



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 158

TO FACILITY OPERATING LICENSE NO. DPR-65

NORTHEAST NUCLEAR ENERGY COMPANY, ET AL.

MILLSTONE NUCLEAR POWER STATION, UNIT NO. 2

DOCKET NO. 50-336

INTRODUCTION

By letter dated April 16, 1992, as supplemented by letter dated May 7, 1992, Northeast Nuclear Energy Company (the licensee) proposed changes to the Millstone Unit 2 Technical Specifications (TS) which would modify the existing two-region spent fuel pool design to a three-region configuration. The May 7, 1992, letter provided information that did not change the initial proposed no significant hazards consideration determination.

These changes were proposed as a result of errors discovered in the spent fuel rack criticality analysis as reported to the NRC in Licensee Event Report 92-003-00, dated March 13, 1992. These calculational errors were due primarily to the incorrect treatment of thin, highly absorbing Boraflex panels and were discovered while performing criticality reanalyses associated with the Boraflex degradation. This prompted the issuance of NRC Information Notice 92-21 and its Supplement.

Presently, Region I of the Millstone Unit 2 spent fuel pool is designed to store up to 384 fuel assemblies with an initial enrichment of up to 4.5 weight percent (w/o) U-235. Region I is comprised of five (5) rack modules and fuel assemblies can be stored in every location. The Region I racks contain Boraflex and have a nominal center-to-center distance between storage locations of 9.8 inches. Region II is designed to store up to 72 fuel assemblies which have sustained a minimum required burnup as specified in TS Figure 3.9-3. Fuel assemblies are stored in a three-out-of-four array, with blocking devices installed to prevent inadvertent placement of a fuel assembly in the fourth location. The Region II storage racks have a nominal center-to-center distance between storage locations of nine (9) inches and contain no Boraflex.

The proposed changes would result in a three-region configuration, described by alphabetic letters rather than the previous numeric convention. Region A would utilize three of the existing Region I poison rack modules. Region A is designed to store up to 224 fuel assemblies, which will be qualified for storage by verification of adequate assembly average burnup versus fuel assembly initial enrichment. Fuel assemblies can be stored in every location in Region A. These racks would be used for immediate storage of fuel discharged from the reactor. Region B would utilize the remaining two existing Region I rack modules. Region B is designed to store up to 120 fresh

(unirradiated) fuel assemblies with an initial enrichment of up to 4.5 w/o U-235 and other assemblies which do not satisfy the burnup versus initial enrichment requirements of either Region A or Region C. Fuel assemblies will be stored in a three-out-of-four array in Region B, with blocking devices installed to prevent inadvertent placement of a fuel assembly in the fourth location. Region C is the new designation for the existing Region II storage racks, designed for fuel assemblies which have sustained their design burnup. Since this group of racks do not contain Boraflex, a reanalysis due to Boraflex degradation or due to previous calculational errors was not required.

2.0 EVALUATION

On September 8, 1987, the NRC issued Information Notice No. 87-43 alerting all operating licensees that gaps had been found in the Boraflex panels of the spent fuel storage racks at Quad Cities Unit 1. In response to this, the licensee initiated blackness testing on the Boraflex panels in the Millstone Unit 2 spent fuel storage racks. To date, approximately half of the poisoned rack cells in Region I have been tested. These measurements confirmed the presence of gaps in about 16% of the irradiated panels with the largest observed gaps at a 2% shrinkage rate, resulting in a maximum gap size of approximately 2.825 inches. The licensee has, therefore, performed criticality analyses to demonstrate the safety of the storage racks accounting for gap formation.

The criticality analysis assumed 4% shrinkage resulting in 5.65-inch gaps at the observed test locations. The analysis also assumed a 4% gap formation with a random distribution in all of the other Boraflex panels. The staff considers these assumptions to be acceptable since the test data has only identified a maximum shrinkage of 2% and existing industry-wide data supports a 4% maximum shrinkage rate. In addition, the random distribution of gap formation is also supported by the licensee's test data.

