VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

March 23, 1995

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

Serial No. 95-036A
NE/JLJ-CGL R1'''
Docket Nos. 50-280
50-281
License Nos. DPR-32
DPR-37

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
CORE UPRATE - MATERIALS & CHEMICAL ENGINEERING BRANCH
REQUEST FOR ADDITIONAL INFORMATION

The Surry Core Uprate Technical Specification change request was submitted for NRC review by an August 30, 1994 letter (Serial No. 94-509). Subsequently, we received a request for additional information from the Materials & Chemical Engineering Branch (EMCB) of NRR regarding our core uprate submittal. The EMCB questions and our responses are documented in Attachment 1.

If you have further questions or require additional information, please contact us.

Very truly yours,

James P. O'Hanlon

James P. O'Hanlon
Senior Vice President - Nuclear

Attachment 1- Responses to EMCB Request for Additional Information Regarding Proposed Technical Specification Changes to Accommodate Core Uprating - Surry Power Station Units 1 and 2

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ATTACHMENT 1

Responses to Materials & Chemical Engineering Branch Request for Additional Information Regarding Proposed Technical Specification Changes to Accommodate Core Uprating - Surry Power Station Units 1 and 2

1. Section 4.2.6, Main Turbine, in the licensee's submittal regarding uprating power at Surry 1 and 2 has been reviewed. The licensee performed an analysis of critical components of the turbine to determine their suitability for operation at the uprated conditions. The licensee is requested to submit this analysis to allow continued review of the subject matter.

RESPONSE:

Safety Aspects of Turbine Analysis

The turbine vendor, Westinghouse, has provided Virginia Electric and Power Company with a synopsis of the turbine analysis. The analyses and evaluations performed to verify the operating safety of the turbine (e.g., turbine missile generation) bound the operating conditions for a core power of 2546 MWt which correlates to the maximum calculated turbine rating.

The steam turbine affects nuclear safety in two ways. The first is through a destructive overspeed, in which steam flow to the turbine cannot be stopped, and turbine speed increases until a turbine disc ruptures. This rupture could cause missiles capable of damaging safety systems. The probability of destructive overspeed is determined by the reliabilities of the turbine inlet valves and of the control system. Neither of these reliabilities depends on turbine power.

The second way the turbine can affect nuclear safety is through the probability of disc rupture at running speed or at an overspeed below destructive overspeed. The probability of disc rupture for these conditions is controlled by adjusting the LP turbine inspection interval. The effect of uprating on the inspection interval has been reviewed. It has been determined that the risk of a turbine missile would not be increased at the uprated conditions and there is no need to adjust the LP turbine inspection interval.

Since the probability of a destructive overspeed is independent of turbine power and the risk of a missile at speeds less than destructive overspeed is not increased at the uprated conditions, the uprating has no detrimental effect on nuclear safety aspects of the turbine.

These evaluations conclude with the assessment that for the core power rating of 2546 MWt, there would be no increase in the probability of turbine overspeed nor associated turbine missile production due to the uprating. Hence, operation of the turbines at the uprated power levels will have no adverse impact on plant safety. This

conclusion completely addresses the safety impact of turbine operation at uprated conditions (i.e., external missiles produced as a result of an overspeed condition - refer to Surry Units 1 and 2 UFSAR Section 14.2.13, "Likelihood of Turbine-Generator Overspeed").

Operating Reliability Aspects of Turbine Analysis

Additional information from other efforts performed for the uprating analysis for the turbine has been included in the Surry Core Uprate Licensing Report. The results of those evaluations addressed the stationary turbine components, the moisture separator-reheaters, the control stage blading, the high pressure turbine reaction blading, and the low pressure turbine reaction blading.

For the turbine stationary components, the design requirements for pressure vessels were verified not to have changed since the original design of these units. The only significant impact on the pressure vessel parts related to the uprating effort is on the high pressure turbine for the case where the steam pressure is increased (throttle pressure 820 psia). The high pressure vessel was compared to a similar unit operating at conditions higher than the Surry high pressure value, and the results were acceptable. The main steam inlet piping was also reviewed and found acceptable for the increased pressure. The current turbine pressure vessel and main steam inlet piping design bounds the conditions that the turbine will see at uprated conditions.

For the moisture separator-reheaters, the original design conditions for the moisture separator-reheater vessel integrity continue to apply.

The control stage and high pressure reaction blading continues to meet design requirements.

Independent of core uprate considerations, the turbine vendor has indicated that there are some reliability concerns for certain rows of low pressure reaction blading for turbines of the same model and vintage of the Surry turbine. With technical input from the turbine vendor, we have established a long term inspection and repair (as required) program, which specifically addresses the reliability concerns identified by the turbine vendor. The program requires visual and nondestructive inspections to be performed on a regular schedule. The inspection results are reviewed by the turbine vendor and, as required, repairs are performed. This program ensures the operating reliability of the turbine.

