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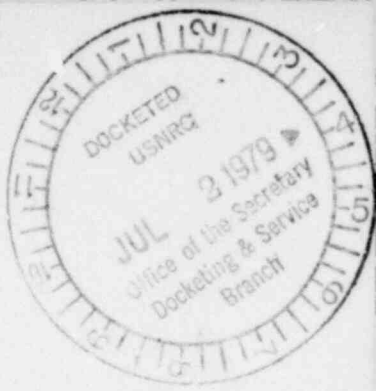

6/29/79

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket Nos. 50-338 SP
VIRGINIA ELECTRIC AND POWER COMPANY	)	50-339 SP
	)	(Proposed Amendment to Facility
(North Anna Nuclear Power Station, Units 1 and 2)	)	Operating License NPF-4 to Permit Storage Pool Modification)

NRC STAFF RESPONSE TO INTERROGATORIES FROM
CITIZENS' ENERGY FORUM AND POTOMAC ALLIANCE

On May 31 and June 1, 1979, respectively, Intervenors Citizens' Energy Forum (CEF) and Potomac Alliance (Alliance) served written interrogatories upon the NRC Staff in the above-captioned proceeding. The NRC Staff hereby waives the provisions of 10 CFR §2.720(b)(2)(ii) governing interrogatories to the NRC Staff and will respond without Licensing Board interdiction.

In its "Order Partially Granting VEPCO's Motion for Summary Disposition," dated June 28, 1979, the Board dismissed a number of contentions. Accordingly, this response only addresses interrogatories related to contentions that remain in issue, specifically, Contention 2 (accidents portion), 3, and the newly admitted contention on the service water cooling system.

Each interrogatory from the Alliance contains five subparts, A through E. Subpart (B) to each interrogatory seeks, in part, the location "other than the offices of the NRC" where referenced documents are available for inspection. The Staff objects to this request on the grounds that provision of the requested information is unduly burdensome. The referenced documents

are available for inspection through NRC Staff Counsel or the NRC Public Document Room. The Alliance is as capable as the NRC Staff of ascertaining where else the referenced documents might be located. Supart (C) to each interrogatory requests the identification of "all documents and studies, and the particular parts thereof, which pertain to the subject matter of the question." The Staff objects to this request on the grounds that it is overly broad and would place an undue burden upon the Staff. Subpart (D) to each interrogatory requests, in part, an explanation whether the Virginia Electric and Power Company (VEPCO) "is engaged in or intends to engage in further research which may affect the answer to the interrogatory." The Staff objects to this request on the grounds that the request is more properly directed to VEPCO as indeed the Alliance has done in its June 1 interrogatories to VEPCO.

A response to the interrogatories follows.

I. CEF Interrogatories

Interrogatory 2-1:

The Safety Evaluation by the Office of Nuclear Reactor Regulation Relating to Modification of the Spent Fuel Storage Racks (hereinafter referred to as SER), dated January 29, 1979, states that "The fuel racks could slide under seismic conditions . . ." What would the effect be on the pool and racks, and on the keff in the pool, if these seismic conditions were to cause 2 or more racks to slide closer together than the planned 14" center -to-center spacing? How far, and in what directions, are the racks designed to slide under seismic conditions?

Answer:

The spent fuel storage racks are designed and built such that the center-to-center spacing of two storage cells in adjacent racks could not be closer than 14". The racks are free-standing but restrained from lateral motion under seismic excitation. The staff therefore has not analyzed the effect of the keff in the pool in a seismic event.

This interrogatory was answered by Sai P. Chan. He will testify on aspects of Contention 2 at the upcoming hearing. His testimony is provided in the "Affidavit of Sai P. Chan on Contention 2(a): Radioactive Emission (Accidents)" which accompanied the "NRC Staff Supplemental Response to VEPCO Summary Disposition Motion," dated June 25, 1979. A copy of his professional qualifications was attached thereto.

Interrogatory 2-2:

The SER states that "we conclude that the likelihood of a heavy load handling accident is sufficiently small so that the acceptability of the proposed modification is not affected . . ." On what basis is this conclusion reached? In what specific way was such a likelihood calculated?

