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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 220

TO FACILITY OPERATING LICENSE NO. DPR-65

NORTHEAST NUCLEAR ENERGY COMPANY

THE CONNECTICUT LIGHT AND POWER COMPANY

THE WESTERN MASSACHUSETTS ELECTRIC COMPANY

MILLSTONE NUCLEAR POWER STATION, UNIT NO. 2

DOCKET NO. 50-336

1.0 INTRODUCTION

By letter dated August 23, 1995, the Northeast Nuclear Energy Company, et al. (the licensee), submitted a request for changes to the Millstone Nuclear Power Station, Unit No. 2 (MNPS-2) Technical Specifications (TS). Supporting information was provided by the Combustion Engineering Owners Group (CEOG), on June 14, 1995, which was referenced in the licensee's submittal. The requested changes would extend the Allowed Outage Time (AOT) for an inoperable Safety Injection Tank (SIT) from 1 hour to 24 hours, unless the SIT is inoperable due to either boron concentration not within its limits or an inoperable water level or nitrogen cover pressure instrument. The proposed change, for these two special cases, extends the AOT for an inoperable SIT to 72 hours. In addition, changes were proposed for action statement completion times, conditions, and the criteria for surveillance requirements.

Since the mid-1980s, the NRC has been reviewing and granting improvements to TS that are based, at least in part, on probabilistic risk assessment (PRA) insights. In its final policy statement on TS improvements of July 22, 1993 , the NRC stated that it:

> expects that licensees, in preparing their Technical Specification related submittals, will utilize any plant-specific PSA [probabilistic safety assessment][1] or risk survey and any available literature on risk insights and PSAs.... Similarly, the NRC staff will also employ risk insights and PSAs in evaluating Technical Specification related submittals. Further, as a part of the Commission's ongoing program of improving Technical Specifications, it will continue to consider methods to make better use of risk and reliability information for defining future generic Technical Specification requirements.

[1] PSA and PRA are used interchangeably herein.

The NRC restated this point when it issued the revision to 10 CFR 50.36, "Technical Specifications," in July 1995 (60 FR 36953). In August 1995, the NRC adopted a final policy statement on the use of PRA methods in nuclear regulatory activities that encouraged greater use of PRA to improve safety decision making and regulatory efficiency (60 FR 42622). The PRA policy statement, which expanded its previous position, included the following points:

1. The use of PRA technology should be increased in all regulatory matters to the extent supported by the state of the art in PRA methods and data and in a manner that complements the NRC's deterministic approach and supports the NRC's traditional defense-in-depth philosophy.

2. PRA and associated analyses (e.g., sensitivity studies, uncertainty analyses, and importance measures) should be used in regulatory matters, where practical within the bounds of the state of the art, to reduce unnecessary conservatism associated with current regulatory requirements.

3. PRA evaluations in support of regulatory decisions should be as realistic as practicable and appropriate supporting data should be publicly available for review.

In August 1995, the CEOG submitted several joint application reports for the staff's review. Two of the CEOG joint application reports provided justifications for extensions of the AOTs for SITs and the low pressure safety injection system (LPSI).[2] The justifications for these extensions are based on a balance of probabilistic considerations, traditional engineering considerations, including defense-in-depth, and operating experience. Risk assessments for all of the Combustion Engineering (CE) plants are contained in the joint application reports. The staff first reviewed the reports and then reviewed the licensee's plant-specific amendment request, which incorporated the joint application reports by reference.

Arkansas Nuclear One, Unit 2 (ANO-2) was the lead CE plant for the SIT and LPSI system TS changes. The staff performed an in-depth review of the ANO-2 PRA methodology relating to these changes, as the lead plant for the CEOG. Therefore, a portion of the review of the MNPS-2 amendment request was based on a comparison of its PRA results with those from ANO-2.

In addition, one of the proposed changes would revise TS 3.5.1, "Safety Injection Tanks (SITs)" to incorporate recommendations and suggestions from Generic Letter (GL) 93-05, "Line-Item Technical Specifications Improvements to Reduce Surveillance Requirements for Testing During Power Operations."

