UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

October 26, 1976

Honorable Marcus A. Rowden
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: REPORT ON PARTIAL REVIEW OF NORTH ANNA POWER STATION UNITS 1 AND 2

Dear Mr. Rowden:

At its 198th meeting, October 14-16, 1976, the Advisory Committee on Reactor Safeguards completed a partial review of the application of the Virginia Electric and Power Company for authorization to operate the North Anna Power Station, Units 1 and 2. The project was previously considered at Subcommittee meetings in Washington, D.C., on July 7, 1976, August 11, 1976, and October 13, 1976, and at the 196th meeting of the Committee on August 12-14, 1976. Tours of the facility were made by Subcommittee members on February 3, 1976 and May 27, 1976. During its review, the Committee had the benefit of discussions with representatives and consultants of the Virginia Electric and Power Company, the Westinghouse Electric Corporation, the Stone and Webster Engineering Corporation, the Sun Shipbuilding and Dry Dock Company, the North Anna Environmental Coalition, and the Nuclear Regulatory Commission (NRC) Staff. The Committee also had the benefit of the documents listed. The Committee discussed the application for a construction permit for the North Anna Power Station, Units 1 and 2, in its report of August 20, 1970. The Committee also discussed matters related to fault zones under or adjacent to the foundations of North Anna Power Station, Units 1, 2, 3, and 4 in its report of April 15, 1974.

The site is located on 1,075 acres on the shores of Lake Anna in Louisa County, Virginia, about 24 miles southwest of Fredericksburg, Virginia, and 40 miles north-northwest of Richmond, Virginia.

The Committee has not completed its review of North Anna Units 1 and 2 with regard to the following matters: adequacy of seismic design basis and seismic design; loss-of-coolant accidents and emergency core cooling; quality assurance and control in on-site fabrication and installation; asymmetric loads on pressure vessel structures arising from certain postulated pipe breaks; and plans for upgrading protection against fires.

Also, in Supplement No. 3 to the Safety Evaluation Report, the NRC Staff has identified several items to be resolved, and the Committee has a few remaining items relating to systems interactions on which it wishes further information.

An unexpected amount of settlement has been experienced by the service water pump house for the North Anna Units 1 and 2. Some cracking of the pump house walls has resulted. The Applicant has examined the causes of the settlement and has made design changes, including the provision of flexible expansion coupling between the piping and the pump house to accommodate additional settlement. The NRC Staff is satisfied with the re-analysis of stresses and, except for review of the design of a system of well points for ground water control, believes the situation is currently acceptable. Future settlement, which should be modest, will be monitored carefully in accordance with technical specifications to be prepared. The Committee concurs with the NRC Staff.

The Applicant has submitted a revised probable maximum flood analysis. The NRC Staff has reviewed the analysis and found it acceptable with the inclusion of a technical specification to restrict facility operation when the water level in Lake Anna exceeds an elevation of 256 feet above mean sea level. The Committee concurs.

The North Anna Power Station, Units 1 and 2 will employ a 17x17 fuel assembly similar to that employed in Beaver Valley Unit 1. A considerable portion of the Westinghouse research and development program on these assemblies has been completed, and has been evaluated and accepted by the NRC Staff. The Committee wishes to be kept informed on those matters still under review.

The steam-generator and reactor-coolant-pump supports are constructed of heavy rolled steel shapes and thick plate. After delivery of these structures at the site, the Applicant found many weld defects and proceeded to remove all welds and to reweld the supports. The Unit 1 steam-generator supports had been installed and were rewelded in place, which made it necessary to substitute peening for thermal stress relieving. The Committee finds this procedure acceptable. The Unit 2 supports were rewelded in the shop and thermally stress relieved. The NRC Staff has not completed its review of this unit. Two different steel specifications (ASTM A36-70a and ASTM A572-70a) covered most of the material used for the supports. Toughness tests, not originally specified and not in the relevant ASTM specifications, were made on

those heats for which excess material was available. The toughness of the A36 steel was good, but the toughness of the A572 steel was relatively poor at an operating temperature of 80°F. The Applicant, therefore, proposes to operate so that all A572 material is at 180°F or above. He also plans periodic inspection of the A572 members to the extent that they are accessible. The Committee believes that increasing the operating temperature is an acceptable solution, but recommends that the operating temperature of the A572 material be substantially above the proposed temperature. The Committee believes also that it would be prudent not to permit pressurization of the primary system to substantial levels while temperatures of the supports might be well below the operating temperature.

The NRC Staff is satisfied with regard to the Emergency Plan, and the Applicant has made considerable progress in providing instrumentation to follow the course of an accident.

The Committee recommends an early resolution of the matter of anticipated transients without scram for North Anna Units 1 and 2. The Committee wishes to be kept informed.