Answer:

The Staff did not calculate the probability of a heavy load drop on the spent fuel assemblies. Our evaluation is based on the Applicant's technical specifications ("3/4 9.7 crane travel - spent fuel pit") which limit the maximum weight which can be carried over the fuel storage racks to 2500 lbs. which is the approximate weight of a fuel assembly, control rod assembly and handling tool.

This limitation prohibits the transfer of heavy objects such as the spent fuel shipping casks over that portion of the pool used to store the irradiated fuel assemblies.

This interrogatory was answered by Charles M. Ferrell. He will testify on aspects of Contention 2 at the upcoming hearing. His testimony and supporting documentary references are provided in the "Affidavit of Charles M. Ferrell on Contention 2(a): Radioactive Emission (Accidents)" which accompanied the "NRC Staff Supplemental Response to VEPCO Summary Disposition Motion"(Supplemental Response), dated June 25, 1979. A copy of his professional qualifications was attached thereto.

II. Potomac Alliance Interrogatories

Interrogatory 6:

In § 2.4 of the Safety Evaluation Report (SER) prepared in connection with the proposed modification it is stated that the original design of the SFP and fuel building was accepted on the basis that there was a "low probability" that a tornado generated missile would damage sufficient fuel assemblies to cause offsite does in excess of 10 CFR Part 100.

(a). What is the probability of such an occurrence (assuming the proposed modification is not permitted)?

(b). In the Staff's opinion, is this probability likely to increase if the proposed modification is permitted?

(c). If the answer to (b) is in the negative, explain the basis for your answer.

(d). If the answer to (b) is in the affirmative, explain the basis for your answer and estimate the increased probability of such an occurrence.

Answer:

(A).(a). The probability for exceeding 10 CFR Part 100 dose guidelines is much less than 10^{-7} per year, and is therefore acceptably low.

(b). The Staff does not believe that this probability is likely to increase if the proposed modification is permitted.

(c). The probability estimate in (a) above is based on the fact that, even if all the assemblies of a freshly discharged 1/3 of the reactor core were damaged, the site boundary doses would be within 10 CFR Part 100 dose guidelines.

(B).1. "Technical Basis for Interim Regional Tornado Criteria," E. H. Markee, et al., WASH-1300, pp. 10 and 12, May 1974.

2. Standard Review Plan, "Missiles Generated by Natural Phenomena," Section 3.5.1.4, November 24, 1975.

(C). None.

(D). None.

(E). Kazimieras M. Campe. A copy of his professional qualifications accompanied the NRC supplemental response to VEPCO's summary disposition motion.

Interrogatory 7:

In §2.4 of the SER it is stated that the "design criterion for the tornado missile protections for the facility was such tornado-generated missiles would not cause damage to more than one spent fuel assembly within the spent fuel pool."

(a). Explain this statement.

(b). What is the probability that a tornado missile may damage more than one assembly in the SFP (assuming the proposed modification is not permitted)?

(c). Is the probability of such an occurrence likely to increase if the proposed modification is permitted?

(d). If the answer to (c) is in the negative, explain the basis for your answer.

(e). If the answer to (c) is in the affirmative, explain the basis for your answer and estimate the increased probability of such an occurrence.

Answer:

(A).(a). The statement describes the criterion used by the Applicant in the design of the spent fuel pool building with respect to tornado missiles. As indicated in Section 2.4 of the Safety Evaluation (SE) issued in connection with the proposed fuel pool modification, the Staff's basis for accepting the design of the fuel building and spent fuel pool, with regard to tornado missiles, was that there is an acceptably low probability that a tornado-generated missile would damage sufficient fuel assemblies to cause offsiete doses in excess of 10 CFR Part 100 levels.

(b). About 6.8×10^{-6} per year as an upper limit. Removal of the conservatisms used in obtaining the above estimate would result in a significantly lower value.

(c). The probability of damaging more than one assembly is not likely to increase significantly.

(d). The principal contributor to the probability is the steel rod. Since the diameter of the rod (1 inch) is much less than the width of a fuel assembly (10 inches), the proposed modification would not affect appreciably the probability that one or more additional assemblies may be damaged after one assembly is damaged initially by the same missile.

(B).1. SER, §3.5.

2. SE, §2.4.

3. See also documents identified in response to Interrogatory 6(B) above.

(C). Note objection.

(D). None.

(E). K. Campe.

