction, and upon reaching the speed of 250 knots, the pilot will start a descent and turn towards an emergency landing field. State Findings ¶¶ 61-62. The fact that pilots will turn towards an emergency air field is in accordance with emergency procedures, is confirmed by the PFS Crash Report, and is the consistent testimony of all pilots. Tr. (Horstman) at 8576-79; 8601-05; 8625-27; 13366-70; State Exh. 186; Tr. (Bernard) at 3921-23; Applicant Exh. N, Tab E; Tr. (Fly) at 3334. The fact that the F-16 may not be flying directly over or towards the PFS site when an engine fails gives no assurance that the F-16 will not strike the PFS facility. In fact, aircraft flying on the east side of Skull Valley will be drawn towards the PFS site during an engine failure as the pilot turns toward Michael Army Air Field, the designated emergency landing field southwest of the PFS site. State Exh. 186.

The logic for trying to establish a "preferred" flight path is flawed in even more basic ways. Even if a favorite or preferred route of today's pilots was somehow determined, it would simply be their personal choice since the Air Force has clearly stated that F-16s can fly anywhere in Skull Valley. Tr. (Cole) at 3396-97. The safety of the PFS facility would depend on the assumption that pilots, who may fly anywhere in Skull Valley, will not change their "favorite" route over time. This absurdity is self-evident.

The Staff has rejected PFS's "single route" claim and has advised PFS to "spread them out" in the usable airway. Tr. (Jefferson) at 3443. This is consistent with NUREG-0800 methodology which requires an input value for *w* the "width of airway" in miles. Resnikoff Tstmy, Post Tr. 8698 at 5-6. However, PFS chose an airway width of 10 miles, which is physically impossible, and which understates the resulting crash probability. PFS asserts that the width of 10 miles is "based on the useable airspace in the Sevier B MOA through which the F-16s could fly at the latitude of the PFSF." PFS Findings ¶ 43. However, at the altitude admittedly used by F-16s, 3,000 to 4,000 feet AGL, Sevier B MOA has physical boundaries which limit the width to 8 to 9 miles. State Exhibit 156B, taken from PFS's own Crash Report, shows a cross section of Sevier B MOA at the latitude of the PFS facility, and clearly shows a with of only 8 to 9 miles at 3,000 to 4,000 feet AGL. On cross examination, PFS witness General Jefferson was asked by Judge Farrar how he could justify using a 10 mile width when State Exhibit 156B shows it did not exist. Tr. (Farrar, J) at 3450-53. After further questioning by Judge Farrar, General Jefferson admitted the width of 10 miles does not exist. Tr. (Jefferson) at 3452-53. Judge Lam agreed with Judge Farrar noting that the width of ten miles was not possible:

> . . . let's look at what is the physically permissible space. That is what Mr. Soper is driving at. Do you have the space or do you not have that space? I think this chart [State Exhibit 156B] is self-evident.

Tr. (Lam, J.) at 3451.

Not only is the permissible width only 8 to 9 miles, pilots leave a buffer of at least one mile from the western boundary of Sevier B MOA to prevent straying into restricted air space west of the MOA. Horstman Tstmy, Post Tr.___ at 7; State Findings ¶ 43. The furthest east ship in a formation will fly at least 2 miles away from the Stansbury Mountains to the east. Horstman Tstmy, Post Tr.___ at 6-7. The resulting air space of approximately six miles in width forces over half of the aircraft in two or four ship formations towards the middle of the airspace. Id. The result is that a majority of Skull Valley flights are in airspace less than five miles wide, as shown on State Exh. 48 (overlay to Fig. 1 of the Crash Report). Id. PFS witness General Jefferson agrees that at least half the flights are within a 5 mile width. Tr. (Jefferson) at 3455.

PFS now asserts, contrary to its Crash Report, that the relevant airspace width is the wider airspace north of the PFS site because aircraft would have to glide some distance before impacting the PFS site. However, NUREG-0800 calls for an input value *w*, the width of the aviation corridor that passes "through the vicinity of the site." Appl. Exh. RRR at 3.5.1.6-3. The use of the airspace width at some other point would have the illogical result that the width over the actual site becomes irrelevant. In reality, aircraft approaching the site at 450 KIAS[29] (517 miles per hour) are already within the same airspace width that is available over the site. In any event, all aircraft will have to be pointed so as to pass within the available airspace over the PFS site, making it the only relevant width that corresponds to the likelihood of a crash.

PFS asserts that the State has advanced a number of theories as to why PFS should have used a smaller width than 10 miles, and then devotes Findings ¶¶ 45 through 53 to discussing various points that do not squarely address the greatest flaws, which have been discussed above. While generally in disagreement with PFS Findings ¶¶ 45-53, the State has adequately addressed those matters in its Proposed Findings and will not do so again here. *See* State's Findings ¶¶ 40-45.

## V. ASSERTIONS REGARDING NUMBER OF FLIGHTS THROUGH SKULL VALLEY

The PFS Proposed Findings concerning the number of Skull Valley flights conspicuously omit the full historical data shown in the Addendum to the PFS Crash Report:

[29] Knots indicated air speed.

| | Sevier B | Sevier D |
|---|---|---|
| FY98 | 3,871 | 215 |
| FY99 | 4,250 | 336 |
| FY00 | 5,757 | 240 |

PFS Exh. O at 4; PFS Findings ¶¶ 12, 54-66. In view of the large increases for every year, any reasonable forecast for the next 20 years would not be less than the actual flights for FY00. A realistic estimate would allow for some increase due to the obvious increasing trend. Yet, contrary to the data, PFS based the future number of flights on the average of FY99 and FY00, resulting in 13% flights that actually occurred in FY00. PFS Findings ¶¶ 12, 54. Incredibly, PFS asks the Board to find, in four separate findings, that this subjective reduction of the data is conservative. PFS Findings ¶¶ 12, 54, 63, 66. The amorphous reason advanced by PFS for this arbitrary reduction is that "continuing modernization and increased technological capability of newer military aircraft will likely result in fewer aircraft and a reduction in annual sorties." PFS Findings ¶ 12; *see also* ¶¶ 62-63. The actual data, however, show that even with "continuing modernization" the number of annual flights have, in fact, increased from year to year over the PFS site. Even if PFS's assertions could be shown to have some validity for "military aircraft" generally, the data show it is simply untrue for the MOAs at issue here, which are part of the nation's largest test and training range airspace.

PFS also offers the "crystal ball" prediction that based on "past history and the current war on terrorism," fewer flights can be expected from Hill AFB. PFS Findings ¶ 57. "Past history" is the data itself and shows increasing flights. The suggestion that the current war on terrorism will have a predictable effect on Skull Valley flights is patent speculation.

PFS does correctly recognize that 12 additional F-16s were assigned to Hill AFB in 2001, proportionally increasing the future number of flights by 17.4%. PFS Findings ¶¶ 12, 59. This fact shows that the number of aircraft at Hill AFB continues to increase, contrary to the PFS's assertion that "modernization" and "technology" will result in fewer aircraft and fewer sorties. PFS Findings ¶¶ 12, 62, 63.