The NITAWL-KENO-5a computer code package was used in a three-dimensional mode with the 27-group SCALE neutron cross section set. This model has been benchmarked against experimental data and has been found to adequately reproduce the critical values. The original calculations for the Millstone Unit 2 spent fuel pool used the DOT two-dimensional, discrete ordinates transport code with cross sections generated by the CEPAC code, a synthesis of FORM, THERMOS, and CINDER. As previously mentioned, the original calculations were found to be in error. The reactivity of the Region I spent fuel storage racks was underpredicted due to inaccuracies in predicting Boraflex absorption, thus resulting in a nonconservative analysis. A more recent analysis of the original Region I design using the NITAWL-KENO-5a package resulted in a k-eff of 0.9812, assuming fully loaded racks of 4.5 w/o fuel and not accounting for Boraflex shrinkage. This does not meet the NRC 95/95 upper limit k-eff criterion of no greater than 0.95.

The licensee has, therefore, reanalyzed the Region I rack design with NITAWL-KENO-5a assuming a three-out-of-four storage configuration (new Region B designation) with 4.5 w/o fresh fuel and 5.65-inch gaps at the locations observed in the Millstone 2 blackness tests and a random axial distribution of 5.65-inch gaps in all other Boraflex panels. The resulting maximum k_{eff} , including all appropriate biases and uncertainties, was 0.9179 for ANF fuel, 0.9252 for Westinghouse fuel, and 0.9201 for CE fuel, all well within the 0.95 limiting criterion. The calculations also assumed a conservative shrinkage of 4% in width even though such shrinkage was not evident from visible inspections of Boraflex panels.

The old Region I rack design was also reanalyzed utilizing all of the cells in a four-out-of-four cell arrangement with credit for fuel burnup (new Region A designation). The same Boraflex gap distribution assumed in the Region B analysis was used. As seen from TS Figure 3.9-4, fuel with an initial enrichment of 4.5 w/o U-235 and minimum burnup of 8670 MWD/MTU is equivalent to unirradiated fuel enriched to 3.3 w/o U-235. The resulting maximum (95/95) k_{eff} was 0.9317 for ANF fuel, 0.9381 for Westinghouse fuel, and 0.9335 for CE fuel, all within the 0.95 limiting criterion.

It is possible to postulate events, such as the inadvertent misloading of an assembly with a burnup and enrichment combination outside of the acceptable area or the placement of a fresh assembly in the fourth cell of the three-out-of-four configuration, which could lead to an increase in reactivity. However, for such events, the Double Contingency Principle allows credit for the presence of approximately 800 ppm of boron in the pool water required by TS whenever a fuel assembly is being moved in the spent fuel pool. The reduction in k_{eff} caused by the boron more than offsets the reactivity addition caused by credible accidents.

The following TS changes have been proposed as a result of the reanalysis of the Millstone Unit 2 spent fuel pool. The staff finds these changes acceptable as well as the associated Bases changes.

- (1) Definition 1.39, STORAGE PATTERN is currently defined for Region II. This is being changed to define the three-out-of-four array to be used in Regions B and C.
- (2) TS 3.9.17 is currently concerned with fuel movement over Region II racks (due to the dropped assembly accident and misplaced fuel assembly event). This is being changed from any fuel movement over the Region II racks to any fuel movement in the spent fuel pool.
- (3) TS 3.9.18 is being modified to change the wording in the surveillance requirements from Region II to Region C, and adds a surveillance requirement to ensure that fuel assemblies to be placed in Region A are within the enrichment and burnup limits of a new Figure 3.9-4.
- (4) Figure 3.9-1 is being modified to change the references from Region II to Region C.