2.0 BACKGROUND

The staff evaluated the licensee's proposed changes to the TS AOTs using a combination of traditional engineering analysis, PRA methods, and a review of operating experience. The staff's traditional analysis evaluated the capabilities of the plant to mitigate design basis events with one SIT inoperable. The staff then used insights derived from the use of PRA methods to determine

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[2] CE NPSD-994, "Joint Application Report for Safety Injection Tank AOT/SIT Extension," May 1995, and CE NPSD-1995, Joint Application Report for Low Pressure Safety Injection System AOT Extension," May 1995.

the risk significance of the proposed changes. The results of these evaluations were used in combination by the staff to determine the safety impact of extending the AOTs for one inoperable SIT.

2.1 Proposed Change to an SIT AOT From 1 to 72 Hours When an SIT is Inoperable Due to Inability to Verify Level or Pressure

The NRC issued GL 93-05 on September 27, 1993, and recommended that licensees add a condition to the SIT TS for the case where one SIT is inoperable due to an inoperable water level or pressure channels in which the AOT to restore the SIT to operable status would be 72 hours. GL 93-05 stated that the NRC staff and industry efforts to develop new Standard Technical Specifications (STS), recognized that SIT instrumentation operability was not directly related to the capability of the SITs to perform their safety function. Therefore, surveillance requirements for SIT pressure and level instrumentation were relocated from the new STS to the TS Bases section and the only surveillance that was retained was that surveillance required to confirm that the parameters, which define SIT operability, are within their specified limits. At the time of the development of the STS, the staff did not include a separate condition in the SIT TS for an inoperable SIT due to the inability to verify level or pressure, as was recommended in GL 93-05. However, the staff believes this is appropriate based on the analysis done during the development of NUREG-1366, "Improvements to Technical Specifications Surveillance Requirements," which formed the basis for the issuance of GL 93-05, and the 72-hour time period is acceptable.

2.2 Proposed Change to an SIT AOT From 1 to 24 Hours When an SIT is Inoperable for Other Reasons

Industry operating experience has demonstrated that many of the causes of an inoperable SIT have been diagnosed and corrected within a relatively short period, but one that is often longer than the existing 1-hour AOT. In several cases, the diagnosis of an inoperable SIT has resulted in plant shutdowns.

If a single SIT were to be diagnosed as inoperable for reasons other than boron concentration being outside of limits (which is already addressed as a separate action item with a 72-hour completion time), the current MNPS-2 TS 3.5.1, Action b, allows 1 hour for operators to restore the SIT to operable. If the action is not completed within 1 hour, the plant would have to be placed in Mode 3 and brought to less than 1750 pounds per square inch absolute (psia) within the next 8 hours. The extension of the existing SIT AOT from 1 to 24 hours should provide the licensee with sufficient time in which to diagnose and possibly repair minor SIT system malfunctions at power, thereby averting an unplanned plant shutdown. Since risk analyses demonstrate that the increased risk of operating with a single SIT out of service is negligible, increasing the AOT can be beneficial to plant safety by avoiding unplanned shutdowns associated with an inoperable SIT. Unnecessary plant shutdowns associated with the outage of nonrisk-significant equipment are undesirable because mode changes have the potential to increase the risk above that of steady state operation.

2.3 Traditional Engineering Analysis

The performance of all of the Emergency Core Cooling Systems (ECCS), including the SITs, is calculated in accordance with 10 CFR Part 50, Appendix K, such that the ECCS ensures that the acceptance criteria of 10 CFR 50.46 are satisfied. These criteria were established in order to

define deterministic acceptance criteria that could be used to judge the acceptability of a given ECCS design. The methodology defined in Appendix K conservatively represents loss-of-coolant accident (LOCA) thermohydraulic and hydrodynamic phenomenology to be used in calculating the peak fuel clad temperature. As a result, the methodology may well overstate the minimum equipment requirements needed for adequate response to an event.