These data cannot be hidden and are undisputed: there were 5,997 flights in FY00 in the airspace above the PFS site and 12 additional F-16s were assigned to Hill AFB in 2001, which will increase the number of sorties by 17.4%. No reasonable estimate of future flights should be lower than the flights known to occur at this particular location, that is: 5,997 x 17.4% = 7,040 annual flights. This number may be an underestimate of future flights because it does not account for the trend of increasing annual flights and the possibility of another increase in aircraft stationed at Hill AFB. An estimate of 7,040 annual flights per year is in no respect conservative, but is the absolute minimum number of flights to realistically expect over the next 20 years.

PFS asserts that it would be unreasonable to use the combined Sevier B and Sevier D sortie counts because they include aircraft that do not transit Skull Valley. PSF Findings ¶ 65. Thus, PFS has arbitrarily omitted the sortie counts for Sevier D, and based its estimate on the average of FY99 and FY00 flights for Sevier B MOA only. PFS Findings ¶¶ 55, 65. However, PFS's Addendum to its Crash Report states:

> Further, the Air Force has now indicated that, in addition to F-16 Skull Valley flights going through Sevier B, the majority of flights going through Sevier D are also F-16s transiting

Skull Valley.

PFS Exh. O, Tab HH[30] at 2. PFS also admits all the flights shown for the Sevier D MOA may in fact have transited Skull Valley and nothing in the data indicates otherwise. Tr. (Jefferson) at 3356. General Jefferson admits it would be more conservative to include the flight counts for Sevier D MOA. Id. at 3356-57.

In sum, PFS would have the Board ignore the available data which indicates 7,040 Skull Valley flights can be expected, and instead rely on various subjective forecasts used by PFS to obtain a 17% reduction for its estimate of 5,870 flights.

## VI. ASSERTIONS REGARDING CRASH RATE - PFS'S SELECTION OF LOWEST DATA

PFS did not use the 27 years of published F-16 crash history to calculate a crash rate, but rather selected only the years FY89 to FY98 from that history that produce the lowest 10 year crash rate in the F-16's history. PFS Findings ¶ 25; Resnikoff Tstmy, Post Tr. 8698 at 15. Indeed, PFS witness General Jefferson admitted the lifetime crash rate for the F-16 is 23% higher than the period selected by PFS. Tr. (Jefferson) at 8870. Therefore, PFS devotes Proposed Findings ¶¶ 25 through 37 to an effort to justify its self-serving selection of data.

As a preliminary matter, it should be noted the crash rates for the F-16 are published by the U.S. Air Force, and the data given are the number of crashes per year and the number

---

[30]Report titled *Remaining Responses to March 9, 2001 NRC Request for Additional Information Regarding Aircraft and Cruise Missile Hazards a the Private Fuel Storage Facility and Clarification Regarding Impact of Canister Building Design Changes on Air Crash Hazard*, attached to PFS's May 31, 2001 letter to the NRC.

of flight hours per year. Utah Exh. 154. There is no way to determine from the Air Force data how many crashes occurred in a particular phase of flight, such as take off, landing, normal flight, or special operations.[31] PFS, therefore, used the DOE ACRAM[32] publication to determine that 15.09% of all Class A and Class B accidents[33] occurred in the normal phase of flight for the years 1975 through 1993. PFS Exh. N, Tabs C and D. The ACRAM data contain Class A and Class B accidents but does not identify which accidents are Class A accidents, Class B accidents, or destroyed aircraft. Id. Therefore, it is not possible to determine from the ACRAM data what percentage of Class A, Class B or destroyed aircraft crashes occurred in normal flight. However, PFS analyzed accident reports for the ten year period FY89 through FY98 which showed that 22.3% of destroyed aircraft accidents occurred in normal flight. PFS Exh. N, Tab H[34]; Resnikoff Tstmy, Post Tr. 8698 at 15. In computing a crash rate, PFS used only the lower percentage of 15.09% of all Class A and Class B accidents occurring in normal flight to determine that only 24.45 accidents occurred in the 10 year period chosen by PFS. Applicant Exh. N, Tab D at 2. The more relevant

[31]"Special operations" flight phase includes low level flights and maneuvering operations. Applicant Exh. N, Tab C at 4-4 and Table 4.8; *see also* id. Tab E.

[32]*Data Development Technical Support Document for the Aircraft Crash Risk Analysis Methodology (ACRAM) Standard*, Kimura et al., Aug 1, 1996.

[33]The Air Force defines a Class A mishap as an accident resulting in loss of life, a destroyed aircraft, or total cost of property or injury exceeding $1,000,000; a Class B mishap as one resulting in total cost of property or injury of $200,000 or more but less than $1,000,000; and a destroyed aircraft as one which is uneconomical to repair. Applicant Exh. N, Tab C at 4-4.

[34]*See* PFS Exh. N, Tab H at 12: 27 accidents occurring during "normal" flight out of a total of 121 = 22.3%.

ratio of 22.3% of destroyed aircraft accidents occurring in "normal" flight, derived specifically from the ten years of data selected, would yield 30.99 destroyed F-16 accidents during that period. The crash rate used by PFS has thus been understated by 21% by relying on the ACRAM data from a different period of years which includes the lower severity Class B accidents.

It should also be noted that PFS has based its crash rate only on "normal flight" accidents, excluding "special operations," accidents which have 190% greater crash rate.[35] PFS Exh. N, Tab D; Tab C at 4-5 and Table 4.8. Special operations include low level flights and maneuvering operations, which are, in fact, conducted in the MOAs above the PFS site. Horstman Tstmy, Post Tr.___ at 8-9. Thus, PFS has again selected data contrary to the facts, thereby lowering its calculated crash rate even further.

PFS asserts that the ten year period FY89 to FY98 was chosen because it was the most recent data at the time it did its analysis. Such a reason does not even attempt to justify omitting the 15 years of crash experience prior to FY89, nor does it explain the omission of data from years FY99-01, which were available and published prior to hearing, all of which is in evidence as State Exh. 154.

PFS further attempts to justify omitting FY99-01 crash data by making the meaningless comparison of FY99-01 crash rates for Class A and destroyed aircraft accidents

---

[35]*See* PFS Exh. N, Tab C, Table 4.8, which lists 3.86E-08 crashes/mile ("normal" flight) and 1.12E-07 crashes/mile ("special operations"). The 190% figure is calculated thus:

1.12E-07 - 3.86E-08 = 7.34E-08.
7.34E-08 ÷ 3.86E-08 = 190%.

to the crash rates calculated by PFS for the ten year period FY89-98 based on all Class A and Class B accidents.[36]

PFS thus concludes that adding the most recent years would increase crash rates by only "two percent" over the rates used by PFS. In reality, the crash rates for the years FY95 -01 show an increasing trend and years FY99-01 should not be omitted because they are unfavorable to PFS. Tr. (Campe) at 8945, 8948; State Exh. 155.

