

August 24, 1977

Dockets Nos. 50-280  
and 50-281

Virginia Electric and 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 August 24, 1977, issued by the Commission for the Surry Power Station Units Nos. 1 and 2. This Order supplements our Order issued August 24, 1977 and amends Facility Operating Licenses DPR-32 and DPR-37. This Order provides additional details concerning our authorization of the installation of flow limiting orifices in the discharge side of the recirculation spray pumps that are located outside of containment. This Order also requires submittal of additional information as described and scheduled in your letter of August 25, 1977.

A copy of the Order is being filed with the Office of the Federal Register for publication.

Sincerely,

*Original signed by*

Robert W. Reid, Chief  
Operating Reactors Branch #4  
Division of Operating Reactors

Enclosure:  
Order for Modification  
of License

cc w/enclosure: See next page

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| OFFICE >  | ORB#4: DOR   | C-ORB#4: DOR | AD-PS-DSS-A | AD-OR: DOR | D: DOR   | NRC     |
| SURNAME > | MFairtile:rm | RReid        | RTedesco    | KRGoller   | VStellto | EGCase  |
| DATE >    | 8/26/77      | 8/26/77      | 8/26/77     | 8/26/77    | 8/26/77  | 8/26/77 |

Virginia Electric & Power Company

cc w/enclosure(s):

Michael W. Maupin, Esq.  
Hunton, Williams, Gay & Gibson  
P. O. Box 1535  
Richmond, Virginia 23213

Swem Library  
College of William & Mary  
Williamsburg, Virginia 23185

Mr. Sherlock Holmes, Chairman  
Board of Supervisors of Surry County  
Surry County Courthouse  
Surry, Virginia 23683

Chief, Energy Systems  
Analyses Branch (AW-459)  
Office of Radiation Programs  
U. S. Environmental Protection Agency  
Room 645, East Tower  
401 M Street, S.W.  
Washington, D.C. 20460

U. S. Environmental Protection Agency  
Region III Office  
ATTN: EIS COORDINATOR  
Curtis Building (Sixth Floor)  
6th and Walnut Streets  
Philadelphia, Pennsylvania 19106

Mr. James C. Dunstan  
State Corporation Commission  
Commonwealth of Virginia  
Blandon Building  
Richmond, Virginia 23209

cc w/enclosures and incoming  
dtd: 8/24 & 8/25/77  
Commonwealth of Virginia  
Council on the Environment  
903 9th Street Office Building  
Richmond, Virginia 23219

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

In the Matter of )  
VIRGINIA ELECTRIC AND POWER COMPANY ) Dockets Nos. 50-280  
Surry Power Station, Units Nos. 1 and 2 ) and 50-281

ORDER FOR MODIFICATION OF LICENSE

I.

Virginia Electric and Power Company (the Licensee), is the holder of Facility Operating Licenses Nos. DPR-32 and DPR-37 which authorizes the operation of two nuclear power reactors known as Surry Power Station, Units Nos. 1 and 2 (the facility) at steady state reactor power levels not in excess of 2441 thermal megawatts (rated power). The reactors are pressurized water reactors (PWR) located at the Licensee's site in Surry County, Virginia.

II.

By letter dated August 24, 1977, the Commission authorized the Licensee to install flow-limiting orifices in the discharge of the outside recirculation spray pumps for the facility. In addition, the Commission ordered the following limits on operating parameters for the facility effective August 24, 1977:

|   |  |
|---|--|
| Service Water Temperature                   | 55°F to 85°F   |
| Containment Temperature                     | 100°F - 125°F  |
| Containment Air Partial<br>Maximum Pressure | 9.3 PSIA at 85°F<br>service water temperature<br>and 45°F RWST temperature.<br>This value will vary in a<br>manner similar to existing<br>Technical Specification 3.8. |

This Order is supplementary and confirmatory to the August 24, 1977 Order and provides the bases, as follows, for our actions.

