



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 118 TO FACILITY OPERATING LICENSE NO. DPR-36

MAINE YANKEE ATOMIC POWER COMPANY

MAINE YANKEE ATOMIC POWER STATION

DOCKET NO. 50-309

1. INTRODUCTION

By letter dated December 28, 1990, and supplemented on December 31, 1990 and January 4, 1991, the Maine Yankee Atomic Power Company (licensee) submitted a request to amend the Technical Specifications of the Maine Yankee Atomic Power Station in an emergency situation. The proposed amendment would change Technical Specifications Table 4.10-2, Steam Generator Tube Inspection, by extending the inspection plan to include all tubes in the steam blanketed region of S/Gs #2 and #3, in lieu of extending the inspection program outside of the steam blanketed region in S/G #1, as required by the current Technical Specification.

2. BACKGROUND

On December 17, 1990, Maine Yankee performed a controlled shutdown when the calculated primary to secondary leak rate in S/G #1 exceeded the administrative limit (0.035 gpm) for operation. Although Maine Yankee has experienced a small amount of leakage in this steam generator since their last refueling outage, the leak rate did not significantly change between startup (July) and mid-December. Calculations performed later showed the leak rate was approximately 0.1 gpm when the shutdown was begun, and approximately 1.0 gpm when shutdown conditions were achieved and plant conditions stabilized. At no time during the operating cycle following the last refueling outage has there been any indication of leakage from either S/G #2 or #3.

Following isolation and cooldown of S/G #1, a low pressure leak test (steam side) was performed. This test showed a leak in the tube occupying row 6, line 43(R6 L43), at the apex of the tube's U-bend. This tube is in the "steam blanketed" region where mechanical supports (batwings) restrict flow and thus permit the creation of steam voids at or near the apex of the U tubes in this area. It is believed that moisture entering this region flashes to steam, and any contaminants combined with residual tube stresses that are created during the manufacturing process, result in tube degradation that is believed to be some form of corrosion cracking.

3. DISCUSSION

Technical Specifications Section 4.10, Steam Generator Tube Inspection, provides the requirements for selecting the number and location of additional tubes to

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be inspected to demonstrate steam generator operation following repair of leaking steam generator tubes. The licensee commented that the initial inspection sample of S/G #1 tubes in accordance with the Technical Specifications. The initial inspection sample examined 525 tubes (approximately a 9% sample) in S/G #1. This initial sample included 100% of the tubes in rows 1 through 11, bounding the steam blanketed region, which the licensee reports is located from row 5 through row 8. The initial sample also included 9 tubes that had been found during previous inspections to contain small pits near the top of the tubesheet. In addition to the leaking tube in R6 L43, which indicated a four inch crack and which was plugged, one additional tube R6 L41 was found to contain a 3/4 inch long axial indication at the U-bend apex. This tube exhibited an absolute signal with the bobbin coil that was similar to the "precursor signal" exhibited by R6 L43 in 1988. The axial indication from R9 L41 was confirmed with the motorized rotating pancake coil (MRPC) probe and the tube was plugged. This tube was not inspected in 1988.

Two additional tubes in row 7 (R7 L8 and R7 L130) were found to contain 18% and 3% indications, respectively, at the U-bend apex using the bobbin coil. An MRPC inspection failed to confirm the indication for R7L8. An MRPC examination was not performed for R7 L130. R7 L8 had exhibited a 10% bobbin indication in 1988. R7 L130 was not inspected in 1988. Tubes R7 L8 and R7 L130 will remain in service, because their indications do not exceed the plugging limit.

Inspection of the nine previously degraded tubes revealed two tubes (R26 L29 and R50 L57) with pit indications exceeding the 40% plugging limit. These tubes were plugged.

Based on a finding of four defective and plugged tubes (i.e., tubes with indications exceeding the plugging limit), the inspection results are category C-2 as defined in Technical Specifications Table 4.10-2. Accordingly, Table 4.10-2 requires a second sample inspection consisting of 18% of the tubes (i.e., 1028 tubes) in S/G #1. The licensee stated in its December 28, 1990 letter that the additional inspections in S/G #1 are not warranted in view of the fact that 100% of the suspect (critical) area (steam blanketed region) has already been inspected, and that pitting is not expected to degrade to significant tube leakage. As initially suggested by the NRC staff, the licensee proposed in its December 31, 1990, letter to inspect the entire steam blanketed region in S/G #2 and S/G #3. This tube inspection program would be in lieu of performing the second sample inspection in S/G #1 outside the steam blanketed region. This proposal is intended to provide assurance of continued operation of S/G #1, and identify any other U-bend defects that may exist in S/Gs #2 and #3, while minimizing outage time and personnel radiation exposure.