PFS asserts various reasons that the Board should find that the F-16 crash history does not show a "bathtub effect," *i.e.*, higher crash rates at the beginning and the end of an aircraft's service life. PFS, therefore, reasons its selection of years FY89-98 should be accepted. PFS Findings ¶¶ 27-29. However, the fact that the lifetime crash rate of 23% is higher than the FY89-98 period used by PFS requires the conclusion that the crash rate is higher before or after the years selected by PFS, or both. Tr.(Jefferson) at 8870. The actual data, in fact, show a higher F-16 crash rate both in the initial years of service and in the most recent years. State Exhs. 154, 155.

PFS asserts that the Joint Strike Fighter ("JSF"), or whatever other fighter aircraft replaces the aging F-16 in approximately 2010, will not have a high initial crash rate. PFS Findings ¶¶ 30-35. However, PFS admits that the accident rate for the replacement aircraft is unknown, and even the aircraft which will replace the F-16 is unknown. Tr. (Jefferson) at 3374. PFS also admits that every single engine fighter aircraft the Air Force has ever had

---

[36] *See* the State's discussion of how PFS has made invalid comparison for crash rates computed for destroyed aircraft and those computed for all Class A and Class B accidents. State Findings ¶¶ 128 -132.

shows the phenomena of higher crash rates in initial years. Id. at 3365; PFS Exh. N, Fig. 2. The fact that the crash rate for the F-16 replacement is unknown and the fact that all single engine fighters have experienced a higher crash rate in initial years, offer no support for PFS to use a crash rate based on the lowest ten year period of the F-16's 27 year history. Once again, PFS has endeavored to have the Board make findings that ignore the data available and instead rely on subjective claims that future data will be more favorable to PFS.

Finally, PFS asserts that its selection of the lowest ten year crash rate is, in fact, conservative because it included Class A and Class B accidents in which no aircraft were destroyed. PFS Findings ¶ 36. As explained above, PFS has no basis to conclude that destroyed aircraft accidents are over-represented or under-represented in the crash rate determined by PFS. The underlying ACRAM data used by PFS do not reveal whether the accidents shown for "normal flight" were mostly Class A (which includes destroyed) or Class B. State Findings ¶¶ 128-132. PFS cannot use a crash rate based on an unknown number of destroyed aircraft accidents, possibly all, and then argue that its rate is conservative because it may contain non-destroyed aircraft accidents. As previously mentioned, the legitimate use of destroyed aircraft accidents data is to recognize that for the specific ten year period elected by PFS, 22.3% of all accidents occurring in "normal" flight were destroyed aircraft and those accidents (30.99) should have been used as the basis for a crash rate. PFS used the lower ACRAM data which show 15.09% of all accidents as being Class A and Class B accidents and, thus, based its crash rate on an estimated 24.45 accidents. State Findings ¶¶ 37-39. The PFS crash rate is not conservative but rather underestimates the realistic crash rate.

## VII. ASSERTIONS REGARDING A PILOT'S ABILITY TO AVOID THE PFS CASKS

PFS asserts there are two components to its claim that a pilot in a crashing F-16 could aim the aircraft before ejecting, so that after it glides for over 3 miles, it would not impact the PFS site or any populated areas. Those components are: 1) the percentage of crashing F-16s that remain controllable by the pilot, and 2) the percentage of time that a pilot in a crashing but controllable F-16 would in fact avoid the PFS site. PFS Findings ¶ 67. Obviously, if a crashing aircraft is not controllable, the pilot has no influence whatsoever over determining a crash landing site.

### The percentage of crashing F-16s that are "controllable"

PFS asserts that in 90% of F-16 crashes the pilot could control the aircraft prior to ejecting. PFS Findings ¶ 69. PFS claims that this determination is based on the review of 121 F-16 accident reports from the period FY89-FY98. Id. As a preliminary matter, it should be noted that these accident reports were prepared under Air Force Instruction AFI 51-503, which does not have as its purpose the determination of whether a pilot could control the aircraft following the emergency so as to avoid a ground site. State Exh. 60. PFS witness General Jefferson admits that the reports were never intended for the purpose of determining whether pilots can avoid features on the ground. Tr. (Jefferson) at 13118-19. Nevertheless, PFS proposes the overreaching finding that the reports are a credible source of data to evaluate pilot and aircraft responses to F-16 accidents relevant to Skull Valley. PFS Findings ¶ 70. While it is true that some of the reports establish that the crashing aircraft is spinning out of control or otherwise uncontrollable by the pilot, they do not otherwise provide information relevant to PFS's claims. Rather, they are used by PFS to speculate that the mishap pilot would have been able to control the aircraft, and would in fact have attempted and accomplished without fail the extremely improbable and difficult task proposed by PFS.

PFS concluded that in 42% of the 121 reports reviewed, the pilot did not have control of the aircraft. Tr. (Jefferson) at 3816-17. Therefore, only 58 % of the reports showed the aircraft was controllable. The higher percentage of 90% used by PFS was obtained by eliminating 60 of the reports which PFS judged were not "Skull Valley-type events." PFS ¶ 74. This questionable selection of data left only 3 accidents out 61 where the aircraft was not controllable, with the remaining 58 accident reports showing the aircraft to be controllable, according to PFS.[37] Id.

---

[37]The State notes that PFS devotes over 12 pages of Proposed Findings (¶¶ 71-90) in an attempt to defend its elimination of 60 accident reports and nearly all of the "uncontrollable" accidents from consideration. Because the evidence is unfavorable, PFS diverts the Board's attention by attempting to slur the State's witness through quotes taken out of context. For example, PFS refers to Lt. Col. Horstman's testimony that he reviewed all accident reports prior to his December 2000 deposition, and then asserts:

> Yet later in the hearing he retracted these unequivocal statements and stated that, "I had not reviewed all the accident reports prior to the December deposition." These contradictory statements can only cast doubt upon Lt. Col. Horstman's credibility.

PFS Findings ¶¶ 77-78. In fact, Lt. Col. Horstman made no contradictory statement, as shown by his full testimony, read into the record from the December 2000 deposition itself:

> I reviewed all the documents that the State provided. The crash issue was one of them. There were a half a dozen.

