UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

**RAS 3563**

**DOCKETED 11/14/01**
**SERVED 11/14/01**

COMMISSIONERS

Richard A. Meserve, Chairman
Greta Joy Dicus
Nils J. Diaz
Edward McGaffigan, Jr.
Jeffrey S. Merrifield

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| In the Matter of | ) | |
| PRIVATE FUEL STORAGE L.L.C. | ) | Docket No. 72-22-ISFSI |
| (Independent Spent Fuel Storage Installation) | ) | |

**CLI-01-22**

**MEMORANDUM AND ORDER**

In a May 31, 2001 order, the Atomic Safety and Licensing Board referred to the Commission its ruling on the design standard for accidental aircraft crash hazards at the proposed independent spent fuel storage installation (ISFSI) site at issue in this proceeding.[1] In that ruling, the Board found that the facility need not be designed to withstand aircraft crashes having less than one-in-one-million ($1 \times 10^{-6}$) annual probability of occurring. The Commission must determine, as a matter of law and policy, how probable an accidental aircraft crash would have to be to qualify as a "credible event" which the ISFSI must be designed to withstand without releasing dangerous levels of radiation.[2]

[1] *See* LBP-01-19, 53 NRC 416 (2001).

[2] As this question has a potential impact on all Part 72 facilities, the Nuclear Energy Institute, a trade group representing the nuclear energy industry, has filed a motion for permission to file an amicus brief. The Commission by this order grants the motion and has considered NEI's brief in reaching its decision.

We note that the issue we consider today is only the threshold probability for accidental events and has no bearing on the issue of whether or to what extent intentional acts must be considered in designing the facility.[3]

We find the Board's $10^{-6}$ standard consistent with our own view, hence affirm the Board's decision.

## I. BACKGROUND

The applicant, Private Fuel Storage, L.L.C., seeks a license to operate an ISFSI on the Skull Valley Goshute Indian Reservation in Utah. Contention Utah K/Confederated Tribes B claims the applicant has not adequately considered credible external accidents that could affect the proposed facility. As admitted, the contention's principal concern was that aircraft, jettisoned ordnance from military aircraft, or land-launched missiles could crash into the proposed spent fuel storage facility. Through earlier summary disposition, the issues were narrowed to only hazards associated with the Salt Lake City International Airport; hazards from conventional ground weapons fired from Dugway Proving Ground; military aircraft crash hazards from Dugway Proving Ground, Hill Air Force Base, and the Utah Test and Training Range (UTTR); and hazards from cruise missiles testing.[4]

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[3] In light of the September 11, 2001 terrorist attacks on the Pentagon and World Trade Center, the staff has been directed to review its regulations to determine whether additional steps should be taken to design and defend regulated facilities against potential terrorism. The State of Utah has also filed a late-filed contention concerning the threat of terrorist acts, such as the intentional crash of a large plane into the facility. *See* State of Utah's Request for Admission of Late-Filed Contention Utah RR (Suicide Mission Terrorism and Sabotage), Oct. 10, 2001. In addition, Utah has asked the Commission to halt the proceedings until it has determined whether the regulations concerning ISFSIs should be revised. *See* State of Utah's Petition for Immediate Relief Suspending Licensing Proceedings, Oct. 10, 2001. Today's decision has no effect on the staff's review of the regulations or the terrorist-threat related petitions pending before the Board and Commission.

[4] LBP-99-35, 50 NRC 180, 200-01 (1999).

In December, 2000, PFS filed a Motion for Summary Disposition of these remaining portions of this contention, claiming that there was no longer any issue of material fact as to whether any of these hazards could credibly threaten to cause a release of radioactive material from the proposed ISFSI. In order to show no credible threat, PFS presented evidence that safety controls made various accident scenarios extremely unlikely, and in some cases that even if the posited accident did occur, no radioactive materials would be released.[5] As part of its claim that aircraft pose no credible threat, PFS argued that any event having a less than one chance in a million of occurring should be deemed not credible.