Other generic problems relating to large water reactors are discussed in the Committee's report, entitled "Status of Generic Items Relating to Light Water Reactors: Report No. 4," dated April 16, 1976. Those problems relevant to North Anna, Units 1 and 2, should be dealt with appropriately by the NRC Staff and Applicant as solutions are found. The relevant items are: II-1, 2, 3, 4, 5, 6, 7, 9, 11; IIA-1, 4, 5, 6, 7, 8; IIB-2; IIC-1, 2, 3, 4, 5, 6, 7.

The ACRS believes that, if due regard is given to the items mentioned and subject to satisfactory resolution of those matters still under review and to satisfactory completion of construction and pre-operational testing, there is reasonable assurance that the North Anna Power Station, Units 1 and 2 can be operated at power levels up to 2775 MW(t) without undue risk to the health and safety of the public. The Committee will report in the future on those matters for which its review is not yet complete.

Additional comments by Dr. Spencer H. Bush are presented on the following page.

Sincerely yours,

Dade W. Moeller

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Chairman

Additional Comments by Member Spencer H. Bush

These additional comments are directed to what appears to be the NRC Staff's position regarding acceptance of operation with the North Anna, Units 1 and 2 steam-generator and reactor-coolant-pump supports at or below temperatures of 180°F. I find it difficult to accept system pressurization to substantial levels while temperatures of the supports might be well below those suggested as "equilibrium", e.g., <180°F temperature. I do not consider it unreasonable to require that the minimum temperatures of the supports be at a level of 225-250°F, obtainable by methods such as electric "trace" heating. The combined benefits of operation in the elastic-plastic fracture mechanics regime, major increase in critical flaw size and minimization of fast fracture propagation, admittedly represent conservatisms, but these conservatisms can be achieved relatively easily with no apparent adverse degradation mechanisms. Since we do not have complete impact or fracture mechanics data, equilibrating at 225-250°F prior to pressurizing fully is recognized as conservative, but is considered desirable.

REFERENCES

1. Final Safety Analysis Report, North Anna Power Station, Units 1 and 2, with Amendments 1 through 56.

2. Safety Evaluation Report related to the operation of North Anna Power Station, Units 1 and 2, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, with Supplements 1, 2, and 3. (NUREG-0053)

3. Letter dated October 8, 1976, from Ernst Volgenau, Director, Office of Inspection and Enforcement, USNRC, to R.F. Fraley, Executive Director, ACRS, Subject: "Comments Regarding North Anna Nuclear Plant".

4. North Anna Environmental Coalition (NAEC) letters dated August 17, 1976 and September 1, 1976 and NAEC Statement of August 11, 1976 continued on October 13, 1976.

5. "Interim Report on the Examination of Core Samples from Reworked Steam Generator Supports of VEPCO, North Anna", William S. Pellini, April 8, 1976.

6. "The Safety of Steam Generator Support Structures for North Anna, Units 1 and 2", J.D. Harrison and R.E. Dolby, for Sun Shipbuilding and Dry Dock Company, May 1976.

7. "Additional Information found in VEPCO and Stone and Webster files", 3 pp., Sun Shipbuilding and Dry Dock Company.

8. "The Safety of Steam Generator Support Structures for North Anna, Units 1 and 2", Sun Shipbuilding and Dry Dock Company, May 20, 1976, with Appendix 1, plus a one-page "Final Note".

9. "Book 1, Summary of Information on Core Samples Including Source, Dimensions", (with 30 pages of photographs), Sun Shipbuilding and Dry Dock Company, May 20, 1976.

10. "Book 2, Photographic Documentation of Defects in Core Samples", (with 30 pages of photographs) Sun Shipbuilding and Dry Dock Company, May 20, 1976

REFERENCES (con't)

11. "The Safety of Steam Generator Support Structures for North Anna, Units 1 and 2" by Sun Shipbuilding and Dry Dock Company, July 7, 1976.

12. "The Safety of Steam Generator Support Structures for North Anna, Units 1 and 2" Statement before the ACRS by Sun Shipbuilding and Dry Dock Company, October 13, 1976.

13. "Further Comments on the Safety of the North Anna Support Structures", LD 22955/2, June 1976, J.D. Harrison and R.E. Dolby, the Welding Institute, (for Sun Shipbuilding and Dry Dock Ltd.).

14. "Catalog of Brittle Failures of Bridges and Other Related Structures, and Brittle Failures of Other Items Recorded at Higher Temperatures", VEPCO report to ACRS North Anna Subcommittee, October 13, 1976.

15. "Test Data for Materials in North Anna Units 1 and 2 Steam Generator and Reactor Coolant Pump Supports", VEPCO report to ACRS North Anna Subcommittee, October 13, 1976.

16. "VEPCO North Anna Units 1 and 2 Support Structures, Discussion of Fracture Mechanics Studies Presented by Various Parties", H.T. Corten, October 1976.

17. "Repairs, Inspection and Quality Assurance, Steam Generator and Reactor Coolant Pump Repair Program", VEPCO report to ACRS North Anna Subcommittee, October 13, 1976.