Tr. (Horstman) at 4319-20 (reading from Dec. 2000 deposition) (*emphasis added*). In light of

PFS, therefore, relies on these selected 58 F-16 accident reports during the ten year period FY89 to FY98 to support its claim that 90% of crashing aircraft are controllable. PFS Findings ¶ 74; PFS Exh.100A. PFS further asserts that an engine failure is by far the most likely cause of an accident in Skull Valley and in every case of engine failure the aircraft is controllable. PFS Findings ¶ 73. However, even a cursory review of these 58 accident reports shows that the pilot in many cases could not control the aircraft, even in engine failure accidents. Nor does an engine failure accident guarantee that the pilot can stay in the cockpit to control an aircraft that may be otherwise controllable. The following reported accidents, taken from the 58 reports claimed by PFS to show examples of controllable aircraft, in reality show that the aircraft was either not controllable for some mechanical reason, or that the pilot was forced to make a sudden ejection due to fire or smoke in the cockpit, or due to the aircraft having reached a dangerously low altitude:

1. 15 Jan. 91 Fire in fuselage "grew in intensity until pilot ejected." PFS Exh. 119.

2. 17 Dec. 92 After the pilot ejected, "the still-burning aircraft turned about 72 degrees further right, rolled beyond inverted, and impacted." PFS Exh. 145.

3. 3 Apr. 90 Pilot reported smoke in the cockpit and ejected. PFS Exh. 110.

4. 13 Jan. 91 Smoke and fumes in cockpit, pilot ejected while in uncontrolled spin.

the full testimony, the reference to having reviewed all the accidents reports refers to all that were provided by the State, *i.e.* "half a dozen." His subsequent statement, "I had not reviewed all the accident reports prior to the December deposition," was in response to a question asking if he had read all (121) reports in Table 1 of Tab H of the Crash Report. Id. at 4480. This is a transparent effort to blur Lt.Col. Horstman's answers to different questions.

PFS Exh. 118.

5. 19 Mar. 91 Jet began uncommanded barrel rolls, the pilot ejected while out of control. PFS Exh. 124.

6. 18 Apr. 91 F-16 struck 4.5 pound bird causing engine failure and fire. PFS Exh. 127.

7. 16 Dec. 91 Aircraft on fire when pilot ejected. Joint Exh. 4.

8. 19 Mar. 96 Pilot could not read instruments due to smoke and ejected. PFS Exh. 184.

9. 3 Sept. 90 Aircraft on fire, pilot ejected, aircraft "pitched forward violently" and impacted ground at steep angle. PFS Exh. 113.

10. 19 Feb. 93 Aircraft on fire, began uncontrolled climb into clouds and pilot ejected. PFS Exh. 147.

11. In 33 of the 58 accidents, the pilot ejected below the minimum safe altitude of 2,000 feet AGL, 8 of which were below 500 feet AGL; in 3 cases the pilot ejected on the runway; in 1 accident there was no ejection. State Exh. 223.

12. In at least 4 of the 58 accidents, the pilot could not see the ground due to clouds. State Exh. 223.

Of the 58 engine failure accident reports reviewed, less than 50% showed a controllable aircraft, with a pilot remaining in the aircraft capable of controlling it. This is consistent with the finding of the United Kingdom Atomic Energy Authority "that about half the military aircraft crashes arise from causes which effectively prevent any pilot control." PFS Exh. TTT. at 8 (lines 11-12). PFS's self-serving selection of data to determine that 90% of crashing aircraft are controllable is unsupportable, much less conservative.

The percentage of time a pilot in a controllable aircraft would in fact avoid the PFS casks.

*The task of the pilot.*

PFS asserts that a pilot in a controllable F-16 will cause it to crash somewhere other than the PSF site 95% of the time. PFS Findings ¶ 92. Consideration of this claim must begin with an understanding of what a pilot would actually be required to do to accomplish this task, and the emergency conditions under which the pilot would be operating at the time. Assuming a Skull Valley emergency caused by an engine failure, the task of pilot includes:

1. Upon a pilot realizing the engine has failed, a pilot will zoom the aircraft trading speed for altitude to prolong the time aloft before crashing. State Findings ¶ 61. A fire or smoke in the cockpit may require that the pilot eject at any time as shown by the accident reports above. Also, it may take substantial time for the pilot to even analyze the emergency as an engine failure. *See* Air Force training video (State Exh. 220). During the zoom, the aircraft nose will be pointed 30 degrees nose high, blocking the view of the ground in front of the aircraft. State Findings ¶ 61.

2. At the altitude of 7,000 – 8,000 feet AGL, the pilot will begin a 6 degree descent, during which the pilot's view of the ground in front of the aircraft will be remain blocked for a certain distance. For example, at 4,000

feet AGL, the pilot will not be able to see the ground closer than 22,000 feet (4.2 miles) in front of the aircraft. State Findings ¶ 62. The pilot will turn the F-16 toward the designated emergency landing field, Michael Army Airfield southwest of the PFS site, then attempt to restart the engine. Id. Many pilots will become focused on the task of restarting the engine, which if not accomplished, will require the pilot to eject. The Air Force has formally warned that many pilots spend too much time trying to restart the engine and make erroneous assumptions due to the stress of an emergency, resulting in ejections at dangerously low altitudes. State Exh. 57. Each of the testifying pilot witnesses who had actually ejected testified that they had spent too much time trying to restart their failed engine. Tr. (Cosby) at 3978-80; (Bernard) at 3895-96. Both pilots committed substantial errors. The Air Force board investigating Colonel Cosby's crash said he would have been able to avoid the crash and land the F-16 if he had spent less time focused on restarting the engine. Tr. (Cosby) at 4008. Colonel Cosby testified that there is an incentive for pilots to restart the engine and avoid ejection and that pilots will "take every opportunity to do that before they actually have to eject . . " Tr. (Cosby) at 4010-11. Colonel Bernard testified "it was error on my part. I should have been out of the airplane a lot sooner." Tr. (Bernard) at 3896. Colonel Bernard, a former squadron commander and chief of safety in the Air Force Reserve, became so consumed with the task of restarting the engine that he was nearly killed, ejecting only 4 seconds before his F-16 impacted the ground. State Exh.220.

3. Upon reaching an altitude of 2,500 feet AGL, the pilot will slow the F-16 to the slowest possible speed in preparation for ejection. State Findings at ¶ 62. This is done by raising the nose 20 degrees, which will block the pilot's view of the ground in front of the aircraft for 10 miles. Id. The pilot will eject at or before the minimum safe altitude of 2,000 ft. AGL, at which time the aircraft will be at least 3.22 miles from the crash landing site. Id. The F-16 manual shows additional checklist steps to be performed prior to ejection, including, "[i]f time permits, . . . direct the aircraft away from populated areas." PFS Exh. PPP at 3-43; State Exh. 224 at 3-39.[38] If the pilot has not erred by descending to an unsafe altitude or otherwise used all available time, and to the extent weather conditions and nose of the aircraft allow the pilot to see the ground, the pilot would try to determine whether there is a populated area at the projected crash site over 3 miles away. If the pilot could determine from 3 miles away that the PFS storage casks were a populated area, and the pilot could see a preferred alternative crash site which was not a ranch, Goshute Village or other populated area, the pilot would attempt to aim the aircraft at the alternate crash site. It is important to note here that a pilot would not search for the PFS site and simply turn away from it. No evidence suggests that pilots will search for any

[38]State Exh. 224 was filed August 16, 2002 per the Board direction at Tr. 13718.

particular site in an emergency other than an emergency landing field. Even if the PFS casks were seen and thought to be a populated area, the notion that a pilot would blindly turn away from the PFS site at the risk of Skull Valley residents is arrogant and unfounded.