The specific proposal from the licensee is to add a footnote to Technical Specifications Table 4.10-2, which would be applicable solely to the steam generator inspection of December 1990. The footnote states that a 100% inspection of rows 3 through 10 in S/G #2 and S/G #3 shall be conducted, instead of the action indicated by this specification (i.e., the actions identified in the "Action Required" columns of Table 4.10-2, which call for additional inspection samples that depend on the results of the initial sample). Although not included as part of the proposed change, the licensee stated in its December 28, 1990 letter that it would expand the inspection of SGs #2 and #3 into additional rows (i.e., beyond row 10 or below row 3) as necessary to bound any u-bend indications by at least two rows found to be free of U-bend indications.

The licensee completed its inspection of S/Gs #2 and #3 on January 3, 1991. In S/G #2, 372 tubes were inspected, including all tubes in rows 3 through 10, and 13 tubes that were observed in previous inspections to have pit indications (not exceeding the plugging limit). Three tubes (R8 L19, R5 L132, and R6 L103) were found with confirmed U-bend indications and were plugged. One additional tube was plugged due to a pit exceeding the plugging limit.

In S/G #3, 440 tubes were inspected. In addition to all tubes in rows 3 through 10, all tubes in row 11 were inspected because of a U-bend indication found in row 9. The tubes inspected also included 18 tubes with previous (non-pluggable) pit indications. Five tubes were found with U-bend indications and were plugged (R8 L105, R8 L107, R9 L118, R6 L39, and R7 L42). One additional tube was (conservatively) plugged in response to a bobbin coil "precursor" signal in the U-bend; however, MRPC inspection (which is generally more sensitive than a bobbin coil inspection) failed to confirm the indication. Five additional tubes were plugged due to pit indications in excess of the plugging limit.

By letter dated January 4, 1991, the licensee provided the staff with the modified administrative controls being implemented to govern actions in the event of an SG tube leak. The administrative controls incorporate lessons learned from the December 17, 1990, tube leak and will be implemented prior to plant restart.

#### 4. SAFETY EVALUATION

The staff has been in close communication with the licensee concerning the conduct of the S/G tube inspection program. As evidenced by the rapid increase in leak rate prior to achieving cold shutdown and the length (4 inches) of the leaking crack, U-bend cracks in the steam blanketed region can potentially challenge tube integrity if not detected by inspection. The available evidence from both Maine Yankee and St. Lucie suggests that such cracks are most likely to occur in the steam blanketed region. For this reason, the staff concurs with the licensee's proposal to extend the inspection plan to include all tubes in the steam blanketed region of S/Gs #2 and #3, in lieu of extending the inspection program outside the steam blanketed region in S/G #1 as required by the current Technical Specification requirement. Indeed, the finding of eight additional U-bend indications during the recently completed inspection of S/Gs #2 and #3 has confirmed the appropriateness of extending the inspection program into these steam generators. Detection of pits outside the steam blanketed region is not of major importance at this time since (1) pits were not a factor in the recent leak occurrence, (2) pits generally do not significantly affect tube pressure boundary integrity, and (3) pits have and will continue to be monitored during scheduled refueling outage inspections. Apart from the recently completed inspection program, the staff finds that the modified administrative controls for monitoring and responding to SG tube leakage (to be implemented prior to plant restart) provides added assurance that SG tube pressure boundary integrity will continue to be maintained during future operation. For these reasons, the staff concludes that the proposed Technical Specification change requested in the licensee's letters of December 28, and December 31, 1990 is acceptable.

The proposed amendment allows the licensee to conduct an expanded steam generator inspection program, which the licensee believes is technically prudent. The expanded steam generator inspection program provides for examination of tubes in S/Gs #2 and #3 (in addition to the examinations already conducted in S/G #1). The tubes selected for examination are in the steam blanketed region. Additional tubes at the boundary of the steam blanketed region will be inspected to ensure that the tube defect region of interest (critical region) is fully bounded. The expanded steam generator inspection program will also avoid additional unnecessary personnel radiation exposure. The inspection program that was developed is technically sound and presents the best opportunity for identifying tubes in S/Gs #2 and #3 that have the potential for leaking. The proposed change provides reasonable assurance that a steam generator tube rupture will not occur during the remainder of the current operating cycle.

#### 5. STATEMENT OF EMERGENCY SITUATION

Title 10 Code of Federal Regulations Section 50.91(a)(5) makes provision for issuing a license amendment without prior notice and opportunity for a hearing or public comment, provided the Commission finds that an emergency situation exists. The licensee provided the basis for its determination of an emergency situation in its letter dated December 31, 1990.

The need for an amendment to the Technical Specifications under an emergency situation could not have been foreseen when the plant shut down to repair the original leaking tube in S/G #1. Until the defective tube was electronically examined and the examination results analyzed, there was no indication that the failure would be an axial crack in the steam blanketed region. Thus, the licensee had no way to foresee that this particular type of failure in this particular region of steam generator #1 would require the creation of a tube inspection program that differs from Technical Specifications Table 4.10-2.