3.0 EVALUATION OF TS 3/4.5.1 - SAFETY INJECTION TANKS

The SITs are passive pressure vessels partially filled with borated water and pressurized with a cover gas (nitrogen) to facilitate injection into the reactor vessel during the blowdown phase of a large break LOCA. This action provides inventory to assist in accomplishing the refill stage following blowdown. The SITs also provide reactor coolant system (RCS) makeup for a small break LOCA.

Each SIT is piped into an associated RCS cold leg via an ECCS line also utilized by high pressure safety injection and LPSI. Each SIT is isolated from the RCS during full pressure operations by two check valves that are in series and has a motor operated isolation valve, normally open and deenergized, which is used to isolate the SIT from the RCS during normal cooldown and depressurization evolutions. In addition, each of the isolation valves receive a safety injection actuation signal to assure that the valves are open. The SIT gas pressure and volume, water volume, and outlet pipe size are designed to allow three of the four SITs to inject the inventory necessary to keep clad temperature and zirconium-water reaction within design assumptions following a design basis LOCA. The design assumes the loss of inventory from one SIT through the LOCA break.

The Limiting Condition of Operation (LCO) 3.5.1 requires that all SITs be operable whenever the plant is in Modes 1, 2, or 3, with pressurizer pressure greater than or equal to 1750 psia. The LCO is based on the assumption that when the plant is in any of these modes of operation, the SITs must be capable of performing the same safety-related function that would be required for a LOCA at full rated thermal power. When the plant is in any of the applicable modes, an SIT is considered operable when the following conditions exist:

- The associated isolation valve is fully open.
- Electric power has been interrupted to the motor for the associated isolation valve.
- Water inventory in the tank is within the assumed band.
- The boric acid concentration of the water inventory of the tank is within the assumed band.
- The nitrogen cover pressure within the tank is within the assumed band.

In the past, a justification for the short AOT for one inoperable SIT has been that the perceived severity of the consequences of not having all SITs available to provide passive injection during a design basis LOCA warranted the severity of the requirement to return an inoperable SIT to operable status within 1 hour or shut down the unit. However, the current 1-hour AOT is based solely on engineering judgment and did not take into consideration a quantitative assessment of risk.

The SIT operational parameters are set by the design basis large break LOCA analysis. Since the SITs are passive devices and provide a limited safety-related function, operability has been restricted to mean that the equipment's initial conditions are within a band supported by 10 CFR

Part 50, Appendix K, design basis analysis. Analytical models of Appendix K to 10 CFR Part 50 are devised so as to overestimate the amount of liquid lost from the break and to underestimate the residual inventory in the reactor vessel lower plenum. Consequently, inventory discharge requirements are conservatively set at a high level. Extending the AOT from 1 to 24 hours for one SIT that is inoperable, for reasons other than boron concentration being outside of limits or the inability to verify level or pressure, will allow time for the licensee to correct minor problems with an SIT. Considering the short time frame that an SIT is allowed to be out of service, the low likelihood of a large break LOCA during this short time frame, and the potential increase in risk associated with plant shutdowns, extending the SIT AOT will allow the design basis defense in depth to be maintained while not significantly affecting the overall safety margins assumed in the MNPS-2 Final Safety Analysis Report.

The current MNPS-2 TS do not differentiate between an SIT that is inoperable due to tank inventory or nitrogen gas pressure discrepancies and an SIT whose inventory or gas pressure cannot be verified due solely to malfunctioning water level instrumentation or pressure instrumentation. Because these instruments provide no safety-related function, it is reasonable to extend the AOT to 72 hours under these conditions since the SIT is available to perform its safety-related function during this time. This proposed change is consistent with the NRC staff's recommendations in GL 93-05.

3.1 PRA Used to Support the Proposed AOT TS Changes

The staff considered a three-tiered approach to evaluate the risk associated with the proposed TS changes. The first tier evaluated the PRA model and the impact of the AOT extensions for the SITs on plant operational risk. The second tier addressed the need to preclude potentially high risk configurations, should additional equipment outages occur during the time when one SIT is out of service. The application of Tier 3 to the proposed SIT AOTs is not necessary because the SIT sequence modeling is relatively independent of other systems.