The Board agreed that one in a million is the appropriate "threshold probability," beneath which a posited accident can be ignored in the facility's design. The Board certified that portion of its ruling to the Commission. The Board also found that there remained issues of fact with respect to the likelihood of either an F-16 or jettisoned ordnance from an F-16 crashing into the facility; similar crashes resulting from air-to-air combat training activities conducted on the Utah Test and Training Range; the probability of an aircraft using the Moser Recovery Route crashing; the crash impact hazard from flights out of Michael Army Airfield; and the cumulative air crash hazard. Last, the Board granted summary disposition in PFS's favor with respect to various other issues, including the threat posed by cruise missiles, and air-to-ground and air refueling activities at the UTTR. Only the question of the proper threshold probability is under review here.

## II. DISCUSSION

### A. Design Basis

[5] *See* Applicant's Motion for Summary Disposition of Utah Contention K and Confederated Tribes Contention B, dated Dec. 30, 2000, Attachment D, Declaration of Jeffrey R. Johns, dated Dec. 27, 2000.

As is the case for other NRC-regulated facilities, the site of a proposed ISFSI must be evaluated to identify and assess the likelihood of possible accidents, both natural and man-made, that could affect the facility.[6] These natural and man-induced events are made part of the ISFSI's design basis, ensuring that each component will continue to perform its designated functions under normal and extreme conditions.[7] General design criteria require an ISFSI to be designed to "accommodate the effects of and to be compatible with, site characteristics and environmental conditions ... and to withstand postulated accidents."[8] Applicable NRC regulations do not expressly address aircraft impact hazards, but related hazards such as fires and explosions are specifically addressed as hazards that the facility must weather without jeopardizing public safety.[9]

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[6] *See* 10 C.F.R. Part 72, Subpart E; § 72.90(c) ("Design basis external events must be determined for each combination of proposed site and proposed ISFSI or MRS design"); § 72.92, Design basis external natural events; § 72.94, Design basis external man-induced events.

[7] "Design bases" is defined in 10 C.F.R. Part 72 as:

> ... that information that identifies the specific functions to be performed by a structure, system, or component of a facility or of a spent fuel storage cask and the specific values or ranges of values chosen for controlling parameters as reference bounds for design. These values may be restraints derived from generally accepted state-of-the-art practices for achieving functional goals or requirements derived from analysis (based on calculation or experiments) of the effects of a postulated event under which a structure, system, or component must meet its functional goals. The values for controlling parameters for external events include--
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> ...
>
> (2) Estimates of severe external man-induced events to be used for deriving design bases that will be based on analysis of human activity in the region, taking into account the site characteristics and the risks associated with the event.

10 C.F.R. § 72.3.

[8] 10 C.F.R. § 72.122(b)(1).

[9] 10 C.F.R. § 72.122(c).

A facility need not be designed to withstand every conceivable accident, but only those found to be "credible."[10] Credible accidents are therefore generally called "design basis events" or "design basis accidents," and events too improbable to be considered credible are called "beyond design basis" events. If an event does not exceed the design basis, engineered controls will keep any radiation exposure to the public within prescribed limits.[11] If the proposed facility cannot be designed to withstand credible accidents without releasing excessive radiation, the site is unsuitable and NRC will deny the application.[12]

**B. Threshold Probabilities for Design Basis**

The Commission must decide the threshold probability for a design basis event at an ISFSI. Part 72 does not address this question directly, and no agency guidance explicitly applicable to Part 72 facilities answers this question. At other NRC-regulated facilities, the agency uses different threshold probabilities: one in ten million for nuclear power plants and one in a million for geologic repository operations areas (GROA).[13] Because no agency guidance or regulation applies, the most reasonable basis for the Commission to reach a decision here would be to examine the risks associated with these two kinds of facilities to determine which is most comparable to the proposed ISFSI.

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[10] *See*, for example, *Metropolitan Edison Co.* (Three Mile Island Nuclear Station, Unit No. 2), ALAB-692, 16 NRC 921 (1982). There, calculations showed a greater than one-in-ten-million chance that Three Mile Island, Unit 2 (located 2.7 miles from Harrisburg International Airport) could be hit by a 200,000-pound aircraft traveling at 200 knots. Therefore, the impact from an aircraft of that size and speed was determined to be a design basis accident and the reactor was designed to withstand it. Although heavier aircraft sometimes used the airport, the probability of one of them hitting TMI2 was determined to be so low that such a crash was not considered a design basis event.