4. After the pilot ejects, assuming the aircraft was correctly aimed, the aircraft would have to travel for over three miles without changing direction in order to crash at the selected site. However, if the pilot ejects at a slight bank, the aircraft's computer will hold that bank which will generate a turn in the F-16's heading. Tr. (Horstman) at 8526. Even if the aircraft is not initially in bank, an F-16 gliding from 4,000 feet AGL may roll and bank, causing it to deviate 10 to 20 degrees from its initial heading. Tr. (Cosby) at 4016-17. Simple trigonometry shows that an F-16 aimed at a ground site from 3.2 miles away which deviated off course by 10 degrees would miss its target by over one-half mile.[39] In such a case, an aircraft aimed to crash one-half mile away from the PFS site may in fact hit the site.

The difficulty in seeing specific ground features from over 3 miles away and lack of accuracy in causing an F-16 to crash in a distant location over 3 miles from where the pilot ejects illustrate two of the many obstacles a pilot would have in actually avoiding the PFS casks. The difficulty and complexity of avoiding a particular ground site is consistent with the testimony of F-16 instructor pilot Lt. Col. Horstman that pilots are not trained to avoid a

---

[39] 3.2 miles tan 10° = .56 mile.

particular ground site, nor do they have the tools to do that in many cases. Tr. (Horstman) at 13465. Plainly, a city would be easier to avoid than the PFS site. Id. at 13469-70. This is consistent with the crash methodology of the United Kingdom Atomic Energy Authority, which recognizes pilot avoidance only to the extent that pilots should be able to avoid urban areas and cities where flying is prohibited or restricted, 50% of the time. PFS Exh. TTT at 8. PFS's attempt to expand a pilot's capabilities from being able to avoid cities or general populated area to being able to avoid specific ground sites is unsupportable.

It should be fatal to PFS's claim that not a single accident report or other evidence shows that a pilot has ever ejected after aiming an F-16 away from a specific ground site from over three miles away. The issue here is not whether a pilot can generally turn an aircraft after the engine fails or whether a pilot while in the aircraft can turn away from an object it is about to hit. The task as shown above is much more difficult and specific. Not having any data to support its subjective opinion, PFS asserts its conclusion of 95% success for pilots in avoiding the PFS casks is based on various factors which do not address the complexity of the pilot's task. PFS ¶ 92. Those factors include the profoundly simple reason of "the very slight turn required to actually avoid the PFSF." Id.

*Pilot training*

PFS further claims the pilot would avoid the PFS site because pilots are "instructed to avoid ground facilities." PFS Findings ¶ 15 (*emphasis supplied*). PFS cites the testimony of Colonel Bernard for support of this statement although he gave distinctly different testimony: "pilots are trained, time and circumstances permitting, to point their aircraft away from a populated area." Tr. (Bernard) at 3898 (*emphasis supplied*). PFS also asserts that it relies on the "the training that pilots receive to avoid inhabited or built up areas on the ground." PFS ¶ 92 (*emphasis supplied*). Again the citations to the record refer to training to avoid populated areas. The actual "training" a pilot receives is a single one sentence reference in the F-16 flight manual. Tr. (Jefferson) at 3250-52. That reference provides:

> **Ejection (time permitting)**
> If time permits, descend to avoid the hazards of high altitude ejection. Stow all loose equipment and direct the aircraft away from populated areas. Sit with head against headrest, buttocks against back of seat, and feet on rudder pedals.

PFS Exh. N at 19a & n.16A; PFS Exh. PPP (at 3-43); State Exh. 224 (at 3-39, corresponding to PFS Exh. PPP at 3-43) (*emphasis supplied*). Logic suggests no reason why a pilot would consider the window-less, door-less concrete storage casks at the PFS site as a "populated area." If a pilot did consider the PFS casks to be a "populated area" the pilot would likely also conclude that the neighboring Tekoi Rocket Engine Test Facility is a "populated area" worthy of being avoided. State Exh. 222. The actual reference in the F-16 manual suggests that a pilot would be far more concerned with avoiding the Goshute Indian Village or nearby ranches, which are in fact "populated areas." Thus, PFS consistently implies that pilots have been trained for a much more difficult task by stating that pilots are trained to avoid "built up" areas, and are trained to avoid "ground facilities." PFS ¶¶ 15, 92. However, there is no such training or reference in any Air Force manual. Testimony from F-16 Instructor pilot Lt. Col. Horstman was uncontroverted and clear:

> The Air Force training doesn't say avoid a house. It doesn't say avoid a facility. It doesn't say avoid a ground site. It says populated areas.

Tr. (Horstman) at 13465 (emphasis added).

One thing is very clear about the issue of pilot training: PFS has offered no training manuals, testimony from pilots or instructors, or any other evidence that describes the actual training upon which PFS relys in support of its opinion that pilots would avoid the PFS casks. With the importance PFS places on pilot training, one would expect PFS to provide the Board with great technical detail on exactly what is taught and a description of any training exercises that are practiced to hone the skills claimed by PFS. The complete absence of any attempt to describe the training implied by PFS can only be explained by the fact that such training does not exist. The emergency of a crash happens to a pilot typically as a first time experience. The evidence shows that the only "training" for F-16 pilots is a one sentence reference in the F-16 flight manual: "If time permits . . . direct aircraft away from populated areas." Tr. (Jefferson) at 3250-52.

*Obstacles preventing a pilot from seeing and avoiding a particular ground site.*

In addition to the fact that pilots are not trained or equipped for the specific task PFS supposes a pilot can perform, the many obstacles to such a task include:

1. Pilot error rates documented by the U.S. Air Force, as high as 73% during ejection emergencies.

2. Documented emergency stress and the common pilot error of spending all available time on restarting a failed engine.

3. Ground visibility being totally obstructed 11.5% of the time due to complete cloud or ground fog coverage, with a pilot's visibility adversely impacted by weather 50% of the time.

4. The pilot's view of the ground being blocked by the aircraft nose during F-16

emergency procedures.

5. The uncertainty of future training exercises over the PFS site and type of aircraft, missiles and weapons employed.[40]

The State has pointed out in detail the relevant portions of the record supporting these issues in its Proposed Findings and will not repeat that information here. *See, e.g.*, State Findings ¶¶ 77-96; 103-104.