2. **The Steam Generator Tube Integrity portion of the Surry Power Uprate amendment has been reviewed. The licensee is requested to respond to the following questions:**

   a. **The structural analyses performed by the licensee has not been adequately described (i.e., the licensee states that the analysis performed for their steam generator replacement program was reperformed with the uprated conditions and that the components continue to remain in compliance with the ASME Code). A more detailed description of the analyses performed to demonstrate the adequacy of the 40% plugging criteria should be provided. This analysis should include an assessment of the changes in such factors as temperature, pressure, and flow on the minimum required tube wall thickness. Regulatory Guide 1.121 describes a methodology acceptable to the staff for determining tube repair limits.**

   RESPONSE:

   Response will be provided by a separate transmittal.

   b. **The licensee states that the propensity for steam generator corrosion would not be affected by the power uprate; however, the licensee did not address the affect of the power uprate on potential mechanical types of degradation (e.g., tube wear). Although the Surry steam generators have relatively undegraded steam generator tubing, an assessment of the impact of the power uprating on the degradation rates (e.g., tube wear) should be provided. A description of the active degradation modes at Surry Units 1 and 2 would be useful.**

   RESPONSE:

   Surry is equipped with Westinghouse Model 51F steam generators. The core power uprate generates an increase in steam flow and concurrent increase in void fraction in the U-bend region. While these circumstances do result in an increased potential for vibration, they do not contribute to any significant decrease in long term bundle integrity for the Model 51F steam generators. For the small radius U-bends, this vibration does not lead to significant fatigue. A necessary condition for significant fatigue usage is denting at the top tube support plate. This does not occur in the Surry Model 51F steam generators which have stainless steel support plates. The larger radius U-bends, which are in contact with the anti-vibration bars (AVBs), have been evaluated for increased wear. Evaluations for Model 51 generator models, including the Model 51F, show that the additional tubes subject to wear at the AVB intersections as a result of equivalent core upratings constitute less than 0.3% of the total tube count over the life of the generator. Consistent with these evaluations, to date 8 tubes (6 in Unit 1 and 2 in Unit 2) have been plugged due to minor AVB wear. These eight

tubes were plugged prior to reaching the Technical Specification through wall plugging limit. Therefore, core uprating at Surry should not result in any significant increase in long term fatigue usage or wear at the tube bundle.

Since the steam generators in both Surry units have been replaced, no active degradation modes, except minor AVB wear, have been observed in the steam generators. Steam generator tube plugging, performed during past outages, has been and will continue to be reported to the NRC, along with a description of the type of indications seen. Any developing degradation modes would be monitored by the steam generator inspections performed, which go beyond those required by the Surry Technical Specifications and are consistent with industry practices to monitor new-type (i.e., replacement) steam generators for tube conditions.

c. The effects of tube support plate broach hole blockage under the uprated conditions, if any, should be addressed (e.g., effects on flow induced vibration analysis, structural analysis, tube wear rates, etc.).

RESPONSE:

Steam Generator Chemical Cleaning has now been performed on Surry Units 1 and 2. Results for both units indicate that steam generator support plate broach hole deposits have been successfully removed. Improved steam generator chemistry controls recently put into place are expected to significantly reduce corrosion product transport and deposit formation inside the steam generator.

The uprating causes an increase in average heat flux which will, in turn, cause some increase in the potential for long term deposit buildup. However, heat flux is not the dominant factor affecting this buildup. Operating temperatures and plant chemistry, coupled with plant materials, are more significant factors. Changes in the operating conditions (e.g., improved chemistry controls) and component materials (e.g., replacement of copper-containing feedwater heaters) will reduce the deposit buildup. In view of these considerations, core uprating is not expected to significantly affect support plate broach hole deposit buildup.

3. Section 4.1.1, Reactor Vessel, of the Surry Core Uprate amendment request has been reviewed. In the description of page 293 of the inputs used to assess reactor vessel fracture mechanics, input 3) states that ". . . . . an Appendix G analysis to cover the balance of the normal and upset conditions was not required." Explain what is meant by this statement.

RESPONSE:

At the time of the initial plant licensing, normal operation heatup and cooldown curves were generated in accordance with the requirements of ASME III Appendix G. However, no ASME III Appendix G requirement for Service Levels A and B (normal and upset conditions) or Service Levels C and D (emergency and faulted conditions) fracture mechanics analyses existed when the Surry units received their licenses. Adequate resistance to fracture in the upper-shelf temperature range has been ensured by demonstration of compliance with the minimum Charpy upper-shelf energy requirement in 10CFR50 Appendix G. The potential for Surry to experience Charpy upper-shelf energies below the 50 ft-lb threshold prior to end-of-license prompted the performance of J-integral based elastic-plastic fracture mechanics analyses for the most limiting Surry Units 1 and 2 reactor vessel beltline materials. Acceptance criteria developed by the Working Group on Flaw Evaluation of Section XI of the ASME Boiler and Pressure Vessel Code Committee were used in these analyses. The analyses have been approved by the NRC and are documented in Topical Reports BAW-2192 (December 1993) and BAW-2178 (April 1993) for Service Levels A and B and Service Levels C and D, respectively. As described in the Surry Units 1 and 2 response to Generic Letter 92-01 based on Topical Reports BAW-2166 (dated June 1992) and BAW-2222 (dated June 1994), Topical Reports BAW-2192 and BAW-2178 are an integral part of the analyses demonstrating compliance with the requirements of 10CFR50 Appendix G for Surry Units 1 and 2. The BAW-2192 and BAW-2178 analyses considered fluences consistent with an uprated power level in the determination of mechanical properties for the limiting Surry Units 1 and 2 materials. These analyses also used pressure and temperature forcing functions which conservatively bound the transients that may be experienced at either Surry unit. Therefore, the conclusions of the BAW-2192 and BAW-2178 analyses remain valid at the uprated core power level.

Note: The Surry responses to Generic Letter 92-01 and subsequent requests for additional information were provided by the following letters:

- Serial No. 92-211, dated June 29, 1992
- Serial No. 93-473, dated September 23, 1993
- Serial No. 94-342, dated June 30, 1994