# UNITED STATES OF AMERICA

### NUCLEAR REGULATORY COMMISSION

In the Matter of

Virginia Electric and Power Company (Surry Power Station, Unit No. 2) Docket No. 50-281

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### ORDER

Ι.

The Virginia Electric and Power Company (the licensee) is the holder of Facility Operating License No. DPR-37 which authorizes operation of the Surry Power Station, Unit No. 2 at power levels up to 2441 megawatts thermal (rated power). The facility, which is located at the licensee's site in Surry County, Virginia, is a pressurized water reactor used for the commercial generation of electricity.

## II.

Secause certain safety related piping systems at the facility had been designed and analyzed with a computer code which summed earthquake loads algebraically, the potential existed for compromising the basic defense-indepth provided by redundant safety systems in the event of an earthquake. This potential compromising resulted from the possibility that an earthquake of the type for which the plant must be designed could cause a pipe rupture as well as degrade the emergency cooling system designed to mitigate such an accident. Therefore, by Order of the Director of Nuclear Reactor Regulation (the Director) for the Nuclear Regulatory Commission (NRC), dated March 13, 1979 (44 FR 16512, March 19, 1979), the licensee was ordered to show cause:

- Why the licensee should not reanalyze the facility piping systems for seismic loads on all potentially affected safety systems using an appropriate piping analysis computer code which does not combine loads algebraically;
- (2) Why the licensee should not make any modifications to the facility piping systems indicated by such reanalysis to be necessary; and
- (3) Why facility operation should not be suspended pending such reanalysis and completion of any required modifications.

In view of the importance to safety of this matter, the Order was made immediately effective and the facility was required to be placed in the cold shutdown condition and remain in that mode until further Order of the Commission.

#### III.

The facility is currently in the cold shutdown condition. Pursuant to the March 13, 1979 Order, the licensee filed a written answer to the Order by letter dated April 2, 1979. In this response the licensee stated that it is reanalyzing all potentially affected safety systems for seismic loads using an appropriate method which does not sum loads algebraically. By letters dated February 22 and March 21, 1980, the licensee requested the startup of Surry Power Station, Unit 2. This request is based on the completion of all pipe stress reanalysis and all resulting modifications installed prior to startup for all stress problems originally run on the SHOCK 2 computer program.

Technical Support for these conclusions is provided in the "Report of the Reanalysis of Safety-Related Piping Systems, Surry Power Station, Unit 2" dated February 22, 1980 and the references contained therein.

The licensee's analyses were performed using the NUPIPE computer code, which combines stresses in a manner acceptable to the NRC staff. The reanalyses resulted in the calculation of some stresses above allowable. In these cases, the licensee recalculated the stresses using soil structure interaction (SSI) methodology with a 50 percent increase in the inertia forces which the staff required to be applied to each pipe run after computer calculation of stress and support loads. This methodology with a 50 percent increase was approved by the NRC staff in its letter dated May 25, 1979. In those cases when stresses on the piping from the calculations using SSI indicated that support loadings were above original design values, the licensee was required to reanalyze the support.

The licensee reanalyzed 62 pipe stress problems which required reanalysis as a result of the March 13, 1979 Show Cause Order. Seventeen problems required hardware modifications. Of these 17 problems, seven required modifications to supports as a result of seismic overstresses. Other

- 3 -

modifications were required because of verification of "as-built" conditions, thermal stresses, and modeling differences. The licensee has also evaluated 482 pipe supports inside containment. Of these supports, 165 required modifications, and about half of these modifications were because of significant load increases. The other modifications resulted from as-built conditions.

The 'IRC staff has reviewed the licensee's submittals. This review included, among other things, an evaluation of the codes which compute pipe stresses resulting from the facility's response to an earthquake. The means by which piping responses are combined in the codes that are currently a basis for the facility design are summarized below:

# NUPIPE

This code combines intramodal\* responses by a modified the square root of the sum of the squares (SRSS) and combines intermodal\* responses by SRSS or absolute sum for closely spaced modes.

The NRC staff has determined that an algebraic summation of responses was not incorporated into the NUPIPE code. The NRC staff has further concluded that this code provides an acceptable basis for analyzing the facility piping design.

Based on the attached NRC Staff's Safety Evaluation, the staff finds the piping affected by the March 13, 1979 Show Cause Order and all piping supports inside containment have been acceptably reanalyzed.

Floces are defined as dynamic piping deflections at a given frequency. Intramodal responses are the components of force, moment and deflection within a mode. Intermodal responses are the components of force, romant and deflection of all modes.



- 4 -

Out of a total of 220 supports outside containment, all have been evaluated. Of these 220 supports, 81 require modification. All modifications will be completed prior to startup.

The licensee will have completed the actions required by the Order to Show Cause dated March 13, 1979 prior to startup and this Order supercedes the March 13, 1979 Order.

The licensee's answer to the Order did not request a hearing nor did any other person request a hearing.

IV.

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 DETERMINED THAT: The public health, interest or safety does not require the continued shutdown of the facility, AND IT IS HEREBY ORDERED THAT:

- Effective this date the suspension of facility operation required by the Order to Show Cause of March 13, 1979 is lifted.
- All modifications to correct piping system overstress shall be completed prior to startup.

FOR THE NUCLEAR REGULATORY COMMISSION

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

Dated at Bethesda, Maryland this 26th day of March, 1980. - 5 -