*Lack of supporting evidence from mishap reports.*

After opining a 95% success rate for a pilot's ability to avoid the PFS casks, PFS reviewed 58 accident reports from the years FY89-98 in hopes of justifying its opinion. Tr. (Jefferson) at 3967; 13100-01, 13118-22. PFS admits that the reports do not statically support its conclusion. Tr. (Jefferson) at 13109-10. PFS witness General Cole testified that the reports show a statistical success rate of 12%. Tr. (Cole) at 3668. Astonishingly, PFS asserts its subjective estimate is "corroborated by 10 years of information from the Air Force F-16 accident reports" and that the reports showed that pilots "do in fact take necessary action to avoid sites on the ground." PFS Findings at 33, ¶ 143. Hoping for an unsophisticated reader, PFS also asserts that "the accident reports showed no cases in which a pilot failed to take steps to avoid or minimize damage to facilities or populated areas on the

---

[40]The State notes that on October 2, 2002, the Applicant advised the Board of a 10 September 2002 letter from Hill AFB 388th Wing Commander Stephen L. Hoog relative to the recent change in minimum altitude from 1,000 feet to 100 feet over the proposed PFS site. In particular, Commander Hoog notes, "The mission of the 388 FW [Fighter Wing] is to fight and win. In order to do so, it is imperative we train the way we plan to fight, utilizing all of our assigned airspace, as required by changing tactics and weapon systems requirements." The PFS Crash Report relies on the previous 1,000 foot minimum altitude for military training. PFS Exh. N at 6.

ground." Id. ¶ 143. The emptiness of this assertion is revealed by PFS itself: ". . .many of the accident reports do not contain any discussion of pilot avoidance." Id. ¶ 144.

Lt. Col. Horstman reviewed each of the 58 accident reports which PFS claims support its opinion of a 95% success rate for pilot avoidance. The results of that review are shown in State Exh. 223. Without any speculation, the reports do present some inescapable facts:

1. The crash report of 11 July 1996 shows the pilot turned "towards what he perceived to be a less congested area," yet the impact destroyed two houses, killing a child and injuring her mother. Joint Exh. 10; State Exh. 223 no.14.

2. The crash report of 13 Jan 1992 shows the pilot "attempted to point the aircraft away from population centers," yet the aircraft hit and destroyed a house. PFS Exh. 134; State Exh. 223 no. 6.

3. In 5 of the 58 crashes, the pilot ejected during an uncontrolled spin or the aircraft was otherwise uncontrollable. PFS Exhs. 145, 118, 124, 113, 147; State Exh. 223 at entries 8, 19, 20, 46, 53.

4. In 11 of the 58 crashes, the F-16 was on fire when the pilot ejected. PFS Exhs.119, 145, 158, 110, 118, 127, 184, 113, 147, 180; Joint Exh. 4; State Exh. 223 at entries 3, 8, 10, 17, 19, 21, 24, 38, 46, 53, 59.

5. In 29 of the 58 crashes (50%), the pilot ejected below the published minimum altitude of 2,000 feet AGL, 8 of which were below 500 feet AGL, indicating that the pilot did not have time to complete emergency procedures including the contingent procedure, "*If time permits. . . direct the aircraft away from populated areas.*" State Exh. 223 (entries identified).

6. In at least 4 of the 58 accidents, the pilot could not see the ground due to clouds. State Exh. 223 entries 40, 41 53, 58.

PFS asserts that the "clearest example" of pilot avoidance is found in the 21 April 1993 accident of Colonel Cosby, who also testified via telephone. PFS Findings ¶ 147; PFS Exh. 79. In that accident, Colonel Cosby, who had admittedly spent too much time trying to restart a failed engine, was attempting to reach his base to land without power. Tr. (Cosby) 3980. At well below the minimum ejection altitude, he found himself about to hit an apartment complex (8 to12 three story buildings) directly in front him, requiring him to make a 180 degree turn to avoid it. PFS Findings ¶147; Tr. (Cosby) at 4012. Colonel Cosby continued to fly the F-16 in an effort to land, and when he was "about 300 feet" from the runway, another aircraft pulled onto the runway. Colonel Cosby turned his F-16 away from the runway and ejected at 38 feet AGL, breaking his back in two places. Tr. (Cosby) at 3980-82.

Colonel Cosby stayed in the aircraft, steering it while attempting to land, until it was 38 feet above ground, at which time he ejected. Colonel Cosby's accident shows that a pilot about to hit an object can turn away from it, a proposition neither surprising nor significant. This accident provides no basis to conclude a pilot could identify the PFS site as a populated area from 3 miles away, and successfully aim the aircraft at an alternate unpopulated area from that distance before ejecting. The Air Force board investigating Colonel Cosby's crash found that he would have been able to avoid the crash and land the F-16 if he had spent less time focused on restarting the engine. Tr. (Cosby) at 4008. As asserted by PFS, this accident is the "clearest example" of pilot avoidance ability from accident reports covering ten years. PFS ¶ 147.

As suggested by PFS, the remaining accidents do not provide clear examples of pilot avoidance and in fact "many . . . do not contain any discussion of pilot avoidance." PFS ¶ 144. In 28 reports where the pilot simply turned the aircraft in some direction, PFS proposes the Board find that "the pilot had situational awareness and knew where he needed to go." PFS Findings ¶¶ 144, 146. The implication that a pilot merely turning an aircraft somehow supports the claim that a pilot could see a specific site and aim an aircraft from a distance of 3 miles could not survive the slightest of scrutiny. More astonishing is the PFS assertion that 13 of the accident reports imply successful pilot avoidance solely on the basis that no damage was reported on the ground. PFS Findings ¶146. The nearly unlimited possible reasons for lack of reported ground damage, including the likelihood that the training flight was over a desert, underscore the total lack of scholarship in such a claim.

PSF devotes Proposed Findings ¶¶ 147 through 180 to the analysis of a phrase or sentence lifted from various accident reports, attempting to reason and speculate that the pilot would be able to accomplish the far different task of avoiding the PFS casks. PFS's Proposed Findings regarding these reports omit the altitude at which the pilot ejected, whether the aircraft was on fire, whether the aircraft was spinning out of control, whether the pilot could see the ground due to smoke in the cockpit or clouds, whether the aircraft flew straight after the pilot ejected, whether the crash was caused by pilot error, all of which were obtained from the accident reports and summarized on State Exh. 223. State Exh. 223 was prepared by F-16 instructor pilot Lt. Col. Horstman after a thorough review of all 58 accident reports,[41] with a full explanation of his review in the record. Tr. (Horstman) at 13363-411. The State will therefore not repeat here each PFS assertion regarding these reports, none of which demonstrates that a pilot would be able to avoid the PFS casks. Tr. (Horstman) at 13407-11.

## VIII. ASSERTIONS REGARDING CRASHES FROM AIRCRAFT TRAINING IN THE UTTR

PSF devotes Findings ¶¶ 185- 193 to generalities about training on the UTTR. PFS relies on the testimony of Colonel Fly who retired in 1998, to make the general assertion that aggressive training takes place "towards the center"of the UTTR. PFS Findings ¶ 186; Exh. N at 37-37a. PFS "assumes"a 3 mile buffer as a "practical limit" on the boundary of the UTTR where F-16 do not fly while conducting aggressive training. PFS Findings ¶ 186. Relying on this general information, PFS asserts that training on the UTTR poses a negligible hazard of less than 1 E-8. PFS Findings ¶186.