As a result of the ongoing operating license review of the North Anna Station it appeared that the net positive suction head (NPSH) available to the containment recirculation spray pumps might be insufficient for the post loss-of-coolant accident (LOCA) operation of the recirculation spray system. A review of this matter for the North Anna Station is being conducted by the staff. The Surry Station Units Nos. 1 and 2 are operating plants with a design similar to North Anna.

To determine whether a similar problem may exist at Surry, we requested that the licensee and their architect/engineer, Stone and Webster, meet with the staff on August 19, 1977.

At the meeting held on August 19, 1977 and reported in their letter dated August 20, 1977, VEPCO and their architect engineer, Stone and Webster, reported that they have reanalyzed the containment pressure transient response and associated available NPSH in the recirculation cooling pumps. This reanalysis was performed using new considerations in the overall thermodynamic model. The new modeling assumptions minimize the calculated containment pressure and maximizes the containment sump water temperature, thereby minimizing the NPSH. Information was provided from the pump manufacturer which concluded that the pumps would continue to pump reliably at the minimum NPSH available however at reduced flow.

All four recirculation spray pumps were determined to be operable through recent tests. Considering reduced flow, but with all four pumps in service, the containment would depressurize in less than one hour, meeting the original design requirements. The licensee agreed not to remove any of these pumps from service prior to August 24, 1977 and to submit additional information by August 24, 1977 to justify continued operation beyond August 24, 1977. Based on the short time involved, and the availability of all four recirculation spray pumps the staff concluded that continued operation until August 24, 1977 would not pose an undue threat to the health and safety of the public.

The staff met with the licensee on August 24, 1977, to discuss the above cited submittal. Based on the staff's review of the licensee's submittal and on the discussions cited above, the staff found the licensee's proposed modifications and accompanying restrictions acceptable to permit continued operation. While such continued operation was authorized without requiring that all four recirculation spray pumps be continually available for use, the staff concluded that installation of orifices on two of the pumps, as authorized by the August 24 letter, and imposition of the restrictions ordered by that letter, would provide reasonable assurance that continued plant operation would not pose an undue threat to the health and safety of the public. Additional assurance was provided by the test results discussed below.

The calculated pressure of the containment and the temperature of the water that accumulates in the containment sump are important parameters in determining recirculation spray pump operability following a LOCA with regard to available NPSH. These terms in combination with the pump static head and associated line losses establish available NPSH during the transient.

At the meeting held on August 24, 1977 and in their letter dated August 24, 1977, VEPCO presented a pump performance curve of the minimum NPSH required to prevent cavitation as a function of flow rate. The curve is based on tests performed on August 22, 1977, with a North Anna Unit No. 2 recirculation spray pump, which is the same model as installed in the Surry Units Nos. 1 and 2. Test results preliminarily reported by the licensee indicate that the pumps can be operated in the cavitating mode, though with loss of performance (flow rate and developed head), for periods of time significantly longer than potential periods of cavitation calculated for Surry, without damage to the pump. For a flow rate of 3300 gpm as assumed in the containment depressurization analyses, the minimum required NPSH is approximately 10.2 feet. The specified NPSH of the pump is 15 feet.

Using the new modeling assumptions an available NPSH of greater than 11 feet is calculated for the two recirculation pumps inside containment, except for the time from 700 seconds to 2100 seconds after the postulated accident. This NPSH assures satisfactory pump operation. During the 700 to 2100 second time interval the available NPSH reaches a minimum of 8.4 feet and the pump could potentially operate in a cavitating mode for about 23 minutes with a reduced flow rate of 3000 gpm.

For the two recirculation pumps located outside containment the friction losses in the suction piping are substantially larger and therefore result in a smaller available NPSH. To assure satisfactory pump operation the licensee has installed a flow limiting orifice, in discharge, reducing the flow to 2000 gpm with a required NPSH of approximately 6.4 feet compared to an available NPSH of 7.3 feet. This flow reduction assures continued pump operation without cavitation.

On the basis of the above flow as input to the containment response calculation, the licensee stated that the containment spray system pumps will still adequately function and the containment depressurization time requirements are not exceeded for the design basis LOCA.