[11] *See* 10 C.F.R. §72.106(b).

[12] 10 C.F.R. §72.90(d).

[13] This one-in-a-million threshold probability for design basis events at a GROA also includes consideration of the probabilities and component failures. *See* discussion *infra*.

**1. Standard Review Plan for Nuclear Power Reactors**

With respect to power reactors, the NRC long ago determined that events having at least a one-in-ten-million ($1 \times 10^{-7}$) probability generally should be taken into consideration in facility design, an approach reflected in the Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants.[14] The Standard Review Plan also provides formulas for calculating, with a conservative margin, the probability of various hazards. The subchapter dealing specifically with aircraft hazards provides a formula that takes into consideration factors like the distance from the proposed facility to the airfield and the number of flights into and out of the airfield.[15]

Estimating the probability of extremely unlikely events involves considerable uncertainty when sufficient data are not available to plug into the formula. Therefore, the Standard Review Plan for reactors deems a threshold probability of one in a million ($1 \times 10^{-6}$) to be acceptable where, "when combined with reasonable qualitative arguments, the realistic probability can be shown to be lower."[16] That is, where a conservative estimate shows an event has no greater than a one-in-a-million probability, that event may be ignored in facility design if reasonable estimates result in a lower probability when conservative margins are not factored in. To illustrate, in *Consumers Power Co.* (Big Rock Point Plant),[17] a conservative estimate assumed that any navigational errors made by B-52s training near the Big Rock site would send the aircraft over the plant. The Board noted that a navigational error would in fact be just as likely

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[14] Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, NUREG 0800 (Rev. 2--July 1981), §§ 2.2.1 - 2.2.2, "Identification of Potential Hazards in Site Vicinity;" and § 3.5.1.6, "Aircraft Hazards."

[15] *Id.*, § 3.5.1.6.

[16] *Id.*, § 2.2.3(II), "Evaluation of Potential Accidents."

[17] LBP-84-32, 20 NRC 601, 639-52 (1984).

to send an aircraft away from Big Rock as toward it, so the "realistic" probability of a B-52 overflight was lower than the conservative estimate showed.[18] Similarly, a conservative estimate assumed that 1500 aircraft would fly in and out of a nearby military base, whereas the realistic estimate, based on actual data from a recent year, showed only 99 flights.[19] Because the conservative estimate of the cumulative aircraft hazards was approximately one-in-a-million, and there were reasonable arguments that the realistic probability of a crash was lower, the Board in *Big Rock* found no need to redesign the plant to withstand an airplane crash.[20]

**2. Geologic Repository Operations Area**

In 1996, the NRC published revised regulations concerning design basis events at a GROA -- the surface operations of a geologic repository -- before permanent closure.[21] The statement of considerations published along with the revised regulations noted that:

> Assuming bounding repository event consequences of roughly 0.2 Sv (20 rem), a lifetime risk to individuals in the general population of 0.05 fatal cancers per Sv of exposure, and a lower bound of $1 \times 10^{-6}$ per year for the probability of occurrence of Category 2 design basis events, the estimated risk of cancer fatality from these low probability events would be $1 \times 10^{-8}$ per year. Events which result in risks at or below this level do not contribute significantly to repository risk to an individual and, as such, can be neglected in the overall risk assessment.[22]

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[18] *Id.* at 642.

[19] *Id.* at 648.

[20] *Id.* at 651.

[21] *See*, Final Rule, "Disposal of High-Level Radioactive Wastes in Geologic Repositories; Design Basis Events," 61 Fed. Reg. 64,257 (Dec. 4, 1996). For the GROA, "design basis events" refers to the probability of the "event sequence" which includes an initiating event (*e.g.*, an earthquake) and the associated combinations of repository system or compoent failures that can potentially lead to exposure of the public to radiation. *Id.* at 64,263. Here, however, we are only considering the appropriate threshold probability of the initiating event without consideration of the probability of system or component failures.

[22] *Id.* at 64,265.

Thus, in considering bounding event consequences in which the initiating event probability is considered rather than the event sequence probability, the Commission determined that event probabilities of less than 1 x $10^{-6}$ would not significantly contribute to risk and could be screened from further consideration.