3.2 Cross Comparison Approach

After completing a detailed evaluation for the tentative approval of SIT AOT extensions for ANO-2, the staff used a cross comparison approach to consider the viability of similar AOT relaxations for other participating CEOG plants, including MNPS-2. The pilot technical evaluation report [3] used in support of the staff's safety evaluation for ANO-2 [4] focused on:

- the process adopted by the CEOG to assess single AOT risk,
- the identification of ANO-2 accident sequences in which credit was taken for SITs and LPSI,

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[3] SCIE-NRC-318-97, "Technical Evaluation of Combustion Engineering Owners Group (CEOG) Joint Application for Safety Injection Tanks and Low Pressure Safety Injection System Allowed Outage Time (AOT) Extension," July 21, 1997.

[4] SECY-97-095, "Probabilistic Risk Assessment Implementation Plan Pilot Application for Risk-Informed Technical Specifications," April 30, 1997.

- independent verification of the single AOT risk [essentially equivalent to incremental conditional core damage probability (ICCDP)[5]], and
- determination of the significance of single AOT risk relative to an acceptance guideline value.

The objective of this cross comparison evaluation is to use insights derived from the ANO-2 plant-specific safety evaluation to examine the validity of the conclusions drawn in the joint submittals. A common methodology was employed by the CEOG to quantify AOT risk and because CE plants generally have similar design characteristics, the staff believes that the findings of the lead pilot plant evaluation is generally applicable to other CE plants. The staff confirmed that differences in the underlying PRA models are chiefly attributed to:

- minor design differences,
- operational differences,
- success criteria assumptions, and
- common cause failure β-factor assumptions.

The cross comparison draws on information contained in the CEOG joint application reports, the licensees' responses to the staff's requests for additional information, the licensees' individual plant examinations (IPEs) performed in response to GL 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities," and the corresponding IPE evaluations performed by the staff.

3.3 Impact of SITs on Tier 1, 2, and 3 Requirements (Risk Measures)

The following factors are chiefly responsible for the differences in SIT AOT risks among the CE plants:

- modeling for success criteria for SITs,
- initiating event frequency assumed for the initiators challenging the SITs, and
- credit for SITs in mitigating medium size LOCAs.

The SIT single AOT risk (or essentially equivalently, ICCDP) for MNPS-2 is very small and below the acceptance guideline value of 5.0E-07, which was in the NRC Draft Guide (DG) -1065, "An Approach for Plant-Specific Risk-Informed Decision making: Technical Specifications," noticed in the Federal Register on June 25, 1997 (62 FR 34321). In addition, the change in the MNPS-2 updated baseline core damage frequency (CDF) due to the SIT AOT changes, as reported in the CEOG joint application report, is very small and remains about 3.41E-05 per year. The CDF of 3.41E-05 is within the acceptance guidelines published in DG-1061, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Current Licensing Basis," also included in the same Federal Register notice.

In the context of integrated decision making, the acceptance guidelines should not be interpreted as being overly prescriptive. They are intended to provide an indication, in numerical terms, of what is considered acceptable. As such, the numerical acceptance guideline is an approximate

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[5] ICCDP = [(conditional CDF with the subject equipment out of service) - (baseline CDF with nominal expected equipment unavailabilities)] X (duration of single AOT under consideration).

value that provides an indication of the changes that are generally acceptable. Furthermore, the state of knowledge or epistemic uncertainties associated with PRA calculations preclude a definitive decision with respect to the acceptance of a proposed change based purely on the numerical results. The intent in making the comparison of the PRA results with the acceptance guidelines is to demonstrate, with reasonable assurance, that the increase in risk is small and consistent with the intent of the Commission's Safety Goal Policy Statement. The staff believes that the proposed changes to the MNPS-2 SIT AOT TS meets this principle.

The Tier 2 evaluation did not identify the need for any additional constraints or compensatory actions that, if implemented, would avoid or reduce the probability of a risk-significant configuration. Because the SIT sequence modeling is relatively independent of other systems, the staff has determined that the application of a Tier 3 evaluation of the proposed SIT AOTs is not necessary.

