72-16

VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

April 14, 1997

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Serial No. 97-103
NL/RPC R1
Docket No. 72-16

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI)
REQUEST FOR ADDITIONAL INFORMATION (TAC NO. L22113)

By letter (Serial No. 95-195) dated May 9, 1995, Virginia Electric and Power Company submitted an application for the review and approval of a site-specific license for an independent spent fuel storage installation (ISFSI) at North Anna Power Station. In a letter dated February 12, 1997, the NRC requested additional information which the staff requires for a determination of compliance with 10 CFR 72.

Our response to the request for additional information is included in Attachment 1. Please note that the analyses which support the response to Question No. 4-3 concerning design earthquake cask sliding and tipping have not been completed. The complete results of these analyses will be submitted to the NRC no later than May 31, 1997.

Very truly yours,

RF Saunders for

James P. O'Hanlon
Senior Vice President - Nuclear

Attachments

1. Response to Request for Additional Information
2. Soil Failure/Liquefaction Susceptibility Analysis
3. Soil/Rock Profiles
4. Impact Limiter Assembly Drawing
5. Universal Cask Lifting Yoke Assembly Drawing

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Commitments made in this letter:

1. Results of the analyses, which support the response to Question No. 4-3 concerning design earthquake cask sliding and tipping, will be submitted to the NRC no later than May 31, 1997.
2. The Emergency Plan will be revised by May 31, 1998 to include revisions due to the North Anna ISFSI.
3. North Anna Security Personnel will receive initial training on special security requirements of the ISFSI and cask transportation.

Drawings in Central File

cc: U. S. Nuclear Regulatory Commission
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NRC Senior Resident Inspector
North Anna Power Station

Mr. Carl J. Paperiello, Director
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U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

ATTACHMENT 1

VIRGINIA ELECTRIC AND POWER COMPANY
RESPONSE TO REQUEST FOR
ADDITIONAL INFORMATION
NORTH ANNA ISFSI
TAC NO. L22113

REQUEST FOR ADDITIONAL INFORMATION
NORTH ANNA ISFSI
TAC NO. L22113

1-1 Update the SAR to reflect the revision of the TN-32 Topical Safety Analysis Report (TSAR) approved by the Nuclear Regulatory Commission.

Response: SAR Appendix A, Table A-1 will be revised to reference Revision 9A of the TN-32 TSAR.

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2-1 Revise the safety analysis report (SAR) sections and associated analyses pertaining to the independent spent fuel storage installation (ISFSI) design earthquake to clearly comply with the requirements of 10 CFR 72.102(a)(1), (a)(2), (f)(1), and (f)(2).

SAR Section 2.5.2.3 states that the North Anna Power Station Units 1 and 2 Preliminary Safety Analysis Report and design were completed prior to the promulgation of Appendix A to 10 CFR Part 100, and the term "design-basis earthquake" as used in the ISFSI SAR has the meaning it had prior to the promulgation of these regulations. The SAR also references American Nuclear Standards Institute/American Nuclear Society (ANSI/ANS) 2.19 and states that "The North Anna Power Station operating-basis earthquake in Section 2.5.2.6 of the UFSAR exceeds the 500-year earthquake and was used as the Design Earthquake" (page 4.2-3). NRC has not endorsed ANSI/ANS 2.19 as acceptable for meeting the requirements of 10 CFR 72.102. In any case, the design earthquake must comply with 10 CFR Part 72 requirements.

Response: SAR Section 2.5.2.3 will be revised to change the ISFSI design basis earthquake from the North Anna Power Station "operating basis earthquake" to the "design-basis earthquake", which is equivalent to the "safe shutdown earthquake". This change will ensure compliance to 10 CFR 72.102(f)(1).

2-2 Provide calculations and documentation to demonstrate compliance with 10 CFR 72.102(c) and support the statement in the SAR that "...liquefaction would not occur under the Design Basis Earthquake of 0.18g."

While the ISFSI concrete storage pads may not be classified as a structure, system or component important to safety, the SAR must demonstrate that the pad will continue to support the casks without causing a tip-over as a result of the ISFSI design earthquake. The calculations should provide the maximum pad settlement(s) and identify the location(s). If reinforcing bars are stressed beyond yield, identify the locations and evaluate the effect on the casks.