The State would note that the hazard from training as assessed by PFS supposes that the Air Force will not use the UTTR in a manner different from the PFS assumptions. In practical terms, PFS has asked the Board to ignore the fact that this huge nuclear fuel storage site would be located next to the nation's largest bombing and training range, and used by military agencies over which neither PFS nor the NRC has any control.

The PFS assertion that the hazard posed by UTTR training is less than 1 E-8 is based

[41] The actual accident reports in the order presented on State Exh. 223 are in evidence as Joint Exhs. 1, 7, 9,10, 4, 6, 11, 5; Applicant Exhs. 115, 119, 122, 128, 134, 140, 145, 79, 158, 182, 179, 205, 110, 111, 118, 124, 127, 130, 133, 137, 138, 141, 143, 157, 166, 164, 169, 173, 174, 177, 183, 184, 185, 188, 189, 191, 198, 203, 113, 116, 129, 181, 192, 194, 147, 148, 161, 162, 172, 175, 189.

on a calculation using the subjective *R* factor, which for reasons already given is unfounded.

## IX. ASSERTIONS REGARDING CRASHES FROM FLIGHTS ON THE MOSER RECOVERY ROUTE

The PFS Crash Report expressly states the Moser Recovery Route ("MRR") is used by F-16s returning to Hill AFB at night or during marginal weather conditions. PFS Exh. N at 48-48A. Subsequent to preparation of the PFS Crash Report, the U.S. Air Force announced on July 18, 2001 that night vision goggle training would increase and stated that of the total training flights in MOAs, "approximately one third will be night sorties." State Exh. 64 at 4; Horstman Tstmy, Post Tr.___ at 30. In an effort to avoid recognizing the increased use of the MRR, PFS asserts it is only used at "night under specific wind conditions." PFS Findings ¶ 191. However, the testimony of PFS witness Col. Fly cited for this proposition is vague at best, and in any event, no testimony suggests that wind conditions appropriate for the use of the MRR are not generally prevailing. Because the latter testimony of Colonel Fly is contrary to the express statements made in PFS's Crash Report (PFS Exh. N), which Colonel Fly also adopted as his sworn testimony, it should be disregarded.

PFS asserts that its own estimate that the MRR is used by 5% of flights returning to Hill AFB is supported by Hill AFB officers and an air traffic controller. PFS Findings ¶ 192. Typical of PFS assertions, the information portrayed as being official and authoritative is in fact only an offhand estimate made in a telephone conversation. For example, PFS's 5% estimate is based on a telephone call from PFS witness General Cole to Hill AFB vice commander Colonel Oholendt. Incredibly, the answer to the question was suggested by the higher ranking retired General Cole:

> I asked Colonel Oholundt [sic], "How often do you use the Moser Recovery?" . . . And he said, "Well, not very often." And I said, "Well, less than 15%?" And he said, "Sure. Less that 15 percent."

Tr. (Cole) at 3456-66.

General Cole also telephoned a member of the National Air Traffic Controllers ("NATC") association named Doug Scaddon. Id. at 3458-59. The NATC is the union for air traffic controllers. General Cole was also then employed by the NATC as the Executive Director. Cole/Jefferson/Fly Tstmy, Post Tr. ___, Cole Resume. Even though Mr. Scaddon did not control flights on the MRR, he reportedly gave General Cole an estimate of less than 5%. Id. at 3456-59. Mr. Scaddon gave no basis for his estimate. Id. The PFS 5% estimate plainly lacks any assurance of reliability, and should be given no weight contradicting the official statement that night sorties will increase to 33% of the sorties flown.

PFS also asserts that for the MRR probability calculations, it used the same basis to determine the F-16 crash rate, the *R* factor, and the number of flights as were used to calculate the hazard from F-16s transiting Skull Valley. For the reasons given earlier, those values are unsupportable by the evidence.

The State has calculated the hazard from flights on the MRR using documented data to be 1.64 E-6. State Findings ¶¶ 106-113. PFS's lower determination based on telephone conversations and speculation should be disregarded.

## X. ASSERTIONS REGARDING MILITARY ORDNANCE HAZARD

PFS asserts that approximately 2% of F-16s transiting Skull Valley carry ordnance based on FY99 and FY00 data. PFS Findings ¶ 196. However, PFS again omits the actual data. The actual information from PFS's Revised Addendum to its own Crash Report[42] shows:

Total Sorties Carrying Ordnance

FY98 678 x 1.278 = 866

FY99 151 x 1.278 = 193

FY00 128 x 1.278 = 164

The actual data shows that in FY98, 21.2% of flights carried ordnance (866/4,086 flights = 21.2%). State Findings ¶ 117. Only one question is presented for the Board: is it conservative to base the safety of 40,000 metric tons of spent fuel on a lower amount of ordnance than the Air Force has found necessary for training in the past? PFS asserts that "the Air Force Safety Agency has stated that ordnance expenditures are not expected to increase in the future." PFS Findings ¶ 199. This purportedly formal and authoritative

---

[42]In FY1998, the 388th Fighter Wing carried ordnance on 678 sorties. PFS Exh. O, Tab HH at 13. That number was reduced to 151 sorties with ordnance in FY1999 and 128 sorties with ordnance in FY 2000. Id. at 13-14. The 419th Fighter Wing at Hill AFB also carries ordnance but no records showing ordnance carried by the 419th are available. Id. at 12, n.27. According to the Vice Commander of the 388th Fighter Wing, it is reasonable to assume the 419th FW carries ordnance of the same type and at the same rate as the 388th FW. Id. PFS has used the ratio of aircraft assigned to the 388th and 419th Fighter Wings to determine that by multiplying the number of 388th sorties by 1.278, the total 388th and 419th Fighter Wing sorties is obtained. PSF did not account for 419th FW ordnance in its Crash Report shown in Applicant Exh. N, but based all calculations and discussion on 388th FW data only.

information was in reality based only on an informal conversation between General Cole and one "Colonel Fred Clark" who "monitors the expenditures" at the Air Force Safety Agency. Tr. (Cole) at 13087-88. The notion that PFS would have the Board find that "the Air Force Safety Agency has stated" this information, expecting the Board to make critical decisions in reliance on this information's purported "official" status, makes a mockery of the NRC's duty to ensure the safety of the public.

PFS asserts it has used the same values for the number of flights, crash rate, width of airway and the *R* factor that it used to determine the hazard from F-16 flights through Skull Valley. PFS Findings ¶ 197. For the reasons previously set forth, those values are unsupportable.

The State has calculated the hazard from military ordnance to be 1.53 E-6. State Findings ¶¶ 114 -122. The Board should not find a lower risk based on speculation of future training that is beyond the control of PFS and the NRC.