Interrogatory 8:

Describe the damage that would have to be sustained by fuel in the SFP in order to exceed the limits established in 10 CFR Part 100.

Answer:

(A) In order to conservatively determine the amount of damage that would have to be sustained by the fuel in the SFP in order to exceed the guideline values of 10 CFR Part 100, the Staff calculated the radiological consequences at the exclusion boundary based on the damage of all the fuel rods of a single assembly. For this analysis, the Staff assumed the minimum decay time permitted by the plant Technical Specifications (100 hours after shutdown), also assumed that a tornado driven missile had caused a hole in the roof such that the iodine filtration system was completely bypassed in that all radioactive effluents escaped through the roof, and assumed adverse meteorological conditions that might be expected in a post-tornadic time period.

The resulting radiological consequences were 5.3 rem to the thyroid and 0.018 rem to the whole body. To obtain an estimate of the fuel damage that would be necessary to exceed the values of Part 100, the doses for a single assembly were then scaled to obtain the number of fuel assemblies that would have to be damaged. The thyroid dose was limiting and it was estimated that 57 fuel assemblies would have to be damaged to exceed 300 rem to the thyroid. This is an underestimate since the Staff analysis assumed that all 57 assemblies were in the spent fuel pool and simultaneously damaged after 100 hours decay time. In fact, movement of the first assembly out of the core cannot be initiated until 100 hours after shutdown.

It should also be noted that during normal refueling operations only 1/3 of the fuel assemblies are removed from the reactor core. Since the North Anna, Units 1 and 2, core contains 157 assemblies one third of a core would consist of 52 assemblies. Hence, complete damage of one-third of a core at the minimum shutdown time permitted would yield doses less than the values of 10 CFR Part 100.

(B).1. 10 CFR Part 100.

2. Memo of 6/5/79 from E. Markee to C. Ferrell with post-tornado X/Q value.

3. Standard Review Plan, Section 15.7.4, "Radiological Consequences of Fuel Handling Accidents."

4. Regulatory Guide 1.25 (March 23, 1972).

5. WANG calculator program for fuel handling accidents.

6. Evaluation of fission product release and transport for a fuel handling accident by G. Burley, October 5, 1971.

(C). Objection waived given respondent's independent compilation of the following list of documents:

.1. Fuel handling accident analysis by J. N. Singh, RE-A-78-227, EG & G, Idaho, Inc. (Oct. 1978).

2. Internal memorandum of September 26, 1978 from V. Benaroya, NRC, to W. H. Regan, NRC, re: environmental impact appraisal for North Anna fuel racks.

3. Internal memorandum of May 28, 1969 to R. S. Boyd, AEC, from R. E. Ireland, AEC, on "an investigation of the number of fuel rods during a refueling accident."

4. Memorandum from S. Levine, AEC, to R. S. Boyd, D. J. Skivholt, L. D. Low, E. G. Case, J. A. McBride, AEC, dated August 13, 1968, Reactor Technology Memorandum-Tabulation of accident assumptions used by E & RST for Light Water Power Reactors."

5. Memorandum of April 17, 1969 from P. W. Howe, AEC, to R. S. Boyd, AEC, on "Refueling Accident Assumptions."

6. NRC Staff "Further Additional Supplemental Testimony on Contention I.D. 2 (spent fuel handling accident)" - Jamesport 1/2 hearing - by W. L. Brooks, M. Greenberg, J. Snell and L. Soffer.

7. NRC Translation #266 "simulation of a fuel handling accident in a PWR reactor piree-handling experiment," J. Porcheron and R. Michel.

8. Letter of Oct. 25, 1978 to V. Stello, Jr., NRC, from C. M. Stallings, VEPCO, on "Movement of Heavy Loads Near Spent Fuel."

(D) None

(E). Charles M. Ferrell. A copy of his professional qualifications accompanied the NRC Staff Supplemental Response to VEPCO's Summary Disposition Motion.

Interrogatory 9:

In an NRC document entitled Draft Generic Environmental Impact Statement on Handling and Storage of Spent Light Water Power Reactor Fuel (March 1978) NUREG-0404 it is stated in §4.2.3.2 that a tornado missile entering a SEP could impact a 45 foot row of assemblies.

(a). Justify the discrepancy between this estimate and your estimate that a tornado missile entering the North Anna SFP would not impact more than one assembly.