Response: Enclosed is a portion of a report on soil liquefaction that is referenced in SAR Section 2.5.4. This report concludes that the average factors of safety against soil liquefaction at North Anna for a 0.30g earthquake are 1.80 to 2.24.

We are also providing profiles from the test borings across each pad location which show the areas of non-liquefiable residual soils or weathered rock. The non-liquefiable soils are determined by their composition (i.e., fine grained clayey silts possessing cohesion) or their consistency (relative density) when having penetration resistances greater than 50 blows per foot.

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3-1 Revise SAR Table 3.1-1 to provide the manufacturer and reactor type for the spent fuel assemblies.

The information was noted elsewhere in the SAR, but should be provided here for completeness.

Response: SAR Table 3.1-1 will be revised to include Westinghouse as the fuel assembly manufacturer and identify the reactor type as a pressurized water reactor.

3-2 Revise SAR Section 3.2.3 to comply with the requirements of 10 CFR 72.102 (see also RAI 2-1).

The design earthquake defined in this section is not in compliance with the requirements of 10 CFR 72.102, nor is it consistent with the 0.18g design basis earthquake stated in SAR Sections 2.5.2.3, 2.5.2.4, and 2.5.4.

Response: SAR Section 3.2.3 will be changed as described above in the response to RAI 2-1.

3-3 Clarify your statement in SAR Section 3.3.5 that no occupational dose is expected from decommissioning.

The dose rate on the bottom of the Transnuclear, Inc. Dry Storage Cask (TN-32) is significant (133 gamma/368 neutron), and potential activation of the concrete should be addressed.

Response: Section 14.3.3 of the Safety Evaluation Report for the TN-32 indicates that neutron activation of the metal components of this cask will be "a negligible fraction of the limits of Class A waste." Based on the much lower neutron dose rate emanating from the bottom of cask, as compared to the interior, and the low neutron activation potential of concrete constituents, very little activation of the concrete will occur. Occupational dose from decommissioning will therefore be insignificant.

4-1 Clarify the design compressive strength for the concrete ISFSI pad.

SAR Section 4.2.1 states that the minimum compressive strength shall be 3000 psi.

Response: The design compressive strength for the concrete ISFSI pad is 3000 psi, and SAR Section 4.2.1 will be revised to make this clear.

4-2 Clarify the "E" load identified for the structural design of the concrete storage pad with respect to the design earthquake used for the ISFSI to assure compliance with 10 CFR 72.102 (see also RAI Item 2-1).

Response: SAR Section 4.2.1 will be changed to revise the "E" load to the North Anna Power Station "design basis earthquake" as described above in the response to RAI 2-1. The load described as "E" will therefore be deleted.

4-3 Revise the analyses in SAR Sections 4.2.1.4 and 4.2.1.5 to demonstrate that the casks will not slide or tip-over as a result of the ISFSI design earthquake, based on the method of ANSI/ANS 57.9, Section 6.17.4.1 (see also RAI Item 2-1). Justify that the North Anna site conditions are bounded by the TN-32 Topical Safety Analysis Report (TSAR) Section 2.2.3 analysis.

The analyses provided show that the casks will tip and slide under North Anna Power Station's operating basis earthquake and design earthquake. The calculated accelerations exceed those evaluated in the TN-32 TSAR that are needed to cause tip-over. NRC endorses the ANSI/ANS 57.9 method which defines a factor of safety of 1.1 against sliding and overturning.

Response: SAR Sections 4.2.1.4 and 4.2.1.5 will be revised to incorporate analyses using the North Anna Power Station "design basis earthquake" as described above in the response to RAI 2-1. These analyses have not been completed and will be provided in a later submittal. We will show in these analyses that a factor of safety of 1.1 or greater exists for sliding or overturning under "design basis earthquake" conditions. These analyses will use time-history earthquake inputs generated from the North Anna "design basis earthquake", and the TN-32 cask will be specifically modeled, therefore, comparison to the TN-32 TSAR analysis will not be necessary.

4-4 Describe, in more detail, and provide drawings for the impact limiter and lift beam, that are identified as equipment important to safety.