## C. Parties' Positions

### 1. Staff's Safety Evaluation Report

The NRC staff agreed with PFS and the Board that one in a million is the proper threshold probability for air crash hazards at an ISFSI. In its Safety Evaluation Report for the PFS facility, the NRC staff used the formula found in the Standard Review Plan for reactors to assess the probability of an aircraft crash.[23] These calculations resulted in a cumulative hazard from various civilian and military aircraft accident scenarios of approximately 7.4 x $10^{-7}$.[24]

Rather than use the one-in-ten-million threshold probability that the Standard Review Plan prescribes for power reactors, the NRC staff determined that the appropriate threshold probability for a design basis accident at the PFS ISFSI was one in a million. The staff reasoned that a potential crash into the ISFSI would not have as dire consequences as a possible crash into a power reactor:

> Compared to a nuclear reactor facility, an ISFSI is a relatively passive system that does not have complex control requirements and that has contents with relatively low thermal energy. Therefore, potential fuel damage and the associated radioactive source terms from a potential accident are significantly less than that expected from a potential accident at a nuclear reactor facility. As a result, the estimated consequences from a potential accident at an ISFSI are less severe than from a potential accident at an nuclear reactor facility. Therefore, the staff concludes that a threshold probability of 1 x $10^{-6}$ crashes per year is an acceptable value for evaluating aircraft crash hazards at the PFS facility.[25]

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[23] *See* Safety Evaluation Report (SER), Ch. 15, §15.1.2.11, pp. 15-41 -81.

[24] *Id.* at p. 15-79.

[25] *Id.* at p. 17-77.

In short, the staff found that the less severe consequences of a crash at the ISFSI reduced the overall risk and justified using a one-in-a-million rather than one-in-ten-million threshold probability. As it was not using the Standard Review Plan's reasoning for determining the threshold probability, the staff did not use "qualitative arguments" to show that the "realistic probability" of a crash was actually lower than the probability formula would indicate.

**2. Applicant's Argument**

In its Motion for Summary Disposition, PFS argued that the Board should choose a threshold probability of one in a million because this is the standard used for the surface operations and storage area at a geologic repository. PFS contended that an ISFSI is more similar, in design and function, to the surface operations at the GROA than to a nuclear power plant. It pointed to the Commission's statement of considerations for the GROA design basis rule which showed that the Commission intended that the design standards for a GROA and Part 72 facilities be comparable: "Because operations at the repository are expected to be similar to operations at other facilities licensed by the Commission (e.g., 10 C.F.R. part 72 facilities), the Commission believes that it is appropriate that their design bases be comparable."[26]

PFS also argued that the one-in-a-million standard is appropriate because the consequences of a potential accident at an ISFSI, in terms of how much radiation could be released, would be much less severe than at a nuclear power plant. Because risk is the product of the probability of occurrence multiplied by the consequences, PFS contended that the overall risk associated with a potential crash at an ISFSI is lower than at a nuclear power plant.[27] This reasoning is similar to that which the Commission used in its statement of

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[26] 61 Fed. Reg. 64,262.

[27] *See* PFS Motion for Summary Disposition, at 10.

considerations for the 1996 amendments to 10 C.F.R. Part 60 setting the one-in-a-million lower bound for a design basis event at the surface areas of a geologic repository.[28]

In addition , PFS's motion for summary disposition provided arguments that the realistic probability is actually less than the conservative estimates resulting from the formulas found in the Standard Review Plan.[29]

**3. Utah's Argument**

Utah now argues that summary disposition was premature. First, Utah claims that NRC should apply § 3.5.1.6 of the Standard Review Plan -- that is, the reactor standard -- because that section deals specifically with aircraft crash hazards.[30] Utah points out that Standard Review Plan §3.5.1.6 provides for a threshold probability of $1x10^{-7}$, and does not speak of using a higher probability where the "realistic" probability is lower. The section of the Standard Review Plan that deems a higher probability to be acceptable, where "realistic" probabilities are lower, is the general accident analysis section, § 2.2.3.

