



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 175 TO FACILITY OPERATING LICENSE NO. DPR-28

VERMONT YANKEE NUCLEAR POWER CORPORATION

VERMONT YANKEE NUCLEAR POWER STATION

DOCKET NO. 50-271

1.0 INTRODUCTION

By letter dated May 5, 1999, the Vermont Yankee Nuclear Power Corporation (the licensee) submitted a request to amend the Vermont Yankee Nuclear Power Station (VY) Technical Specifications (TSs). The proposed amendment would revise the TSs to enhance limiting conditions for operation and surveillance requirements relating to the standby liquid control (SLC) system and incorporate certain provisions of NRC's rule on anticipated transients without scram (ATWS) (10 CFR 50.62 or the ATWS rule). The change involves the use of enriched boron in the SLC system and improves upon other aspects of the TS for this system.

Implementation of the enriched boron option for compliance with the ATWS rule has previously been found to be acceptable by staff. In 1997, VY withdrew a similar proposed change and committed to incorporate any ATWS rule TS changes in Improved Technical Specifications (ITS). Based on the licensee's commitment, the NRC subsequently granted VY's request for withdrawal. The licensee subsequently decided to delay the implementation of the ITS conversion. Because of the delay, the licensee has decided to submit the TS change request for the staff's approval.

2.0 BACKGROUND

The SLC system is an independent reactivity control system that can be used to shut down the reactor under normal and ATWS conditions. The SLC system provides the capability to shut down the reactor from full power by the injection of a borated water solution into the reactor pressure vessel. The system is needed only in the improbable event that control rods cannot be inserted sufficiently to accomplish shutdown in a normal manner. The basic requirement for the SLC system is specified in Appendix A of 10 CFR 50 (GD 26, "Reactivity control system redundancy and capability") and paragraph (c)(4) of 10 CFR 50.62 which states, in part:

"Each boiling water reactor must have a standby liquid control system (SLCS) with the capability of injecting into the reactor pressure vessel a borated water solution at such a flow rate, level of boron concentration and boron-10 isotope enrichment, and accounting for reactor pressure vessel volume, that the resulting reactivity control is at least equivalent to that resulting from injection of 86 gallons per minute of 13 weight percent sodium pentaborate decahydrate solution at the natural boron-10 isotope abundance into a 251-inch inside diameter reactor pressure vessel for a given core design."

Equivalent reactivity control can be obtained by increasing the pump flow rate, boron concentration, or boron enrichment. VY chose to implement the enriched boron alternative to meet the Rule.

In a generic Safety Evaluation Report dated October 21, 1986, the staff approved topical report NEDE-31096P which provided the acceptable methods for complying with the ATWS rule.

3.0 EVALUATION

The 86 gpm equivalency requirement of the Rule can be met if the following relationship is satisfied:

$$\frac{Q}{86} \times \frac{M251}{M} \times \frac{C}{13} \times \frac{E}{19.8} \geq 1$$

where:

- Q= expected SLCS flow rate (gpm)
- M= mass of water in the reactor vessel and recirculation system at hot rated condition (lbs)
- C= sodium pentaborate solution concentration (weight percent)
- E= B¹⁰ isotope enrichment (19.8 percent of natural boron)
- M251= mass of water in a BWR/6 reactor vessel (lbs)

The licensee performed plant-specific calculations to verify that the SLC system complies with the ATWS rule referenced above. Using VY's specific values to satisfy the relationship given above, VY established the bases for the revised TSs. This option assumes operation of one pump and maintenance of the existing sodium pentaborate solution concentration. With the boron enriched in the B-10 isotope in the sodium pentaborate solution, and a 205-inch vessel, VY is able to meet the equivalent control capacity requirement of the Rule. The staff has determined that the licensee's proposed plant operation and boron sodium pentaborate solution concentration meet the requirements of 10 CFR 50.62(c)(4) and the proposed change is therefore acceptable.

3.1 TS 3.4, "Reactor Standby Liquid Control System" Section A Changes

The current TS 3.4.A requires that the SLC system shall be operable "during periods when fuel is in the reactor unless:" the reactor is in cold shutdown and all control rods are fully inserted and the provisions of TS 3.3.A, "Reactivity Limitations" are met. The licensee proposed changing TS 3.4.A to require that the SLC system shall be operable when the reactor mode switch is in either the "Run" or "Startup/Hot Standby" position and not in the other positions of "Shutdown" or "Refuel."

TS 3.3.A requires that the reactivity control systems be able to establish a minimum shutdown margin any time there is fuel in the core. No changes to TS 3.3.A were proposed. Because TS 3.3.A must be satisfied whenever fuel is in the core, it is unnecessary and redundant to include this specification in TS 3.4.A and the staff considers it acceptable to remove this reference.

