Docket No. 50-281

April 7, 1978

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Virginia Electric & Power Company
ATTN: Mr. W. L. Proffitt
Senior Vice President - Power
P. O. Box 26666
Richmond, Virginia 23261

Gentlemen:

Enclosed is a signed original of an Order for Modification of License, dated April 7, 1978, issued by the Commision for the Surry Power Station Unit No. 2. This Order amends Facility Operating License No. DPR-37 permitting continued operation of Surry Unit No. 2 for six equivalent months of operation beyond April 7, 1978, and relates to the steam generator repair program license condition of the NRC Orders for Modification of License dated April 1, 1977, August 17, 1977 and October 8, 1977. Appendix A-1 to the license, issued April 1, 1977, is being continued in order to implement the restrictions of Ordered License Condition 3.E.(4) regarding reactor coolant activity.

A copy of the related Safety Evaluation is also enclosed. The Order is being filed with the Office of the Federal Register for publication

Sincerely,

Original signed by

A. Schwencer, Chief
Operating Reactors Branch #1
Division of Operating Reactors

Enclosures:
1. Order for Modification of License
2. Safety Evaluation

cc w/enclosures:
See next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Docket No. 50-281

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ATTN: Mr. W. L. Proffitt
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See next page

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Williamsburg, Virginia 23185

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6th and Walnut Streets
Philadelphia, Pennsylvania 19106

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
VIRGINIA ELECTRIC & POWER COMPANY	)	Docket No. 50-281
	)	
Surry Power Station, Unit No. 2	)	

ORDER FOR MODIFICATION OF LICENSE

I.

Virginia Electric and Power Company (the licensee), is the holder of Facility Operating License No. DPR-37 which authorizes the operation of the nuclear power reactor known as Surry Power Station, Unit No. 2 (the facility) at steady state reactor power levels not in excess of 2441 thermal megawatts (rated power). The reactor is a pressurized water reactor (PWR) located at the licensee's site in Surry County, Virginia.

II.

On April 1, 1977, the NRC staff issued an Order for Modification of License No. DPR-37 which addressed operation of Surry Power Station Unit No. 2 under conditions in which steam generator tubes have been plugged as a result of tube denting caused by corrosion of the tube support plate in the annular spaces between tube and the tube support plate. On August 17, 1977, an Order was issued to permit continued operation of Unit No. 2 to September 15, 1977, under the conditions

of the April 1, 1977 Order. The licensee was required to perform an inspection after the September 15, 1977 shutdown. The licensee's fuel cycle for Surry Unit No. 2 ended before September 15, 1977, and during the resulting shutdown the licensee performed the required inspection. On October 8, 1977, an Order was issued to permit continued operation of Unit No. 2 for six equivalent months of operation beyond October 8, 1977. On March 20, 1978, Surry Unit No. 2 shut down for steam generator tube inspection and the results were submitted on April 4, 1978 as supplemented April 6, 1978. The data derived from the inspection demonstrates that the denting has followed the pattern predicted by the preventive plugging criteria established by the licensee with the NRC staff. The additional plugging performed as a result of the inspection using the preventive plugging criteria will provide adequate steam generator integrity under the conditions of this Order for continued operation for an additional six month period. The NRC staff has evaluated the results of this inspection and repair program and has assessed continued safe operation of the facility. This evaluation is set forth in the staff's concurrently issued Safety Evaluation relating to steam generator tube integrity.

Continued growth of the tube support plate continues to impose stresses on the tubes and may result in the development of stress corrosion cracks in denting locations. The NRC staff has considered the effect of the development of stress corrosion cracking during the course of

operation of this facility, and has assessed the effect of such cracks in conjunction with the steam line break and loss of coolant accident events. The NRC staff has concluded that under the limitations on tube leakage set forth in this Order, the effect of continued denting on LOCA events or on the consequences of the steam line break event would continue to be within those considered in connection with the April 1, 1977 Order. The limitations set forth in this Order will provide reasonable assurance that the public health and safety will not be endangered.

The licensee has proposed in its April 4, 1978, submittal to continue the limitations applicable to this facility in the manner set forth in this Order. The NRC staff believes that the licensee's actions, under the circumstances are appropriate and should be confirmed by NRC Order.

Copies of the following documents are available for public inspection in the Commission's Public Document Room, 1717 H Street, N. W., Washington, D. C. 20555, and at the Swem Library, College of William and Mary, Williamsburg, Virginia, (1) licensee's submittal of April 4, 1978, (2) Orders for Modification of License dated April 1, 1977, August 17, 1977 and October 8, 1977, (3) this Order for Modification of License, In the Matter of Virginia Electric and Power Company, Surry Power

Station, Unit No. 2, Docket No. 50-281, and (4) the Commission's concurrently issued Safety Evaluation supporting this Order*.

III.

Accordingly, pursuant to the Atomic Energy Act of 1954, as amended, and the Commission's Rules and Regulations in 10 CFR Parts 2 and 50, IT IS ORDERED THAT Facility Operating License No. DPR-37 is hereby amended by replacing in its entirety existing paragraph 3.E. of the license with the following:

E. Steam Generator Inspection

(1) Unit No. 2 shall be brought to the cold shutdown condition in order to perform an inspection of the steam generators within six months of equivalent operation from April 7, 1978.

