



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20565-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 199 AND 180 TO

FACILITY OPERATING LICENSE NOS. NPF-4 AND NPF-7

VIRGINIA ELECTRIC AND POWER COMPANY

OLD DOMINION ELECTRIC COOPERATIVE

1.0 INTRODUCTION

By letter dated September 19, 1995, Virginia Electric and Power Company (VEPCO), the licensee, requested changes to the Technical Specifications (TS) for North Anna Nuclear Power Plant, Units 1 and 2. The proposed changes would revise the maximum allowable power range neutron flux high setpoints for operation with inoperable Main Steam Safety Valves (MSSV). This modification of the TS has been proposed by the licensee, specifically, to address the concern expressed by the vendor, the Westinghouse Electric Corporation (Westinghouse), in its Nuclear Safety Advisory Letter, NSAL-94-001, "Operation at Reduced Power Levels with Inoperable Main Steam Safety Valves," issued on January 20, 1994.

2.0 EVALUATION

Westinghouse identified a potential concern in its NSAL-94-001 regarding plant operation within the limits established in the TS. Table 3.7-1 of the TS allows the plant to operate at reduced power levels with a reduced number of operable MSSVs. Westinghouse identified that the current method used for reducing the neutron flux high trip setpoints was potentially inadequate for protecting the main steam system from an overpressure condition following certain design transients. In particular, the assumption that the maximum allowable initial power level is a linear function of the available MSSV relief capacity was determined invalid by Westinghouse. The vendor further noted that, although it has not been shown directly that the reduced neutron flux high trip setpoints generated by this assumption would result in an overpressure condition of the main steam system, the potential exists due to the non-conservative nature of the assumption.

Five MSSVs are provided for each steam generator in North Anna (3 loop plant), and are designed to protect the integrity of the main steam piping from overpressurization. In the event one or more MSSVs are inoperable, the Reactor Protection System power range neutron flux high trip setpoints are reduced to ensure that the Main Steam System is not overpressurized as a result of various transients. A detailed analysis performed for a Loss of Load/Turbine Trip (LOL/TT), the bounding transient, as part of the North Anna Updated Final Safety Analysis Report (UFSAR) Chapter 15 for a full power condition with all MSSVs operable, determined that no overpressure condition would occur. The LOL/TT event was analyzed in the UFSAR to show that core

protection margins (e.g., DNBR) are maintained, the Reactor Coolant System (RCS) will not overpressurize, and the main steam system will not overpressurize.

The secondary side overpressure protection is provided by actuation of the MSSVs, which are designed to relieve at least full power nominal steam flow. The UFSAR analysis verifies that the MSSVs capacity is sufficient to prevent secondary side pressure from exceeding 110 percent of the design pressure. It should be noted, however, that the UFSAR analyzes the LOL/TT transient only from the full power initial condition, with cases examining the effects of assuming primary side pressure control and different reactivity feedback conditions. With fully operational MSSVs, it can be demonstrated that overpressure protection is provided for all initial power levels. TS Table 3.7-1 allows operation with a reduced number of operable MSSVs at a reduced power level as determined by resetting the power range neutron flux high trip setpoints. This TS requirement was not based upon a detailed analysis, but as mentioned earlier, was based upon the assumption that the maximum allowable initial power level is a linear function of the available MSSV relief capacity. Thus, a subsequent detailed analysis for the LOL/TT event for individual cases of inoperable MSSVs was not performed at that time since the original full power analysis was determined to bound such an event. Westinghouse has determined that the assumption that a linearly reduced neutron flux high trip setpoint would limit the heat addition rate below the removal capacity of the remaining operable MSSVs is not valid, and is non-conservative. Therefore, the licensee performed new calculations, as recommended by NSAL-94-001, to support the proposed conservative setpoints. In lieu of a detailed analysis using the TS Table 3.7-1 power range neutron flux setpoint trip values to determine whether a true overpressure condition would result with one or more MSSVs inoperable, calculations were performed by the licensee such that the maximum power level allowed for operation with inoperable MSSVs is below the heat removing capability of the operable MSSVs. This calculation is based upon Westinghouse's recommendation, and represents the conservative methodology by setting the power range neutron flux high setpoint to this level, thus ensuring that the actual power level cannot exceed this value.