With the reactor mode switch in "Shutdown" all rods are automatically inserted and control rods cannot be withdrawn since a control rod withdrawal block is applied. This ensures that the reactor remains subcritical. With the reactor mode switch in "Shutdown" and reactivity margins

established per the TSs, the SLC system is not needed as a backup system to shut down the reactor. With the reactor mode switch in the "Refuel" position, only a single control rod can be withdrawn from a core cell containing fuel assemblies. The provision of TS 4.3.A.1 require verification that the required shutdown margin is met prior to each in-vessel fuel movement during the refueling sequence. TS 3.12.D specifies shutdown margin requirements during control rod and control rod drive maintenance. No changes to TS 4.3.A.1 or 3.12.D were proposed. The staff finds the proposed changes to be acceptable since the SLC system is not necessary when the reactor mode switch is in the "Refuel" or "Shutdown" positions since other TS provisions ensure that the reactor will remain subcritical. In addition, the proposed TS is in agreement with the Standard Technical Specification (STS) for BWR/4.

The licensee also requested an exception to SLC system operability to allow testing of instrumentation associated with the reactor mode switch because it may be necessary to place the reactor mode switch in the "Run" or "Startup/Hot Standby" position while the reactor is actually shutdown or refueling. The licensee proposed that the SLC system need not be operable for the test if the following conditions are satisfied:

- (a) Reactor coolant temperature is less than or equal to 212 degrees F.
- (b) All control rods remain fully inserted in core cells containing one or more fuel assemblies.
- (c) No core alterations are in progress.

Under these conditions there are no credible mechanisms for unacceptable reactivity excursions which would require the operation of the SLC system. The staff finds the proposed change to be acceptable since the SLC system is not necessary when these conditions are satisfied.

3.2 TS 4.4.A.1 and TS 4.4.A.4 SLC System Surveillance Requirements Changes

The licensee proposed an editorial change from "Minimum" to "minimum." The staff finds this change to be acceptable because it does not change the technical meaning of the TS.

The current pump testing TS requirement states that a minimum flow rate of 35 gpm at 1275 psig shall be verified for each pump "by recirculating demineralized water to the test tank." The licensee proposed relocating the statement in quotation marks above to the TS bases. The staff finds this change to be acceptable since it is unnecessary to specify these testing details in the TS and remaining TS requirements adequately describe the testing required to ensure proper pump operation.

Currently, the TS also require testing the SLC system at least once during each operating cycle by initiating one of the SLC loops and verifying that a flow path from a pump to the reactor vessel is available "by pumping demineralized water into the reactor vessel." The licensee proposed relocating the statement in quotation marks above to the TS bases. The staff finds this change to be acceptable since it is unnecessary to specify these testing details in the TS and remaining TS requirements adequately describe the testing required to ensure proper SLC system operation.

3.3 TS 3.4.C and TS 4.4.C, "Liquid Poison Tank - Boron Concentration" Changes

The licensee proposed changing the title of these sections from "Liquid poison tank-Boron Concentration" to "Standby Liquid Control System Tank-Borated Solution." These are administrative changes which reflect the nomenclature currently in use by the licensee and more accurately reflect the TSs that follow the titles. The staff considers the proposed changes to be acceptable because they do not change the TS technical requirements.

3.4 New TS 3.4.C.3 and TS 4.4.C.3

The licensee proposed a new TS section which establishes the relationship among SLC system flow, concentration, and boron enrichment as discussed in section 3.0 of this evaluation. The staff considers the proposed change to be acceptable since the relationship among the parameters specified in the proposed TS complies with 10 CFR 50.62(c)(4).

The licensee also proposed a new surveillance requirement stating that the boron enrichment of the borated solution will be tested and verified once per operating cycle. Testing is necessary to verify the actual boron-10 enrichment is being used for TS 3.4.C.3. The staff considers the new TS requirement to be acceptable because the verification of the boron enrichment once per operating cycle provides reasonable assurance that the value used for boron enrichment in the TS 3.4.C.3 formula corresponds to the actual enrichment of the boron.

3.5 Conclusions

The staff has reviewed the proposed TS changes for the SLC system and has concluded that the proposed TS changes are acceptable because they ensure that the SLC system will continue to provide the required level of shutdown capability per 10 CFR 50, Appendix A, GDC 26, and ATWS conditions as per 10 CFR 50.62.

The licensee also proposed changes to the TS bases to reflect the proposed TS changes and make administrative corrections. The staff has no objection to the proposed changes.

4.0 STATE CONSULTATION

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

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in 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 the amendment involves no significant hazards consideration, and there has been no public comment on such finding (64 FR 35214). Accordingly, the amendment meets 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 amendment.

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 amendment will not be inimical to the common defense and security or to the health and safety of the public.

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Date: September 17, 1999