Response: The impact limiter is attached to the bottom of the cask during loaded cask handling as it is at Surry Power Station. The impact limiter is designed to prevent the loss of subcriticality or fuel assembly integrity if a loaded cask is dropped during loading or unloading operations. Damage to the fuel assemblies

is to be limited so as not to preclude the removal of fuel assemblies by normal means. The impact limiter is designed for drop heights of up to 41 feet. A drawing of the impact limiter used with the TN-32 cask is enclosed.

The lift beam is used for lifting and moving the cask to the various station areas, including the spent fuel storage pool. The lift beam attaches to the 125 ton cask crane using a large diameter pin through a hole in the crane hook. The lift beam attaches to the two upper trunnions of the cask with arms that are moved in and out with air-operated cylinders. A locking mechanism ensures that the arms remain firmly attached to the trunnions during lifts. Movement of the arms and engagement of the locking mechanism is done with a remote control unit. The lift beam is made from carbon steel and stainless steel components, with the carbon steel components painted to prevent corrosion from immersion in the spent fuel storage pool. A test fixture is used to conduct the load tests required by ANSI N14.6. A drawing of the lift beam is enclosed.

4-5 Describe the location of the flashing light described in SAR Section 4.4.5.3 that will energize as a result of the sealed surface storage casks' (SSSCs) pressure monitoring system alarm.

Response: Actuation of the pressure monitoring alarm will cause an alarm in the Station Security Central Alarm Station (CAS) and Secondary Alarm Station (SAS). Security officers continuously monitoring these stations will then contact the Control Room Shift Supervisor. The flashing light described in SAR Section 4.4.5.3 has been removed from the ISFSI design. SAR Section 4.4.5.3 will be revised to describe this improved alarm response feature.

5-1 Add a statement that lifting within the spent fuel and decontamination buildings is governed by the regulatory requirements of 10 CFR Part 50.

Response: This statement is provided in Section 1.1, but SAR Section 5.1 will be revised to include a statement that cask loading and unloading operations conducted in the Fuel and Decontamination Buildings are governed by the regulatory requirements of 10 CFR Part 50.

5-2 Describe the steps that will be taken to monitor and control cask internal pressure and potential fuel damage during cask reflood for unloading operations.

Response: As water is slowly pumped into the cask, the temperature and pressure of the air/steam mixture vented from the cask is closely monitored. If the pressure or temperature of this mixture exceeds certain values, the pumping is stopped until it returns to acceptable values. Once the cask has been filled with water, pumping is continued until the temperature of the water leaving the cask is below an acceptable value.

7-1 Clarify and revise, as necessary, SAR Section 7.3 to consider higher neutron surface dose rates for the TN-32 based on Chapter 5 of NRC's Safety Evaluation Report (SER) for the TN-32.

Chapter 5 of the SER notes that the neutron source term could double for spent fuel enriched to less than 3.85%, thereby increasing the neutron dose for the cask. Increases in neutron doses were also possible for burnups greater than 35,000 MWD/MTU.

Response: The neutron surface dose rates for the TN-32 cask, as determined in the TN-32 Topical Safety Analysis Report and as used in SAR Section 7.3, are 7.9 mrem/hr for the side and 0.7 mrem/hour for the top. If these values were to double, the total (gamma plus neutron) surface dose rate for the TN-32 cask would be 94.1 mrem/hr for the side and 19.0 mrem/hr for the top. These higher values are still well below the ISFSI design basis dose rates of 129.4 for the side and 54.9 for the top, therefore, no changes to SAR Section 7.3 are necessary.

7-2 Explain how the time estimates for the various tasks were determined for estimating the occupational exposures to ISFSI personnel in SAR Tables 7.4-1 through 7.4-6.

Response: The time estimates for the various tasks were determined based on observations of cask loading, transport, maintenance and pad construction activities for the Surry ISFSI. The dose estimates in Tables 7.4-1 through 7.4-6 are conservative when compared to the actual exposures experienced for activities related to the Surry ISFSI.

7-3 Define what the letters A through H indicate on Figure 7.3-1.

Response: The letters A through H on Figure 7.3-1 correspond to the data points A through H included in Table 7.3-6. This connection is explained in SAR Section 7.3.2.2.

7-4 Provide the calculations that demonstrate compliance with 10 CFR 72.104(a).