(b). What would be the radiological consequences if a 45 foot row of assemblies were damaged by a tornado or turbine missile at the North Anna SFP?

Answer:

(A).(a). The Staff has not postulated that a tornado missile entering the North Anna SFP would be limited to impacting only one assembly. Thus the 45 foot row or damaged assemblies assumed in the cited reference does not constitute a discrepancy with the Staff's evaluation.

(b). Since the estimated consequences for a single assembly are 5.3 rem to the thyroid at the site boundary, damage of 45 assemblies, if occurring at the time that the spent fuel is freshly discharged, would be 4.5 x 5.3, or 238.5 rem.

(B).1. Same as reference 2 in answer to Interrogatory 7(B).

2. Draft Generic Environmental Impact Statement on Handling and Storage of Spent Light Water Power Reactor Fuel, NUREG-0404, Vol. 1, Executive Summary Text, Section 4.2.3.2, March 1978.

(C). Note objection.

(D). None.

(E). K. Campe.

Interrogatory 8 (p.6):

Describe the most destructive (1) tornado and (2) turbine missiles which could conceivably be expected to enter the SFP.

Answer:

(A).(1). The utility pole would represent the most destructive tornado missile which could conceivably be expected to enter the SFP. Its assumed weight and dimensions are 1490 pounds, and 13 1/2 inch diameter by 35 feet in length, respectively.

(2). A quadrant of the largest low pressure turbine wheel is the most destructive turbine missile which could conceivably be expected to enter the SFP. The quadrant would weigh 3960 pounds and have overall dimensions of about 2 1/2, 3, and 4 feet along the three principal axes of the quadrant.

Thus, a conservative estimate indicates that the radiological consequences have a potential of being as high as 86 rem thyroid/assembly failed to the thyroid at the site boundary. However, the probability for such an event is extremely low. Taking into account the missile generation probability (10^{-4} per turbine year), the high trajectory turbine missile strike probability (10^{-7} per square foot of horizontal area per missile), the maximum stores fuel area (about 2500 square feet), the probability of missile orientation having a maximum projected area (about 0.3), the number of turbine units which are assumed to be operating at the time that recently discharged fuel is being stored in the SFP (3 Units), the fraction of the year during which fresaly discharged fuel is expected to be stored in the SFP (about 20 days out of 365), and the assumed plant lifetime (40 years), the probability is:

$$(10^{-4})\ (10^{-7})\ (2500)\ (0.3)\ (3)(20/365)\ (40)$$

or 4.8×10^{-8} for the life of the plant that the above dose consequence could be produced.

(B).1. Same as reference 2 in answer to Interrogatory 6(B) above.

2. Westinghouse "Report Covering the Effects of a High Pressure Turbine Rotor Fracture and Low Pressure Turbine Disc Fracture at Design Overspeed," pp. 7 and 8 (April 1974).

(C). Note objection.

(D). None

(E). K. Campe, C. Ferrell.

Interrogatory 9 (p.6):

(a) What is the probability that such missiles would be expected to enter the SFP over the life of the plant?

(b) What would be the radiological consequences of such missiles?

(c) Assuming that the proposed modification is not permitted, what is the probability that such missiles would strike directly more than one fuel assembly?

Answer:

(A).(a) The probability that a utility pole would enter the SFP over the life of the plant is no more than 2×10^{-3} if it is assumed that the probability of striking and entering the spent fuel pool building at 21 feet above grade or higher is one.

The probability that a turbine missile would enter the SFP over the lifetime of the plant is on the order of 10^{-6}.

(b) If a utility pole were to enter the SFP while the pool contained 1/3 of a freshly discharged reactor core, and if it is assumed arbitrarily that the pole damages all of these assemblies, the dose consequence would be 52 x 5.3 or 275.5 rem to the thyroid at the site boundary.

If a turbine missile were to enter the SFP, it may strike the spent fuel racks and damage a number of assemblies. An upper limit on the number of assemblies that could be damaged can be estimated by considering that the missile strikes a fuel rack with the largest projected missile cross sectional area, and that all spent fuel assemblies within the area, plus those that are adjacent to the area, are damaged. The principal maximum dimensions with respect to the largest projected missile area are about six feet by two and a half feet. Thus for the proposed fuel storage configuration, a maximum of about 24 assemblies could be damaged. Significantly fewer assemblies would be damaged if the missile strikes the fuel racks in most of the other possible orientations.