3.4 Implementation and Monitoring - AOTs

The staff expects the licensee to implement these TS changes in accordance with the approach previously described. In addition, the licensee has stated through endorsement of the CEOG joint application reports that the maintenance rule (10 CFR 50.65) will be the vehicle that controls the actual equipment maintenance cycle by defining unavailability performance criteria for the SITs. The AOT extensions will allow efficient scheduling of maintenance within the boundaries established by implementing the maintenance rule. The effect of the AOT extensions should be considered if any adverse trends in meeting established performance criteria are identified for the SITs. The maintenance rule will thereby be the vehicle that monitors the effectiveness of the AOT extensions. Application of these implementation and monitoring strategies will help to ensure that the extension of AOTs for the SITs does not degrade operational safety over time and that the risk incurred when an SIT is taken out of service is minimized.

3.5 Action Statement Completion Time and Clarification

As previously noted, the current TS action statement completion time requirement is that the plant must be in Mode 4 within 8 hours when an AOT is exceeded. The licensee proposes to require that the plant be in Mode 3 within 6 hours and less than 1750 psia within 12 hours when the proposed AOTs are exceeded. Also, the licensee proposes to add an action statement for more than one SIT inoperable for added clarification even though the current TS require that the plant be shut down when more than one SIT is inoperable. The proposed additional clarification and associated completion times are consistent with the current guidance and format of the STS for CE plants, NUREG-1432,"Standard Technical Specifications Combustion Engineering Plants," dated September 1992. Since the proposed completion times and action statement are consistent with the SIT design basis and safety-related function, as well as the guidance provided in NUREG-1432, the staff finds these proposed changes acceptable.

3.6 Boron Concentration Clarification

The current TS requirement is to verify the boron concentration whenever the volume in an SIT increases by 1 percent and does not specify a completion time for the verification requirement. The proposed change would not require verification if an SIT volume is increased from the refueling water storage tank (RWST) and would include a 6-hour completion time when verification is required. As noted in NUREG-1366, the boron concentration of the RWST is

greater than or equal to the minimum boron concentration of the SITs. Since there already is a requirement to verify the boron concentration in the RWST, there is no need to duplicate the requirement in the SIT TS. The addition of a completion time, when the verification of the boron concentration is required, provides added clarification and is consistent with NUREG-1432. Thus, the staff finds these proposed changes acceptable

4.0 SUMMARY

The staff has evaluated the licensee's proposed changes to the SIT AOTs for compliance with regulatory requirements as documented in this evaluation and has determined that they are acceptable. This determination is based on the following:

1. The need to maintain reliable safety systems.
2. Consideration of the design basis requirements for the SITs.
3. Staff recommendations contained in GL 93-05 regarding SIT TS requirements.
4. Interface considerations that ensure the risk incurred when an SIT is taken out of service is minimum.
5. Performance monitoring through the maintenance rule to ensure that extension of TS AOTs for SITs does not degrade operational safety over time.

The staff also evaluated the proposed changes and clarifications to the action statements completion times, and the requirements to verify the boron concentration and determined that they are consistent with the SIT design basis, functional requirements, and the current NRC guidance. The proposed TS Bases changes adequately reflect the proposed TS changes.

The staff has concluded that: (1) the AOT for one SIT that is inoperable for the inability to verify level or pressure may be extended to 72 hours; (2) the AOT for one SIT that is inoperable for reasons other than boron concentration not within limits or inability to verify level or pressure may be extended to 24 hours; and (3) the completion times, conditions for action statements, and the criteria for surveillances are consistent with the SIT design basis, functional requirements, current NRC guidance and will have a negligible impact on overall risk. Also, the staff concludes that the TS Bases adequately reflect the changes. Therefore, the proposed changes to MNPS-2 TS 3/4.5.1 and the supporting TS Bases are acceptable.

5.0 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.

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 and changes surveillance requirements. 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 previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (60 FR 47621 dated September 13, 1995). 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.

Principal Contributors: N. Gillis
M. Wohl

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