Nuclear Regulatory Commission approval shall be obtained before resuming power oepration following this inspection.

Equivalent operation is defined as operation with the reactor coolant at or above 350°F.

*A copy of items idenified in (2), (3) and (4) may be obtained upon request addressed to the U. S. Nuclear Regulatory Commission, Washington, D. C. 20555, Attention: Director, Division of Operating reactors.

(2) Reactor coolant leakage from the reactor coolant system (RCS) to the secondary system (SS) through the steam generator tubes shall be limited to 0.3 gpm per steam generator, as described in the NRC Safety Evaluation of April 1, 1977. With any steam generator tube leakage greater than this limit the reactor shall be brought to the cold shutdown condition within 24 hours. Nuclear Regulatory Commission approval shall be obtained before resuming reactor operation.

(3) Reactor operation will be terminated if RCS to SS leakage which is attributable to 2 or more steam generator tubes occurs during a 20 day period. Nuclear Regulatory Commission approval shall be obtained before resuming reactor operation.

(4) The concentration of radioiodine in the reactor coolant shall be limited to 1 μCi/gram during normal operation and to 10 μCi/gram during power transients as defined in Appendix A-1 to the

Technical Specifications of the license. Appendix A-1 was issued with the April 1, 1977 Order and shall remain in effect for six equivalent months from April 7, 1978.

FOR THE NUCLEAR REGULATORY COMMISISON

Victor Stello, Jr., Director
Division of Operating Reactors
Office of Nuclear Reactor Regulation

Dated at Bethesda, Maryland
this 7th day of April 1978.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING ORDER FOR MODIFICATION OF LICENSE

VIRGINIA ELECTRIC AND POWER COMPANY

SURRY POWER STATION UNIT NO. 2

DOCKET NO. 50-281

INTRODUCTION

By letter dated April 4, 1978, as supplemented April 6, 1978, Virginia Electric and Power Company (VEPCO) submitted the results of the steam generator tube inspection performed at Surry Unit No. 2 during March 1978, including the plugging criteria implemented for the three steam generators. Based on these inspection results, the implemented plugging patterns and previously submitted ECCS analysis, VEPCO concluded that the facility can be returned to operation for another six (6) equivalent months.

Surry Unit No. 2 has been operating under an October 8, 1977 NRC Order for Modification of Facility Operating License No. DPR-37. As one of the conditions of this Order, the steam generator shall be inspected on or before the expiration date of the Order and NRC approval shall be obtained prior to resuming power operation. However, due to a reactor coolant to secondary leak with a leak rate approaching the 0.3 gpm limit and because of scheduling considerations the licensee elected to shutdown the unit earlier and to perform the required inspection of the steam generators approximately one month prior to the end of the authorized period of operation.

DISCUSSION AND EVALUATION

Inspection Program

The steam generator tube inspection program performed during this shutdown was almost entirely devoted to assessing the conditions associated with the "denting" problem. Tube gauging was done in all three steam generators in order to assess the extent and pattern of tube denting. On the hot leg side, all tubes near the tube lane which are predicted to be bounded by the 15% hoop strain contour were gauged. Based on previous leaker history at Surry Unit No. 2 and at similar units, as well as previous gauging results, the gauging program also included wedge and patch plate regions. Additionally, the gauging was performed two rows or columns beyond any tube restricting

a 0.650" probe in the tube lane and wedge regions, and two tubes on either side of a tube that did not allow passage of the 0.650" probe in the patch plate region. Gauging was also performed on cold leg tubes in all three steam generators in conjunction with the U-bend inspection program conducted from the cold leg side. In addition to the tube gauging and U-bend inspection, handhole inspections were performed on the visible tube support plates in all steam generators.

Results of Inspection and Corrective Action

At the time the unit was shut down it was operating with approximately a 0.25 gpm reactor coolant to secondary leak rate. Over the past five months of operation, three tube leaks associated with the denting phenomena occurred in the tube lane and wedge regions. The tube responsible for the 0.25 gpm reactor coolant to secondary leak rate was found to be located at R10C91 in steam generator B. Two other tubes, location R28C10 in steam generator A and R4C35 in steam generator C, were found to be leaking at such slow rates that they could not be detected by chemical analysis. These three tubes and all surrounding tubes have been plugged.

Gauging results indicate that any tube near the tube lane which restricted the 0.650" probe was within the 15% hoop strain contour. In addition, tubes restricting either the 0.610" or 0.540" probes were witin the 17.5% hoop strain contour boundary. The number of tubes in the tube lane region that would not allow passage of the 0.540" probe were as follows: 1 in steam generator A, 3 in steam generator B and none in steam generator C. All of these tubes have been plugged. Activity was also noted in wedge and patch plate areas consistent with previous experience at other units. All indicated cold leg tube restrictions fell within the strain contour maps for the cold leg side. The implementation of the pugging criteria discussed below combined with previous plugging for various causes, resulted in a total of approximately 20.8% of the tubes being plugged.