This approach, however, would have the Commission apply one portion of NUREG 0800 that speaks specifically to airplane crash hazards, while ignoring another section that deals specifically with evaluation of hazards and with risk tolerance.[31]

Utah further claims that even if the "realistic probability" approach set out in Standard Review Plan § 2.2.3 were applicable, PFS has not provided reasonable qualitative arguments to show that its estimate is conservative and that an airplane crash's realistic probability is closer

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[28] *See* 61 Fed. Reg. at 64,259.

[29] PFS Motion for Summary Disposition, at 28-29.

[30] State of Utah's Brief on the Question Certified in LBP-01-19, July 13, 2001, at 13.

[31] NUREG 0800, §2.2.3, "Evaluation of Potential Accidents."

to one in ten million. Utah maintains that whether the calculations are conservative, and what the "realistic" figure is, are material fact issues that preclude summary disposition.[32]

**D. Commission Analysis**

As no law or regulation establishes the threshold probability for design basis accidents at an ISFSI, the Commission must select a standard it finds sufficiently protective. For the reasons set forth below and in LBP-01-19, we conclude that the $10^{-6}$ standard is workable and appropriate for the PFS facility.

Before reaching the substance of this policy question, we first turn to Utah's procedural argument that summary disposition was premature. We disagree. The applicable probability is not a question of fact, but a question of law and policy. Factual issues concerning conservativeness and realistic probabilities would only be material if the hazard analysis acceptance criteria found in Standard Review Plan § 2.2.3 were applicable. That is, if Utah were correct that NUREG 0800 is directly applicable to evaluating an ISFSI, then questions would remain concerning the estimate's conservativeness that would preclude the Board from finding that the threshold probability is one-in-a-million. Therefore, if the Board had based its conclusion about the threshold probability on the Standard Review Plan, then the conclusion itself would be premature. But it did not.

Rather, the Board agreed with PFS's argument that the Commission had already indicated its intention that the design bases for Part 72 facilities and the surface operations of a geologic repository be "comparable."[33] The Commission's statement of considerations in the design basis amendments to Part 60 suggested that the design bases for Part 72 facilities and

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[32] State of Utah's Brief, at 13-14.

[33] LBP-01-19, 53 NRC at 430-431, *citing* 61 Fed. Reg. at 64,262.

the surface operations at the GROA should be the same.[34] In that statement, the Commission also articulated more generally its intention to "harmonize" Part 60 with Part 72.[35] Furthermore, throughout the statement of considerations in amending Part 60, the Commission referred to conforming various sections of Part 60 to their counterpart sections of Part 72.[36] Therefore, affirming the Board's decision is consistent with our past views on this subject.

Moreover, we find little basis to choose the threshold probability used in the Standard Review Plan for reactors. The proposed facility is not, of course, a reactor. Furthermore, NUREGs, such as the Standard Review Plan, like all guidance documents, are not legally binding regulations.[37] Where the NRC develops a guidance document to assist in compliance with applicable regulations, it is entitled to special weight.[38] But where a staff guidance document was not even drafted for use in evaluating applications of the type under consideration, then the guidance is persuasive only insofar as it may bear on distinct questions. Here, for example, the NRC staff has appropriately considered the formulas in the Standard Review Plan for calculating air crash probability, for that methodology pertains regardless of the type of facility at issue. But the staff rightly refused to use the Standard Review Plan's overall

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[34] 61 Fed. Reg. at 64,262.

[35] *Id.* at 64,265.

[36] *See, e.g.*, *id.* at 64,264, considering section 60.130: "changes also provide consistency with the corresponding "minimum" design criteria for an MRS, in part 72"; *id*., (regarding section 60.136: "The Commission adopts the basic [dose] provision of part 72 – namely a 0.05 Sv (5 rem) dose limit on or beyond the preclosure controlled area boundary"); *id.* at 64,265 ("The only other noteworthy deviation from Part 72" is that Part 60 refers to "Category 2 design basis events" while the corresponding section in Part 72 refers to "design basis accidents").

[37] *See, e.g.*, *International Uranium (USA) Corporation*, CLI-00-01, 51 NRC 9, 19 (2000); *Curators of the University of Missouri*, CLI-95-1, 41 NRC 71, 149 (1995).