Furthermore, the information in Table 3.7-1 and the Limiting Condition for Operation Action Statement associated with the two loop operation have been deleted from the TS since the licensee is prohibited by the license from operating in this configuration.

In order to calculate the new setpoints, the governing equation is the relationship:  $q = M \times H_{fg}$ , where  $q$  is the heat input from the primary side,  $M$  is the steam flow rate, and  $H_{fg}$  is the heat of the vaporization at the steam relief pressure. Therefore, the equation used in defining the revised TS Table 3.7-1 setpoint values is:

$$H_i = \frac{(W_q \times H_{fg} \times N)}{K} \times \frac{100}{Q}$$

Where:

$H_i$  = Safety analysis power range high neutron flux setpoint (percent)

- Q = Nominal NSSS power rating of the plant (including reactor coolant pump heat, Mwt)  
 K = Conversion factor, 947.82 (Btu/sec)/Mwt  
 Wg = Minimum total steam flow rate capability of the operable MSSVs on any one steam generator at the highest MSSV operating pressure including tolerance and accumulation, as appropriate (lbm/sec)  
 Hfg = Heat of vaporization for steam at the highest MSSV opening pressure including tolerance and accumulation, as appropriate (Btu/lbm)  
 N = Number of loops in plant

The resulting values calculated from this equation were reduced by 9% power to account for instrument and channel uncertainties. With the revised values, the maximum plant operating power level would be lower than the reactor protection system setpoint by an appropriate operating margin. These revised values, by the use of the above equation, resolves the issue identified by the NSAL-94-001 by enabling the licensee to re-calculate and establish more restrictive power range neutron flux high setpoints as listed in the proposed changes in TS Table 3.7-1.

### 3.0 SPECIFIC CHANGES TO THE TS

The following specific TS changes apply to both Units 1 and 2:

Change Section 3.7.1.1, "Limiting Condition for Operation" Action Item "a" by deleting "With 3 reactor coolant loops and associated steam generators in operation and" and begin the sentence by capitalizing "With".

Delete the following Section 3.7.1.1, "Limiting Condition for Operation" Action Item "b" :

"With 2 reactor coolant loops and associated steam generators in operation and with one or more main steam line code safety valves associated with an operating loop inoperable, operation in MODES 1,2, and 3 may proceed provided, that within 4 hours, either the inoperable valve is restored to OPERABLE status or the Power Range Neutron Flux High Setpoint trip is reduced per Table 3.7-1; otherwise, be in at least HOT TANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours."

Change Section 3.7.1.1, "Limiting Condition for Operation" Action Item "c" to Action Item "b".

The following changes were made to Table 3.7-1:

- Delete "During 3 Loop Operation" from title of table
- Change the Maximum Allowable Power Range Neutron Flux High Setpoint (Percent of RATED THERMAL POWER) for one inoperable safety valve in Table 3.7-1 from "87" to "52"
- Change the Maximum Allowable Power Range Neutron Flux High Setpoint (Percent of RATED THERMAL POWER) for two inoperable safety valves in Table 3.7-1 from "65" to "37"
- Change the Maximum Allowable Power Range Neutron Flux High Setpoint



(Percent of RATED THERMAL POWER) for three inoperable safety valves in Table 3.7-1 from "44" to "21"

- Delete all information which discusses two Loop Operation

In addition to the above changes, the licensee proposed to change the relevant TS Bases in order to be consistent with the proposed TS changes.

Based on the above evaluation, the staff has concluded that the proposed reactor trip setpoint reductions were derived from conservative calculations such that the maximum power level allowed for operation with inoperable MSSVs is below the heat removing capability of the operable MSSVs. The conservatism of the proposed methodology was further verified by noting that the resulting setpoint values are lower than the current setpoints in the TS (see the proposed changes in the TS Table 3.7-1). Therefore, the proposed changes in the TS, and the associated Bases are acceptable.

#### 4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Virginia State official was notified of the proposed issuance of the amendment. The State official had no comment.

#### 5.0 ENVIRONMENTAL CONSIDERATION

These amendments change a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that these amendments involve no significant hazards consideration and there has been no public comment on such finding (60 FR 54724). Accordingly, these amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

#### 6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

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