The handhole inspections revealed that the conditions of the visible support plates had not changed since previous inspections. Full flow slot closure and "islanding" were observed during this inspection as in previous ones. No new phenomena were observed.

The gauging program performed at Surry Unit 2 was essentially the same as the programs performed at Surry Unit No. 1 and Turkey Point Unit Nos. 3 and 4.

This program varied from those performed previously in that the 15% tube hoop strain contour was used to define the gauging boundary. Initially the 12.5% strain boundary was used. After two initial inspections and three reinspections of the Surry plants, plant specific information indicates the conservatism of the 12.5% boundary and the adequacy of the 15% boundary. That is, the majority of the tubes inspected do not restrict the 0.650" probe. In addition, all tubes restricting the 0.610" or 0.540" probe have all fallen well within the inspection boundary including the 15% strain boundary. This is significant since the 0.610" and the 0.540" restricted tubes form the basis for the plugging patterns in the tubelane region. Furthermore, the following additional conservatisms were utilized in determining the Surry 2 inspection boundary:

1. The 15% strain boundary indicated by the finite element model at 11.5 EFPM beyond full closure was used. The plant is currently at approximately 9 EFPM beyond full closure.

2. In the flow slot area it is estimated that the 15% strain boundary at 11.5 EFPM beyond full closure extends to approximately the 9th row. The inspection boundary for this inspection extended to the 12th row in order to be consistent with previous inspection plans.

3. When a restricted tube was found close to the inspection boundary, the inspection was expanded in that area.

These gauging programs have been developed over the course of time in consultation with the NRC staff and have been determined to be acceptable to us. The inspection of the Unit No. 2 steam generators has demonstrated that the tube degradation which has occurred to date is similar has to that experienced at Surry Unit No. 1 and Turkey Point Unit Nos. 3 and 4. Furthermore, the results of this inspection at Surry Unit No. 2 indicates that no unexpected degradation is occurring and no new phenomenon was uncovered.

Plugging Criteria

The plugging criteria implemented by the licensee are essentially the same as those used at other units with similarly degraded steam generator conditions. As in the previously accepted plugging criteria; e.g., those discussed in the SER attached to the Order of October 8, 1977, VEPCO has performed preventive plugging based on the projected growth of the critical tube hoop strain contours predicted by the finite element analysis. This same approach has been used to establish the extent of preventive plugging necessary for continued operation of Surry Unit No. 1 and Turkey Point Unit Nos. 3 and 4.

The progression of strain contours over the intended operating period is utilized to preventively plug beyond a tube which does not allow passage of a 0.540" probe. Initially, the 15% strain contour was chosen when limited plant specific data was available and the strain contour lines indicated by finite element analysis fell close together on the plots. A review of the relationship between the 0.540" restricted tubes at Surry 2 at this time and the finite element analysis strain contours at 8.5 EFPM beyond full closure indicates that the 17.5% strain contour more realistically estimates the boundary of 0.540" restricted tubes. Also the movement of the 17.5% strain contour over the next period of operation in the central tubelane region is less than two rows in six months.

The preventive plugging pattern bounds those tubes which may be anticipated to attain the level of strain which could lead to stress corrosion cracking during the next period of operation. The preventive plugging conducted by the licensee during the current outage justifies operation of the Surry Unit No. 2 steam generators for an additional six (6) equivalent months.

ENVIRONMENTAL CONSIDERATION

We have determined that the Order to which this SER is attached does not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that the order involves an action which is insignificant from the standpoint of environmental impact and, pursuant to 10 CFR 51.5(d)(4), that an environmental impact statement, or negative declaration and environmental impact appraisal need not be prepared in conection with the issuance of this order.

CONCLUSION

Our Safety Evaluation Report attached to Amendment No. 27 dated August 16, 1977, to Operating License DPR-31 for Turkey Point Unit No. 3, evaluated the background information concerning "denting" of steam generator tubes which has been experienced at Surry Unit Nos. 1 and 2 and Turkey Point Unit Nos. 3 and 4. This background information is incorporated in this safety evaluation by reference. This safety evaluation discusses the additional information developed during the recent inspection of Surry Unit No. 2 in March 1978 and reported in the licensee's submittal dated April 4, 1978 as supplemented April 6, 1978.

We have concluded based on the considerations discussed above, that: (1) Surry Unit No. 2 may be operated for an additional six (6) equivalent months under the restrictions delineated in the Order to which this SER is attached. At the end of this period the facility is to be shut down, the steam generators are to be reprobed to determine the extent and pattern of additional tube denting and the results of this gauging program are to be submitted to the NRC staff for review and evaluation prior to the resumption of power operation, (2) because the attached Order does not involve a significant increase in the probability or consequences of accidents previously considered and does not involve a significant decrease in a safety margin, the Order does not involve a significant hazards consideration, (3) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner,and (4) such activities will be conducted in compliance with the Commission's regulations and the issuance of this Order will not be inimical to the common defense and security or to the health and safety of the public.

Date: April 7, 1978