(c) About the same as with the proposed modification.

(d) If either of these missiles enters the SFP, the probability of striking more than one assembly is close to one. This is true for either the present or the proposed fuel storage configuration.

(B).1. Same as reference 1 in answer to Interrogatory 6(B) above.

2. North Anna Power Station, Units 1 and 2, Final Safety Analysis Report, Figs. 1.2-17 and 1.2-18, (May 6, 1977).

3. Same as reference 2 in answer to Interrogatory 8(p.6)(B) above.

4. "Amendment to operating license North Anna Power Station, Unit 1, proposed Technical Specification change No. 10;" Letter from C. M. Stallings, VEPCO, to E. G. Case, NRC, dated May 1, 1978, at pp. 26 and 28 of Attachment B.

5. Standard Review Plan, "Turbine Missiles," Section 3.5.1.3, Revision 1.

(C). Note objection.

(D). None.

(E). K. Campe.

Interrogatory 10:

Is it your opinion that the distance between assemblies stored in the SFP is relevant to the question whether more than one assembly is likely to be struck by a missile or a utility pole? Explain your answer.

Answer:

(A) The probability of striking more than one assembly is related to the missile size, energy, and orientation at the time of reaching spent fuel racks. Design basis tornado and turbine missiles for North Anna are sufficient in size such that once the missile is assumed to have reached the spent fuel racks, there is a high degree of likelihood that more than one assembly may be struck. Hence the distance between assemblies stored in the SFP is not relevant to the question of whether more than one assembly is likely to be struck. This is true in the context of the proposed and present spent fuel storage configurations. If storage separation distance were increased to distances significantly larger than the principal dimensions of a missile, then the strike probability per missile would be reduced appreciably.

(B). Same as answer to Interrogatory 6(B) above.

(C). Note objection.

(D). None.

(E). K. Campe.

Interrogatory 19:

Identify all correspondence between VEPCO and the NRC concerning the proposed modification of the SFP.

Answer:

See docket file in NRC Public Document Room.

Interrogatory 20:

Identify all correspondence between the United States Department of Energy, its constituent agencies or predecessor agencies, and owners of commercial nuclear generating facilities, including VEPCO, concerning spent nuclear fuel.

Answer:

This request is objectionable. It is overbroad, unduly burdensome, and irrelevant to a contention at issue in this proceeding.

Interrogatory 21:

Identify all memoranda and other correspondence between NRC Staff concerning the proposed modification of the SFP.

Answer:

The NRC Staff objects to the requested identification of all internal Staff memoranda or correspondence concerning the proposed modification in general which are not relevant to the contentions remaining in issue in this proceeding or likely to lead to the discovery of admissible evidence. Such a broad request would place an undue burden upon the Staff as well. The NRC is prepared to make any such documents relevant to the contested issues available for inspection through NRC Staff Counsel to the extent such documents do not contain information exempt from disclosure under 10 CFR §§2.744 and 2.790.

Interrogatory 22:

Summarize briefly the Staff's independent evaluation of the capability of the SFP cooling and purification system to handle the increased cooling requirements as mentioned on p. 1-6 of the Safety Evaluation. Has this evaluation been modified since VEPCO filed LER 79-44 (April 4, 1979)? If not, why not?

Answer:

(A). The Staff performed an independent evaluation to verify that the existing spent fuel pool cooling system can adequately handle the incremental increase in heat load resulting from the expanded spent fuel storage capability. This evaluation was based on the refueling cycles previously documented by VEPCO plus the additional longer term fuel storage in the pool provided by the proposed modification.

This evaluation has been reviewed in light of LER 79-44 concerning the increased design maximum service water system temperature and it was determined that no change in the Safety Evaluation for the increased spent fuel storage modification was necessary as the actual heat loads on the spent fuel pool cooling system will remain the same. It was verified that the spent fuel pool cooling system is adequately sized to remove the heat loads with the increased service water and component cooling water system maximum design temperatures. Refer to "Affidavit of Jared S. Wermiel on New Contention Concerning Supplemental Response to VEPCO Summary Disposition Motion," dated June 25, 1979.