The licensee's request for this amendment was made by letter on December 28, 1990, and was supplemented by their letters dated December 31, 1990, and January 4, 1991. The request and its supplements were made in a timely fashion, based on the immediate technical evaluation of the results from the examination of S/G #1.

The NRC staff concurs in the licensee's evaluation of the circumstances and the licensee's willingness to expand the tube examination program into S/Gs #2 and #3. The NRC staff believes the licensee has acted in the interest of preserving the pressure integrity of the steam generator tubes in all three of their steam generators. As this situation could neither have been foreseen nor avoided, the licensee's failure to file its application prior to December 28 does not constitute an abuse of the emergency situation provision of 10 CFR 50.91(a)(5). Failure to grant this amendment in a timely way will prevent Maine Yankee from resuming operation without unnecessary delay at the successful conclusion of their current expanded steam generator inspection program. In addition, failure to grant this amendment will result in significant additional radiation exposure to station personnel.

## 6. FINAL DETERMINATION OF NO SIGNIFICANT HAZARDS

The Commission has provided standards for determining whether a significant hazard exists (10 CFR 50.92 (c)). A proposed amendment to an operating license involves no significant hazard if operation of the facility in accordance with the proposed amendment would not (1) involve a significant increase in the probability or consequences of an accident previously evaluated, or (2) create the possibility of a new or different kind of accident from an accident previously evaluated, or (3) involve a significant reduction in a margin of safety.

The licensee addressed the above three standards in their amendment request letters. In regard to these three standards, the licensee provided the following analysis:

1. Operation of the facility in accordance with the proposed amendment would not involve a significant increase in the probability or consequences of an accident previously evaluated.

The history of steam generator defects at Maine Yankee is that without exception, every U-bend defect found to exceed the plugging criteria (imperfection depth at least 40% of nominal tube wall thickness) has been in the steam blanketed region. Maine Yankee has inspected 100% of the steam blanketed region (including rows 3 thru 11) of S/G #1. Additional tube inspections in S/G #1 required by Table 4.10-2 would be outside of the steam blanketed region and of limited technical interest. In lieu of additional inspections outside the steam blanket region of S/G #1, Maine Yankee will inspect at 100% of the tubes in the steam blanket region of S/G #2, and a similar inspection of S/G #3, should any U-bend defects be found in S/G #2. Further, the inspections will include two additional rows of tubes above and below the steam blanketed region, and will be further expanded such that any defects found will be bounded by two defect-free rows of tubes. Without granting this proposed change, additional tube inspections would be confined to S/G #1, with no added inspections of S/G #2 or #3 required. By inspecting the critical area of more than one steam generator, Maine Yankee believes the probability and consequences of previously evaluated accidents (i.e., steam generator tube rupture) are reduced.

2. Use of the modified specification would not create the possibility of a new or different kind of accident from any accident previously evaluated.

The proposed amendment does not create the possibility of a new or different kind of accident from any previously evaluated. The proposed change requires inspection of 100% of the steam blanketed region, plus additional tube rows, in more than one steam generator. This change to the inspection schedule required by Table 4.10-2 will help ensure that additional tubes in other steam generator(s) will not fail due to U-bend axial cracking. The increased scope of this steam generator tube inspection effort does not introduce the possibility of a new or different accident.

3. Use of the modified specification would not involve a significant reduction in a margin of safety.

The proposed amendment does not involve a reduction in a margin of safety. The change modifies the steam generator tube inspection scope of Table 4.10-2. The change would expand, focus and concentrate steam generator tube inspections in areas believed to be susceptible to U-bend axial cracking. The changes does not impact plant design or equipment. Maine Yankee believes and the staff concurs that the proposed amendment increases the margin of safety by inspecting the critical areas of more than one steam generator, in lieu of performing additional inspections in non-critical areas of S/G #1.

The staff has reviewed the licensee's no significant hazards consideration analysis and agrees that it satisfies the standards of 10 CFR 50.92. Based on this review, the staff has determined that the licensee has satisfied the relevant three criteria. The staff, therefore, has made a final determination that the proposed amendment involves no significant hazards consideration.

#### 7. STATE CONSULTATION

In accordance with the 10 CFR 50.91(b) State consultation requirement, the representative of the State of Maine was consulted by telephone. The representative of the State of Maine had no comments with regard to this action.

#### 8. ENVIRONMENTAL CONSIDERATION

This amendment changes a surveillance requirement. The 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 staff has made a determination that this amendment involves no significant hazards. 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.

#### 9. CONCLUSION

The staff 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 this amendment will not be inimical to the common defense and security, or to the health and safety of the public.

Dated: January 4, 1991

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AMENDMENT NO. 118 TO DPR-36 - MAINE YANKEE ATOMIC POWER STATION DATED January 4, 1991

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Docket File 50-309

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