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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 181 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 August 18, 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 reactor core spiral reloading pattern such that it begins around a source range monitor (SRM). The offloading pattern is the reverse sequence.

Normally, VY performed a core shuffle as part of its refueling activities. However, the current TS also permits VY to perform core offload/reload. TS Section 3.12 E.3 states that if the licensee elects to conduct a spiral unload/reload, the reactor should be spirally reloaded from the center cell outwards. The licensee proposed revising the type of the spiral reload/offload to spiral around an SRM. The proposed changes also include editorial changes in the Bases meant to reflect the requested spiral offload/reload from an SRM loading pattern and other changes which delete extraneous phrases from the TSs.

2.0 EVALUATION

The licensee proposed four modifications to TS Sections 3.12 and 4.12. Limiting Condition for Operation (LCO) 3.12 E, "Extended Core Maintenance," specifies the conditions for multiple control rod withdrawal or removal. The VY TS permits both fuel reshuffle and spiral core offload/reload while operating under the extended core maintenance LCO. The following sections present the licensee's justifications for the proposed changes to LCO 3.12 and the staff's evaluation.

2.1 Substitute Spiral Reload from the Center of the Core With Spiral Reload from an SRM

Changes in this area involve changing the spiral loading type and the associated TS Bases.

Licensee's Proposal

TS LCO 3.12 states, in part, that if the licensee elects to perform a spiral unload/reload procedure during core alteration . . . , "the reactor will be reloaded from the center cell outwards, until the core is fully loaded." The licensee seeks to change this statement to, "the reactor will be spirally reloaded around an SRM until the core is fully loaded."

Licensee's Justification

The submittal pointed out that in January 1989, the NRC questioned the adequacy of the neutron flux monitoring by the SRMs during spiral reloading from the center. The issue arose during a Browns Ferry Unit 3 refueling, and in response, General Electric Nuclear Energy released rapid information communication services information letter (RICSIL) No. 039. The RICSIL explained that initially the SRMs were separated by water from the region of the core in which fuel is being loaded and the SRMs in this loading method were ineffective in monitoring the changes in the neutron flux as the fuel is loaded. The licensee stated that the current requirement for spiral loading from the center is non-conservative and should be amended.

The licensee referenced an Electric Power Research Institute (EPRI) sponsored, GE topical report issued by the Nuclear Safety Analysis Center (NSAC) division of EPRI that evaluated refueling practices. The April 1992, NSAC-164L report surveyed the refueling practices of the utilities, performed sensitivity studies of the refueling methodologies, analyzed potential refueling events, and provided recommendations for safe refueling practices. VY referred to a subsection of the NSAC-164L report titled "Neutron Monitoring," which stated, "Initiate fuel reloading adjacent to an SRM or FLC ["FLC" refers to a fuel loading chamber or dunking chamber] connected to the SRM circuitry. Offloading sequences should be reverse of the loading sequences. Loading sequences which bring all four SRMs on scale as soon as practical are recommended." The licensee pointed out that the proposed loading pattern will be consistent with the NSAC-164L report recommendation, and it will improve the core loading reactivity controls.

The licensee concluded that the proposed change from "spiral from the center of the core" to "spiral around an SRM" provides improved flux monitoring. The neutron monitoring of the SRMs will be indicative of the true flux of the loaded fuel, since there will be fewer flux traps or moderator filled cavities surrounded on all sides by fuel."

Staff Evaluation

The Browns Ferry licensee event report (LER) cited by the licensee states that, "with the spiral sequence started at the center of the vessel, the fuel array was neutronically decoupled from the SRM detectors because of the spatial separation, water inventory and control rods between the fuel and the detectors." Center spiral reloads start near the center of the core and the fuel is loaded continuously in the periphery of the fueled region.

Many licensees opt to offload the whole core and reload in order to simplify the outage and perform incore maintenance. Once the first 100 to 200 fuel bundles have been loaded into the core during a full-core reload, the core reaches a reactivity which is close to the final core reactivity. According to NSAC-164L, the potential for a reactivity event may occur during the majority of the reloading pattern. Thus, redundant neutron monitoring is essential to ensure that single failure does not lead to an inadvertent criticality. As evidenced in the Browns Ferry concern, spacing of the SRMs and the water gaps may hinder adequate neutron monitoring by the SRMs during core offload/reload refueling practice. Portable neutron monitoring can provide additional neutron monitoring. However, licensees have found that portable monitors are susceptible to failures, cabling problems and excessive noise. Reload patterns are,

therefore, designed to bring the SRMs on scale with a minimum number of bundles in the core. Spiral reload from an SRM entails loading 16 bundles around an SRM, and then loading the bundles in a continuous array up to the second SRM adjacent to the fueled region. Standard Technical Specification (STS) LCO 3.10.6, which corresponds to VY LCO 3.12, requires the use of an approved spiral reload method in order to minimize core reactivity and bring the neutron monitoring on scale early.

The proposed reload pattern has been shown to maintain the core subcritical while bringing the SRMs on scale early with minimum bundles in the core. Spiral reload from an SRM provides an improved reactivity management during refueling compared to spiral reload from the center. Therefore, the staff finds the proposed change to be acceptable and consistent with the objective of safe core management during refueling. In addition, VY's proposed request to conduct a spiral reload from an SRM is consistent with the requirement of the corresponding STS LCO.

In addition, the licensee proposed to revise the Bases 3.12/4.12 to reflect the proposed spiral reload from SRM and the corresponding offload method. The bases will provide the following description.

> "Spiral reload and unloading encompass reloading or unloading a cell on the edge of a continuous fueled region (the cell be reloaded or unloaded in any sequence.) The pattern begins (for reloading) and ends (for unloading) around a single SRM. The spiral reloading pattern is the reverse of the unloading pattern, with the exception that two diagonally adjacent bundles, which have previously accumulated exposure in-core, are placed next to each of the four SRMS before the actual spiral reloading begins. The spiral reload can be either the original configuration or a different configuration."

The licensee stated that the Bases needs to provide the description of the proposed refueling methodology. The staff finds the proposed description of the type of spiral reload/unload in the bases to be acceptable and that it provides sufficient detail.

2.2 Editorial Changes in LCO 3.12

The licensee also proposed the following editorial changes.

> In Section 3.12.B, the licensee proposed to delete the phrase " their designated," from the statement, "two diagonally adjacent fuel assemblies which previously accumulated exposure in the reactor, shall be loaded into their designated core positions next to each of the four (4) SRMs to obtain the required count of 3 cps." This step is required prior to starting the spiral reload in order to bring the SRMs on scale.
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> In addition, the licensee also proposed to delete the phrase, "Their designated," from TS Sections 3.12E3.b and Bases 3.12 B

VY stated that the phrase "their designated" could be interpreted to mean that the same fuel bundles initially used to load in the diagonally adjacent cell next to the SRMs would have to be used for the same purpose in the next cycle. The licensee states that the objective of loading

two diagonal cells next to an SRM is to ensure the SRM's operability prior to loading the core. Therefore, requiring the same fuel bundles to be used in the next cycle will be overly restrictive if bundles of similar exposure can be used instead.

The staff finds the proposed changes to be acceptable because requiring the same fuel bundles to be used in the next cycle is overly restrictive and bundles of similar exposure provide for similar neutron production thereby providing adequate indication on the SRMs.

3.0 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 comment.

4.0 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. 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 48867). 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.

5.0 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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