(B).1. VEPCO's "Summary of Proposed Modifications to the Spent Fuel Storage Pool Associated with Increasing Storage Capacity," dated April 1978, sections 5.0 and 7.0.

2. NRC Standard Review Plan, Section 9.2.5,"Ultimate Heat Sink,"November 24, 1975.

3. Letter from S. C. Brown, VEPCO, to H. R. Denton, NRC, dated March 8, 1979 and attached special report entitled "Service Water Reservoir and Spray System Performance Testing and Evaluation" by Ford, Bacon & Davis Utah, Inc., section 5.0, February 1979 (Documents proprietary).

(C). None.

(D). None.

(E). Jared S. Wermiel. A copy of his professional qualifications accompanies the NRC Staff response to VEPCO's summary disposition motion.

Respectfully submitted,

Steven C. Goldberg
Counsel for NRC Staff

Dated at Bethesda, Maryland
this 29th day of June, 1979.

AFFIRMATION OF PREPARATION*

I prepared the answers to Interrogatories 2-2, 8, and 8(p.6)(in part). They are true and correct to the best of my knowledge and belief.

Charles M. Ferrell

Subscribed and sworn to before me
this 29th day of June, 1979.

Elizabeth Ann Staton
Notary Public in and for the State
of Maryland, Montgomery County

My Commission expires: July 1, 1982

I prepared the answers to Interrogatories 6, 7, 9, 8(p.6), 9(p.6) and 10. They are true and correct to the best of my knowledge and belief.

Kazimieras M. Campe

Subscribed and sworn to before me
this day of June, 1979.

Notary Public in and for the State
of Maryland, Montgomery County

My Commission expires: July 1, 1982

I prepared the answer to Interrogatory 22. It is true and correct to the best of my knowledge and belief.

Jared S. Wermiel

Subscribed and sworn to before me
this 29th day of June, 1979.

Notary Public in and for the State
of Maryland, Montgomery County

My Commission expires: July 1, 1982

* Messrs. Campe and Wermiel are unavailable at this writing. Their sworn affidavits will be provided later.

I prepared the answer to Interrogatory 2-1. It is true and correct to the best of my knowledge and belief.

Sai P. Chan

Subscribed and sworn to before me
this 29th day of June, 1979.

Notary Public in and for the State
of Maryland, Montgomery County

My Commission expires: July 1, 1982

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	Docket Nos. 50-338 SP
	)	50-339 SP
VIRGINIA ELECTRIC AND POWER COMPANY	)	(Proposed Amendment to Facility
	)	Operating License NPF-4 to Permit
(North Anna Nuclear Power Station, Units 1 and 2)	)	Storage Pool Modification)
	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF RESPONSE TO INTERROGATORIES FROM CITIZENS' ENERGY FORUM AND POTOMAC ALLIANCE" in the above-captioned proceeding have been served on the following by deposit in the United States mail, first class, or, as indicated by an asterisk, by deposit in the Nuclear Regulatory Commission internal mail system, this 29th day of June, 1979.

Valentine B. Deale, Esq., Chairman
Atomic Safety and Licensing Board
1001 Connecticut Avenue, N. W.
Washington, D. C. 20036

Mr. Ernest Hill
Lawrence Livermore Laboratory
University of California
P. O. Box 800, L-123
Livermore, California 94550

Dr. Quentin J. Stober
Fisheries Research Institute
University of Washington
Seattle, Washington 98195

Michael W. Maupin, Esq.
Hunton & Williams
P. O. Box 1538
Richmond, Virginia 23212

Mr. Irwin B. Kroot
Citizens' Energy Forum
P. O. Box 138
McLean, Virginia 22101

James B. Dougherty, Esq.
Potomac Alliance
307 11th Street, N.E.
Washington, D. C. 20002

Anthony J. Gambardella, Esq.
Office of the Attorney General
11 South 12th Street, Suite 308
Richmond, Virginia 23219

Atomic Safety and Licensing
Board Panel*
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

852 201

Atomic Safety and Licensing
Appeal Panel (5)*
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Docketing and Service Section
Office of the Secretary
U.S. Nuclear Regualtory Commission
Washington, D. C. 20555

Steven C. Goldberg
Counsel for NRC Staff

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