In addition to complying with the requirements of 10 CFR Part 20, the dose limit requirements in 10 CFR 72.104(a) for normal and anticipated occurrences must also be met.

Response: Compliance to 10 CFR 72.104(a) is documented in SAR Section 7.5. This section references Section 5.2.2 of the North Anna ISFSI Environmental Report, where more detail is provided and specific reference to 10 CFR 72.104 is made. SAR Section 7.5 will be revised to specifically reference compliance to 10 CFR 72.104(a).

8-1 Reference the SAR section that describes the procedures for verifying proper loading of the spent fuel assemblies in SAR Section 8.2.6.2.

Response: SAR Section 5.1.1.1 will be revised to describe the use of an underwater camera to verify the proper placement of fuel assemblies. SAR Section 8.2.6.2 will also be revised to better describe fuel assembly verification.

9-1 Verify that the results of the pre-operational testing will be evaluated for lessons learned and potential changes to equipment and procedures.

Response: Pre-operational testing of a cask design is conducted using the procedures and equipment developed for loading and unloading operations, without actually using spent fuel in the cask. Pre-operational testing of the cask transporter is conducted in a similar manner. Pre-operational testing of ISFSI facility systems (i.e., lights, cask monitoring, backup diesel generator) can be conducted without a cask at the ISFSI. When pre-operational testing has been completed, changes to equipment and procedures are made based on the lessons learned. If a significant equipment change is needed, retesting of this equipment may be necessary.

9-2 Clearly define the acceptance criteria, margins and acceptance criteria for the pre-operational tests and SSSC seal testing.

Response: The acceptance criteria and margins used during pre-operational testing are the same criteria and margins that will be used during loading, transport and unloading operations. For instance, if the ISFSI Technical Specifications leak rate acceptance criteria for the TN-32 cask is $1x10^{-5}$ mbar-liter /sec, then that is the acceptance criteria that will be used for pre-operational testing. Other acceptance criteria that will be used in the same manner include cask cavity dryness testing, helium pressure of the cask cavity and pressure monitoring system, and cask surface contamination. The only acceptance criteria that cannot be tested is the cask surface dose rate, since pre-operational testing will be conducted without spent fuel in the cask.

9-3 Describe the process by which procedures will be generated for the 10 CFR Part 72 licensed activities.

Response: Procedures currently used at the Surry Power Station and ISFSI to load, transport and unload storage casks will be adapted, as necessary, for use at North Anna. The cask handling facilities and layout at North Anna are almost identical to those at Surry, and the North Anna ISFSI will be similar to the Surry ISFSI. Vendor technical manuals will be used to validate procedures.

9-4 Describe the process/program for the preparation and review of safety and environmental evaluations allowed under 10 CFR 72.48, "Changes, tests, and experiments" (e.g. procedure, preparer/reviewer training and qualifications, unreviewed safety question guidance and determination, etc.)

Response: Station Administrative Procedure VPAP-3001, Safety Evaluations, governs safety and environmental evaluations. This procedure provides the criteria which determine when safety evaluations are required. Instructions are given for preparing, reviewing, and approving the evaluations. This procedure

provides requirements and guidance for evaluations to determine if an activity is safe, if an unreviewed safety question exists, if an unreviewed environmental question exists, or if an amendment to the license or Technical Specifications is required. This procedure also specifies the qualifications and training required of safety evaluation preparers, reviewers, and approvers.

9-5 Provide a description of North Anna's systematic approach to ISFSI training.

A systematic approach to training should include, but not be limited to, identification of tasks to be trained in, identification of skills and knowledge to perform the identified tasks, design of the training program and performance measures, development of lesson plans, implementation of the training, and mechanisms for evaluating the program and personnel being trained.

Response: North Anna will develop a training program for the ISFSI based on the Surry ISFSI program which is approved by the NRC. It is anticipated that for Operations Department personnel, the training will be an addition to the fuel handling training program. Fuel handling personnel will receive in-depth training, while the remainder of Operations personnel will receive general training. In addition, awareness training will be provided to Instrumentation & Control and Health Physics personnel. Security personnel will receive initial training on special security requirements of the ISFSI and cask transportation. Qualification of other physical security requirements will be completed during annual requalification in accordance with the Nuclear Security Training and Qualification Plan.