While we have not been provided with the details of the recent analyses for our review, we believe that the results appear reasonable and are acceptable until additional details have been provided.

The analyses summarized above for plant operations with flow restricting orifices in the discharge piping of the outside recirculation pumps indicate that additional information is required on certain plant operating parameters. These information requirements are given in Section III of this Order.

The licensee has also committed to provide additional detailed analyses to further confirm the operability of the recirculation spray pumps and low head safety injection pumps during potential cavitating modes and to develop a permanent solution eliminating pump operation in a cavitating mode. At the August 24, 1977 meeting the licensee stated that he concluded there was still adequate NPSH margin for the low head safety injection pumping system, a part of the ECCS, while operating in the recirculation mode. Confirmatory calculations are to be provided in subsequent discussions, and as stated in Section III of this Order.

Based on the discussions at our meeting with the licensee on August 19 and 24, 1977 and on their submittals of August 20 and 24, 1977, we conclude, due to the ability of the containment recirculation spray pumps to operate under very adverse NPSH conditions, that operation of Surry Units Nos. 1 and 2, with the modifications detailed above, and until permanent modifications are implemented, will not pose an undue threat to the health and safety of the public.

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) Letters from licensee dated August 20, 1977, August 24, 1977 and August 25, 1977, (2) NRC letter dated August 24, 1977, and (3) This Order for Modification of License, In the Matter of Virginia Electric and Power Company, Surry Power Station Units Nos. 1 and 2, Dockets Nos. 50-280 and 50-281.

### 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 Licenses Nos. DPR-32 and DPR-37 are hereby amended by adding the following new provisions:

1. The Licensee shall submit by August 29, 1977 an interim evaluation concerning the performance of the low head safety injection pumps.



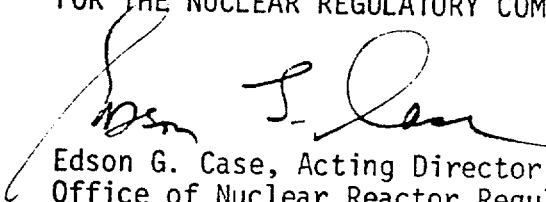
2. The Licensee shall submit by September 12, 1977, the following additional information:
  - a. Analyses of the low head safety injection pump performance including input from the pump manufacturer.
  - b. The net positive suction head time-history for the inside and outside recirculation spray pumps and the low head safety injection pumps for all modes of operation.
  - c. Inspection results of the tests which were conducted on the North Anna recirculation spray pump with additional information on the similarity of the North Anna pump to the Surry pumps.
  - d. A description of the bases for the acceptability of operation for these pumps in the cavitating mode.
3. The Licensee shall submit within 90 days from August 24, 1977, their plans and schedules for implementing any required modifications.
4. In order to demonstrate that condition 2.b is complied with the analysis shall include the following containment cooling conditions:
  - a. full containment cooling (i.e., two quench spray pumps and four recirculation spray pumps);
  - b. minimum containment cooling (i.e., one diesel generator operating);
  - c. single failure of a recirculation spray pump; and
  - d. single failure of a quench spray pump.

For each analysis, curves shall be provided to show the responses of containment total pressure, containment vapor pressure, available NPSH, sump water level, and sump water vapor pressure.

Analyze the available NPSH for smaller break sizes in the hot leg and cold leg to demonstrate that the conditions of break location and size which result in the lowest available NPSH have been determined. Provide the mass and energy release rates as a function of time throughout the blowdown, reflood, and post reflood phases.

For each analysis, specify the containment evaluation parameters in a manner similar to that previously reported in your letter dated August 24, 1977. Also, provide a description of the recirculation spray heat exchanger characteristics; e.g., UA and type, parallel flow/counter flow.

FOR THE NUCLEAR REGULATORY COMMISSION



Edson G. Case, Acting Director  
Office of Nuclear Reactor Regulation

Dated in Bethesda, Maryland  
this 24th day of August 1977.