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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR POWER STATION, UNIT 2

DOCKET NO. 50-410

INTRODUCTION:

The design of the Nine Mile Point, Unit 2 (NMP-2) downcomers is unique in that it does not provide lateral supports at the free end of the downcomers; i.e., at the bottom, the downcomers are free to move in the plane perpendicular to the downcomers. Because of the uniqueness of the unbraced downcomer design and the concern over the potential loss of structural stability before reaching the design limits, the staff performed a review of the design calculations for the downcomers and concluded that the licensee had not adequately demonstrated the design adequacy of the downcomers for the faulted condition. The licensee requested and was granted a schedular exemption to General Design Criterion (GDC) 2, Appendix A to 10 CFR Part 50 for the NMP-2 downcomers until the first refueling outage, to allow additional time to demonstrate the adequacy of the downcomer design under the plant faulted condition. The details of the staff's concerns and the evaluation of the request for a schedular exemption are contained in section 6.2.1.7.4 of Supplement 3 to the Staff Safety Evaluation Report (SSER 3) issued in July 1986.

In a letter dated May 15, 1987, as supplemented October 14, 1987 and January 12, 1988, the licensee provided a reanalysis of the downcomer design. The reanalysis included a reevaluation of the hydrodynamic loads in the suppression pool that would occur in the event of an accident. The revised hydrodynamic loads were specifically, the safety relief valve (SRV) and the condensation oscillation (CO) loads. The reanalysis also included an evaluation of the structural adequacy of the downcomers with these revised loads. The staff's evaluation of the revised hydrodynamic loads and the structural adequacy of the downcomers to withstand these loads is addressed below.

EVALUATION OF THE REVISED HYDRODYNAMIC LOADS

The "Downcomer Reanalysis Report" submitted May 15, 1987 contained a reevaluation of the SRV and the CO loads on the downcomers at NMP-2.

The changes in the computation of the SRV loads consisted of using an alternate approach which has been found acceptable to the staff. Specifically, the licensee used the methodology as described within the acceptance criteria of NUREG-0802, "Safety Relief Valve Quencher Loads: Evaluation for BWR Mark II and III Containments." The revised load calculations utilized the same model, as well as the analytical method, as

the previously accepted calculation. The only difference between the two methods was the data base that was used in the development of the prototypical pressure traces for the analyses.

The revised SRV loads used the Karlstein Test Group (KTG) test data rather than the Kernkraftwerk Brunsbuettel (KKB) traces. The KKB traces were generated from an in-plant test program using X-quenchers. The KTG test data was generated using a T-quencher. The staff has previously evaluated the use of both data bases in the development of the traces and has found that either data base is acceptable for use in a Mark II design. Specifically, the use of KTG traces in the development of SRV loads was found acceptable in NUREG-0802.

For the CO loads, the licensee also has employed an approach that has been previously found to be acceptable by the staff. The methodology used for the reanalysis has not been changed. Rather, the change has been restricted to the application of the data base. In the previous analysis, the licensee used the generic CO loads using the entire data base. This data base includes all data independent of the pool temperature at which the data were obtained. The revised loads took advantage of the plant unique pool temperature profiles for Nine Mile Point 2 and eliminated all data at pool temperatures above a conservative upper bound. The licensee demonstrated and the staff concurs that the peak calculated pool temperature would be 119°F. To provide for an appropriate margin, the licensee established an upper bound of 130°F as the cut off temperature. Data obtained at suppression pool temperatures greater than 130°F were eliminated from the data base. With the revised data base, the methodology used in the development of the CO loads was the same as the previous analysis.

The method used for the reanalysis of the CO loads, as described above, is in conformance with the acceptance criteria contained in NUREG-0808, "Mark II Containment Program Evaluation and Acceptance Criteria," and is therefore acceptable.

EVALUATION OF THE STRUCTURAL ADEQUACY OF THE DOWNCOMERS TO WITHSTAND THE PLANT FAULTED CONDITION

The downcomers are made of 304 stainless steel (SA 312 - 304) pipes, 24 inches in diameter, 30 to 45 feet in length, and 3/8 inch in thickness. These pipes are designed to ASME Code rules for Class 2 piping and are designed in accordance with staff criteria on load combinations specified in SRP Section 3.9.2. and in NUREG-0484, Rev. 1, "Methodology for Combining Dynamic Responses."

The "Downcomer Reanalysis Report" utilized the same mathematical model of the downcomer and the same analytical method, including the load combination criteria and the associated allowable stresses, as used in the original calculations. These aspects of the original analysis were found acceptable by the staff. Also, the reanalysis focused only on the faulted loading condition because the upset and emergency loading conditions were previously acceptable to the staff.

The only changes were the hydrodynamic load inputs into the downcomer stress analysis. By using these revised hydrodynamic load inputs, the licensee's calculation showed that the resulting downcomer stresses were significantly reduced. The revised maximum stress under faulted condition (including both SSE and LOCA loads) is about sixty-eight percent (68%) of the associated ASME allowable stress.

In "Downcomer Reanalysis Report" the licensee also addressed an earlier staff concern on the functional capability of the NMP-2 downcomers. In its original calculation, submitted January 23, 1986, the licensee utilized the functional capability criteria provided in the topical report NEDO-21985, "Functional Capability Criteria for Essential Mark II Piping," dated September 1978, which the staff had previously reviewed and approved. Based on the review of the analysis provided in the January 23, 1986 submittal, the staff concluded that the licensee did not adequately demonstrate the functional capability of the downcomers. Specifically, the result of the comparison to NEDO-21985 criteria was marginal and it did not have an adequate margin of safety to accommodate the uncertainties associated with the definition of hydrodynamic loading, material properties (actual wall thickness, out of roundness), imperfections in the geometrical configuration, and the method of analysis. In response to the staff's concern, the licensee reevaluated the functional capability of the NMP-2 downcomer by comparing the revised downcomer stresses to the NEDO-21985 criteria in the "Downcomer Reanalysis Report." The result showed that the revised maximum stress under faulted condition is about eighty-five percent (85%) of the NEDO-21985 criteria. The licensee, therefore, concluded that with the stress reduction, the downcomer's functional capability is adequately demonstrated and adequate safety margins exist in the present downcomer design. Based on the review of the information provided by the licensee, the staff agrees with the licensee's conclusion.

All other components within the suppression pool envelope were not included in the reanalysis. The analyses which used the previous loads are conservative and remain valid as the licensing basis for components other than the downcomers.

CONCLUSION

Based on the above evaluation, the staff finds that the revised SRV and CO loads have been calculated in full conformance with the acceptance criteria described within NUREG-0802 and NUREG-0808. Also, the temperature cutoff value used for the elimination of a portion of the data base for CO load computations represents a conservative value. Therefore, the staff finds the revised SRV and CO loads to be acceptable.

Furthermore, the staff has reviewed the reanalysis with respect to the structural adequacy of the downcomers and determined that the design of the downcomers is adequate to withstand the loads in the faulted condition and includes an adequate margin of safety to accommodate the uncertainties previously addressed by the staff in SSER 3 and discussed in the above evaluation.

PRINCIPAL CONTRIBUTORS

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