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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SCRAM DISCHARGE SYSTEM LEVEL INSTRUMENTATION DIVERSITY

VERMONT YANKEE NUCLEAR POWER CORPORATION

VERMONT YANKEE NUCLEAR POWER STATION

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1.0 INTRODUCTION

Following the Browns Ferry Unit 3 partial scram failure event of June 28, 1980, and failures of scram level instruments at the Brunswick and Hatch plants, the NRC staff issued a generic safety evaluation (SE) on the boiling water reactor (BWR) scram discharge system in December 1980. The report addressed the required short-term actions for interim operation as well as the needed permanent modifications to correct existing deficiencies for continued long-term operation of operating BWRs. The report further identified the safety criteria to be used in implementing the permanent system modifications. Included among them is Safety Criterion 3 which states:

> "The scram discharge system instrumentation shall be designed to provide redundancy to operate reliably under all conditions and shall not be adversely affected by hydrodynamic forces or flow characteristics."

The "acceptable compliance" section of the generic SE expanded this criterion to consider not only redundancy but also diversity to reduce the potential for common cause failures of the level instrumentation in the scram discharge system. As a followup to the issue of diverse level-sensing instrumentation for the scram discharge instrument volume (SDIV), by Generic Letter No. 81-18 dated March 30, 1981, the staff requested all operating BWR licensees to provide diversity for the SDIV level switches at their facilities. In response, Vermont Yankee Nuclear Power Corporation (the licensee for Vermont Yankee) submitted a letter dated April 14, 1981, wherein it stated its objections to providing diverse level switches for the SDIV. It contended that its operating experience with the plant SDIV had not indicated any problems with the SDIV level instruments and that the implementation of its proposed modifications to the SDV would further enhance the reliability of the scram discharge system at Vermont Yankee. Additionally, the licensee provided a submittal dated January 10, 1983 requesting changes to its plant Technical Specifications (TS) to reflect the modifications it proposed to complete during the refueling outage for Vermont Yankee in 1983 including those for the scram discharge system. The submittal discussed the bases for the proposed changes and the safety considerations involved.

The licensee completed the proposed modifications during the 1983 plant refueling outage. The staff issued License Amendment No. 76 to the facility operating license for Vermont Yankee approving the licensee's requested changes to the plant TS.

The following evaluation relating to the need for provision of diverse level instrumentation for the SDIV at Vermont Yankee is based on our review of the above-mentioned submittals. We have also reviewed the existing plant TS to determine whether additional TS changes are necessary in this regard.

2.0 EVALUATION

In its submittals, the licensee stated that its SDIV system modifications consist of the following features:

1) A separate instrument volume will be added for a total of two independent SDIVs.

2) Each SDIV will be monitored by four level transmitters. Signals from these transmitters will feed into analog to digital trip units which will provide reactor scram signals on detection of high water level in either SDIV. These analog instrument channels will replace the mechanical float instrument channels that were provided in the original SDIV design.

3) One of the transmitters from each SDIV will also feed a separate analog to digital trip unit to provide a signal to the rod withdrawal block actuations system on detection of high water level (less than that for initiation of scram function) in either SDIV.

4) Vent and drain systems will be modified so as to reduce the probability of level instrumentation failures.

In its submittals, the licensee further stated that there will be no pipe size reductions between the discharge volume header and the instrument volume, thus ensuring that all water accumulates in the independent instrument volumes. The above modifications were completed during the 1983 refueling outage.

Based on our review of the licensee's submittals, we have determined that the completed modifications to the SDIV (particularly, the installation of a second instrument volume and the provision of a total of eight level instruments, i.e., eight analog instrument channels for initiating the scram function, four for each independent SDIV) have significantly improved the reliability of the SDIV. In this context, we note that the generic SE identified the principal reason for requiring diverse level instrumentation for the SDIV to be to alleviate the potential for float crushing associated with the mechanical float level switches. The licensee has resolved our concern in this regard by replacing the mechnical float switches which were

in the original SDIV design with analog instruments. We agree with the licensee that this replacement will effectively eliminate the calibration drift and mechanical problems (such as crushed floats) resulting from hydrodynamic forces (waterhammer) associated with float switches as has been evidenced by operating experience with the analog instruments for other systems at Vermont Yankee and other nuclear power plants. Also, we expect that the overall accuracy and repeatability of the analog instrumentation will be significantly better than the instrumentation it has replaced. These advantages, along with our findings that Vermont Yankee has had no SDIV level instrumentation failures, outweigh other common cause concerns such as human error (particularly during testing) crud buildup, or manufacturing errors identified in the generic SE as secondary reasons for requiring diverse level instrumentation for the SDIV.

We have also reviewed the current plant TS which were incorporated in Amendment No. 76 to the facility operating license in order to reflect design modifications to the SDIV system completed during the 1983 refueling outage. Specifically, we reviewed the number of instrument channels required to be operable and the associated surveillance requirements for automatic initiation of various functions such as scram or rod withdrawal block on detection of high water level in either SDIV. The existing plant TS explicitly identify the addition of a second SDIV with its associated four level transmitters for initiating the scram function on detection of high water level in the second SDIV. They also include the addition of an instrument channel associated with the second SDIV for initiating control rod withdrawal block on detection of high water level (less than that required for scram function) in the second SDIV. We further note that these TS changes including the associated surveillance requirements have been previously evaluated and determined to be acceptable by the staff in an SE issued on March 28, 1983. We have, therefore, determined that the existing Vermont Yankee plant TS acceptably resolve staff concerns associated with the lack of diverse level instrumentation for the SDIV system.

3.0 CONCLUSION

Based on the above considerations, we conclude that the SDIV design modifications completed by the licensee in 1983 are sufficiently effective in reducing the overall SDIV unavailability at Vermont Yankee, such that diversification of the SDIV level switches is not necessary. We further conclude that the existing SDIV TS for Vermont Yankee are adequate and do not require further revision in this regard.

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Dated: September 10, 1985