[38] *See, e.g.*, *Long Island Lighting Company* (Shoreham Nuclear Power Station, Unit 1) ALAB-900, 28 NRC 275, 290 (1988); *Consumers Power Co.* (Big Rock Point Nuclear Plant), ALAB-725, 17 NRC 562, 568 (1983).

$10^{-7}$ design basis standard -- which the NRC developed for reactors, not for facilities like ISFSIs whose failure would not pose nearly the same radioactive consequences as a reactor failure.

Because the hazards associated with temporary storage of spent fuel differs significantly from the hazards associated with operating nuclear power plants and permanent geologic storage, the Commission has said that it will "not automatically apply all regulatory requirements to ISFSIs that it applies to other regulated activities."[39] The Commission has previously recognized that the "public health and safety risks posed by ISFSI storage ... are very different from the risks posed by the safe irradiation of the fuel assemblies in a commercial nuclear reactor, which requires the adequate protection of the public ... in the conditions of high temperatures and pressures under which the reactor operates."[40] This is because the danger presented by irradiated fuel "is largely determined by the presence of a driving force behind dispersion," such as heat and pressure, neither of which is present in an ISFSI.[41] Moreover, the radiological source term is lower at an ISFSI than at a reactor both because the spent fuel has decayed over time prior to placement in an ISFSI and because there are fewer fuel assemblies

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[39] *See* Final Rule, Interim Storage of Spent Fuel in an Independent Spent Fuel Storage Installation at a Reactor Site; Site-Specific License to a Qualified Applicant, 60 Fed. Reg. 20,879, 20,883 (April 28, 1995) (response to public comments).

[40] *Id.*

[41] *Id.*

in an individual cask than in a reactor.[42] Thus, the Board reasonably refused to employ the $10^{-7}$ reactor design standard, and instead set the standard at $10^{-6}$.

**III. Conclusion**

On the basis of the foregoing, we conclude that the threshold probability for design basis events should be set at one in a million ($1 \times 10^{-6}$). The Board's ruling in LBP-01-19 is, therefore, affirmed. The hearing should proceed on the remaining fact issues the Board found in that order.

Commissioner Dicus did not join in this opinion. She would have sent the matter back to the Board for a factual determination whether the consequences of a potential accident at an ISFSI are more similar to those of an accident at a GROA or those of an accident at a nuclear power reactor as a basis for setting the threshold probability.

[42]We recognize that Utah has submitted a declaration in which it is claimed that a worst case scenario resulting from an aircraft crash could result in doses that are significantly larger than those estimated in the bounding consequences analysis for Category 2 design basis events at a GROA. *Compare* 61 Fed. Reg. at 64,265 with Declaration of Dr. Marvin Resnikoff Regarding Material Facts in Dispute with Respect to Contention K, dated January 31, 2001, ¶ 16. However, the affidavit does not explain the input assumptions used to determine the dose, nor does it discuss the physical differences between a reactor and the GROA. Because any dose analysis is highly dependent on input assumptions and because the physical nature of the facilities suggests that the consequences of an accident at an ISFSI are far more similar to those that might result from an accident at a GROA than one at a reactor, the affidavit is not sufficiently probative. Therefore, utah's conclusions, without more, fail to raise a genuine issue of material fact. *See Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 249 (1986)(summary judgment is appropriate when evidence is "merely colorable" or is "not sufficiently probative"); *Advanced Medical Systems, Inc.*, CLI-93-22, 38 NRC 98, 102 n.13 and text (1993).

IT IS SO ORDERED.

For the Commission

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ANNETTE L. VIETTI-COOK
Secretary of the Commission

Dated at Rockville, MD
this 14th day of November, 2001

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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| In the Matter of | ) | |
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| PRIVATE FUEL STORAGE L.L.C. | ) | Docket No. 72-22-ISFSI |
| | ) | |
| (Independent Spent Fuel Storage Installation) | ) | |

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing COMMISSION MEMORANDUM AND ORDER (CLI-01-22) have been served upon the following persons by deposit in the U.S. mail, first class, as indicated by an asterisk (*) or through the Nuclear Regulatory Commission's internal distribution as indicated by double asterisks (**), with copies by electronic mail or facsimile.

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[Original signed by Evangeline S. Ngbea]

Office of the Secretary of the Commission

Dated at Rockville, Maryland,
this 14th day of November 2001