XI. CONCLUSION

The Findings proposed by PFS have the common theme of polishing subjective opinions and private telephone conversations in hopes that they will pass as scientific fact and official statements from government agencies. The single purpose of such exaggeration is to conceal and diminish the documented crash hazards that are inherent at a location two miles from the UTTR and beneath two military operating areas. So transparent is this endeavor, that PFS proposes that the Board make no finding which would even disclose the fact that the UTTR is the largest bombing range operated by the Department of Defense. Because neither PFS nor the NRC has any control over the military's future use of this unique space in preparing for war, close scrutiny and clear facts will be demanded for the proposal of locating 40,000 metric tons of spent nuclear fuel at such a location.

The State has proposed probability calculation findings based on the full data available. In contrast, PFS asks the Board to understate the F-16 crash rate by blatantly selecting from 27 years of data the ten year period that yields the lowest crash rate in F-16 history. Similarly, PFS proposes that the Board base the number of Skull Valley flights on a totally arbitrary number which is lower than the actual data for FY00. PSF would have the Board justify its prediction of fewer future flights by finding as a fact, the vague and unverifiable assertion "that past history and the war on terrorism" will result in fewer flights from Hill AFB.

Even using these artificially reduced values, the calculated probability of crashes exceeds the allowable threshold of 1 E-6. In an effort to nevertheless claim the storage facility is safe, witnesses hired by PFS opine that before the pilot of a crashing F-16 ejects, he will aim the aircraft away from populated areas that may be visible from 3 miles away, and in doing so the aircraft will avoid the PFS site. Without reliance on data or calculations of any kind, the three PFS witnesses, all hired from the same agency to give testimony for PFS, opine that a pilot of a controllable F-16 can perform this task with 95% success. This opinion is made by three retired officers who have never attempted the task, have never ejected from an aircraft, and two of the officers have never piloted an F-16. There are no authorities, studies, or NRC guidance documents that support such a finding. Never in the history of NRC licensing has the probability of a crashing aircraft been reduced on the theory a pilot in an emergency could assure that the crashing aircraft would not impact the nuclear facility. There is no evidence that such a task has ever been performed. PFS would have the Board find that because a pilot can turn an F-16 after the engine fails, it is evidence the pilot could and would be able to aim the aircraft away from specific ground sites over three miles away.

In stark contrast, the record is replete with U.S. Air Force publications and other evidence which show pilot error during emergency ejection situations. PFS asks the Board to find that the task of avoiding the PFS casks during an emergency is a routine matter that can be accomplished even when weather obstructs visibility, and with ample time for the pilot to eject. There is one piece of evidence that unquestionably reveals such a finding as a farce. It is an actual video recording of an engine failure and subsequent crash, taken from inside the cockpit as seen by the pilot, including the impact with the ground after the pilot ejects. Video cameras routinely record F-16 training missions and the tape was recovered from the wreckage. The video recording shows the flight of Colonel Frank Bernard, a highly experienced pilot who had previously ejected. Colonel Bernard became so focused on restarting his failed engine that he delayed his ejection until 4 seconds prior to the crash. PFS objected to the introduction of this video, the only evidence before the Board that shows the emergency situation that PFS claims is routine. State Exh. 220.

The subjective and exaggerated claims of PFS are not hard facts and conservative analysis required for factual findings by the Board. The obligation to protect public health and safety cannot be based on the guesswork and supposition of the proposed PFS findings.

DATED this 7th day of October, 2002.

Respectfully submitted,

Denise Chancellor, Assistant Attorney General
James R. Soper, Assistant Attorney General
Fred G Nelson, Assistant Attorney General
Connie Nakahara, Special Assistant Attorney General
Diane Curran, Special Assistant Attorney General
Laura Lockhart, Assistant Attorney General
Attorneys for State of Utah
Utah Attorney General's Office
160 East 300 South, 5th Floor, P.O. Box 140873
Salt Lake City, Utah 84114-0873
Telephone: (801) 366-0286, Fax: (801) 366-0292

CERTIFICATE OF SERVICE

I hereby certify that a copy of STATE OF UTAH'S REPLY TO THE PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW OF THE APPLICANT AND THE NRC STAFF ON CONTENTION UTAH K/CONFEDERATED TRIBES B was served on the persons listed below by electronic mail (unless otherwise noted) with conforming copies by United States mail first class, this 7th day of October, 2002:

Rulemaking & Adjudication Staff
Secretary of the Commission
U. S. Nuclear Regulatory Commission
Washington D.C. 20555
E-mail: hearingdocket@nrc.gov
(*original and two copies*)

Michael C. Farrar, Chairman
Administrative Judge
Atomic Safety and Licensing Board
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-Mail: mcf@nrc.gov

Dr. Jerry R. Kline
Administrative Judge
Atomic Safety and Licensing Board
U. S. Nuclear Regulatory Commission
Washington, DC 20555
E-Mail: jrk2@nrc.gov
E-Mail: kjerry@erols.com

Dr. Peter S. Lam
Administrative Judge
Atomic Safety and Licensing Board
U. S. Nuclear Regulatory Commission
Washington, DC 20555
E-Mail: psl@nrc.gov

Sherwin E. Turk, Esq.
Catherine L. Marco, Esq.
Office of the General Counsel
Mail Stop - 0-15 B18
U.S. Nuclear Regulatory Commission
Washington, DC 20555
E-Mail: set@nrc.gov
E-Mail: clm@nrc.gov
E-Mail: pfscase@nrc.gov

Jay E. Silberg, Esq.
Ernest L. Blake, Jr., Esq.
Paul A. Gaukler, Esq.
Shaw Pittman, LLP
2300 N Street, N. W.
Washington, DC 20037-8007
E-Mail: Jay_Silberg@shawpittman.com
E-Mail: ernest_blake@shawpittman.com
E-Mail: paul_gaukler@shawpittman.com

John Paul Kennedy, Sr., Esq.
David W. Tufts
Durham Jones & Pinegar
111 East Broadway, Suite 900
Salt Lake City, Utah 84111
E-Mail: dtufts@djplaw.com

Joro Walker, Esq.
Land and Water Fund of the Rockies
1473 South 1100 East, Suite F
Salt Lake City, Utah 84105
E-Mail: utah@lawfund.org
(*electronic copy only*)

Larry EchoHawk
Paul C. EchoHawk
Mark A. EchoHawk
EchoHawk Law Offices
151 North 4th Street, Suite A
P.O. Box 6119
Pocatello, Idaho 83205-6119
E-mail: paul@echohawk.com

Tim Vollmann
3301-R Coors Road N.W. # 302
Albuquerque, NM 87120
E-mail: tvollmann@hotmail.com

James M. Cutchin
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
E-Mail: jmc3@nrc.gov
(*electronic copy only*)

Office of the Commission Appellate
Adjudication
Mail Stop: O14-G-15
U. S. Nuclear Regulatory Commission
Washington, DC 20555

James R. Soper
Assistant Attorney General
State of Utah