Surry ISFSI training materials will be reviewed to identify any additional requirements necessary for North Anna's ISFSI design package. A job and task analysis will be performed to identify all tasks, knowledge requirements, performance standards, conditions under which tasks are performed, tools and equipment required, initiating and terminating cues, safety considerations, and target audience for training.

Classroom lesson plans, self-study modules, and job performance measures (JPMs) will be utilized for training of task objectives for the ISFSI. Classroom training will be provided on ISFSI layout, technical specifications, communications system, and procedures. Job performance measures will be utilized for on-the-job training in storage cask functional areas. Written tests and JPMs will be used for cognitive and performance evaluations. Feedback from Operations Department management, trainers, and trainees will be used to evaluate the program. Trainers and operators have been to Surry to observe the cask handling process. Experienced Surry personnel will assist during the loading, transporting and unloading training exercise conducted prior to the first use of each cask design.

9-6 Provide a copy of the revised North Anna Emergency Plan, noting the sections that were revised due to the addition of the ISFSI.

Response: A revision of the Emergency Plan will include revisions due to the North Anna ISFSI. This submittal will be prepared and sent to the NRC by May 31, 1998.

11-1 Clarify the most recent revision and list of amendments for the Quality Assurance Program document VEP-1-5A.

The revision reviewed by staff, as provided by the licensee, was VEP-1-5a, Amendment 5. The cover sheet shows that the document was updated in February 1994, but the "List of Amendments" on page 17.2-iv shows the last update of the document as June 16, 1992.

Response: In our letter (Serial No. 96-562) dated November 14, 1996, Revision 31 of the North Anna Power Station Updated Final Safety Analysis Report (UFSAR) was submitted. UFSAR Chapter 17 contains the Operational Quality Assurance Program Topical Report VEP-1-5A (UPDATED) Amendment 5 June, 1986 (Updated 10/96).

Financial Assurance and Decommissioning

FAD-1 Provide the annual schedule of construction and operation expenses that Virginia Electric and Power Company (Virginia Power) and Old Dominion expect to incur for the ISFSI over its scheduled operating life.

Response: Initial design, licensing and construction of the ISFSI is expected to cost approximately $10 million. Annual operating expenses for cask purchase, loading and maintenance are expected to average approximately $3 million. If a second or third storage pad is needed, construction costs will be approximately $4 million for each.

FAD-2 Explain whether or not Virginia Power and Old Dominion intend to seek recovery of all or part of the construction, operation, and decommissioning expenses of the ISFSI through ratepayers. If so, state when such rate recovery will be sought.

Response: Virginia Power is currently collecting operating expenses for the North Anna ISFSI as part of its fuel factor in Virginia, and as part of base rates in North Carolina and for customers subject to Federal Energy Regulatory Commission rates. Construction expenses are normally collected under base rates once construction of the facility has been completed. Decommissioning expenses are also collected in base rates.

FAD-3 Verify that the ISFSI decommissioning cost will be fully assured by trust fund or other assurance mechanism provided in 10 CFR 50.75(e)(1) or (3) (as referenced in 10 CFR 72.30(c)(5)).

Although Section 10.2 of the license application briefly discusses decommissioning trust funds, it is not clear that the ISFSI decommissioning costs have been provided for separately, over and above other decommissioning costs associated with the North Anna facility. At a minimum, the North Anna decommissioning trust should either have a separate sub-account for ISFSI decommissioning costs or some clear method to identify separately the various components of decommissioning costs, including NRC-required radiological decommissioning costs, non-radiological costs not required by the NRC, and ISFSI costs.

Response: The Decommissioning Cost Study for the North Anna Power Station includes separate line item cost estimates for "Period 2 Undistributed Costs - NRC ISFSI Fees" as well as "Demolition of Remaining Site Buildings - ISFSI D&D."

ATTACHMENT 2

SOIL FAILURE/LIQUEFACTION SUSCEPTIBILITY ANALYSIS FOR NORTH ANNA POWER STATION SEISMIC MARGIN ASSESSMENT

SOIL FAILURE/LIQUEFACTION SUSCEPTIBILITY ANALYSIS FOR NORTH ANNA POWER STATION SEISMIC MARGIN ASSESSMENT