- (5) Figure 3.9-2 is being modified to delete the references from Regions I and II and add Regions A, B, and C.
- (6) Figure 3.9-3 is being modified to change the references from Region II to Region C.
- (7) A new Figure 3.9-4 is being added to specify the allowable enrichment and burnup limits for fuel assemblies to be stored in Region A.
- (8) TS 3.9.19 is being split into two parts:
 - (a) TS 3.9.19.1 is the old TS 3.9.19, changing the references from Region II to Region C.
 - (b) TS 3.9.19.2 is a new requirement for the STORAGE PATTERN requirements of Region B.
- (9) The Design Features section for Fuel Storage Criticality and Capacity are being changed to describe the design features for the newly defined regions (A, B, and C), as well as to change the storage capacity numbers to reflect the blocked locations in Regions B and C.
- (10) The Bases sections for TS 3.9.17, 3.9.18, and 3.9.19 are being changed to reflect the changes introduced by the new spent fuel storage rack criticality design basis.

Based on the review described above, the staff finds the criticality aspects of the proposed Millstone Unit 2 spent fuel storage pool changes acceptable. Specifically, with the conservatively postulated maximum 5.65-inch gaps in all Boraflex panels, the spent fuel storage racks can safely accommodate spent fuel from Millstone Unit 2 of the burnup-enrichment combinations indicated in TS Figure 3.9-4 (Region A) or Figure 3.9-1 (Region C) using all cells in a four-out-of-four arrangement. In addition, Region B can safely accommodate fresh 4.5 w/o U-235 Millstone Unit 2 fuel in a three-out-of-four loading pattern with the fourth cell empty.

3.0 STATE CONSULTATION

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

4.0 PUBLIC COMMENTS

Ms. Patricia R. Nowicki, representing Earthvision, Inc., by letter dated May 27, 1992, requested a public hearing on this matter citing that "...it would be in the best interest of both Northeast Utilities as well the welfare of the citizens of this area that the licensee provide background information to the public as to the need for and the safety of said amendment." The staff has considered Ms. Nowicki's comments and has concluded that there is nothing in

them that would cause the staff to change the proposed no significant hazards consideration determination.

Ms. Mary Ellen Marucci of New Haven, Connecticut, by letter postmarked May 28, 1992, requested a hearing and a wish to intervene and an implied request for a 10 day delay in the issuance of the amendment citing a concern that "...there is significant unacceptable hazards risk if the spent fuel pool were to be utilized under planned conditions to occur on June 14, 1992, and that the design question of criticality calculations in that pool may not have been resolved. Also the removal of criticality monitors as allowed by the NRC in an experimental fuel consolidation program that is on-going may not have been prudent." The NRC staff has considered Ms. Marucci's comments and has concluded that there is nothing in them that would cause the staff to change the proposed no significant hazards consideration determination.

In a telephone conversation Mr. Michael Pray of New London, Connecticut, on May 28, 1992, indicated that he would file a request for a hearing. That request has not yet been received nor have Mr. Pray's comments.

5.0 FINAL NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

The Commission's regulations in 10 CFR 50.92 state that the Commission may make a final determination that the license amendment involves no significant hazards consideration if operation of the facility, in accordance with the amendment, would not:

1. Involve a significant increase in the probability or consequences of an accident previously evaluated.

Radiological consequences of the fuel handling accident are not impacted by the formation of Regions A and B because the fuel assembly design is unchanged. However, the probability of occurrence of a fuel misplacement error has increased slightly. The increase is not significant because the types of controls being put into place in Regions A and B are of the same type as already in place in Region C. Furthermore, a fuel assembly misplacement error is not considered an accident, as defined in the Final Safety Analysis Report.

2. Create the possibility of a new or different kind of accident from any previously evaluated.

No changes are being made to the fuel assemblies or the storage racks, and controls used in the fuel pool will be of the same type as are now in place. As such, there is no possibility of a new or different kind of accident being created. The existing design basis covers all possible accident scenarios in the spent fuel pool.

3. Involves a significant reduction in a margin of safety.

There is no reduction in the margin of safety since $K_{eff} \leq 0.95$ is met under all analyzed conditions using conservative assumptions which do not credit the soluble boron in the spent fuel pool except under some accident conditions, as allowed by NRC guidelines. The original mechanical analyses are unchanged for thermal and seismic/structural considerations.

Accordingly, the NRC staff concludes that the proposed amendment involves no significant hazards considerations.

6.0 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 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 made a final no significant hazards consideration determination with respect to this amendment. 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.

7.0 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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