



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 230 TO FACILITY OPERATING LICENSE DPR-38
AND AMENDMENT NO. 227 TO FACILITY OPERATING LICENSE DPR-55

DUKE ENERGY CORPORATION

OCONEE NUCLEAR STATION, UNITS 1 AND 3

DOCKET NOS. 50-269 AND 50-287

1.0 INTRODUCTION

By letter dated June 4, 1998, Duke Energy Corporation (the licensee) submitted a request for changes to the Oconee Nuclear Station (ONS), Units 1 and 3, Technical Specifications (TS). The requested changes would revise TS 4.17.2 to allow continued operation with certain steam generator tubes that exceed their repair limit as a result of tube end anomalies (TEAs). These tubes would be temporarily exempt from the requirement for sleeving, rerolling, or removal from service until repaired during the next scheduled refueling outage for the respective unit. The repairs would also be performed prior to the outage if plant conditions result in an extended cold shutdown of greater than 7 days. These amendments supersede the Notice of Enforcement Discretion (NOED) that was issued by the staff on June 4, 1998.

The proposed changes would add the following to TS 4.17.2:

For Units 1 and 3, there are a number of steam generator tubes which exceed the tube repair limit as a result of tube end anomalies. These tubes are temporarily exempted from the requirement for sleeving, rerolling or removal from service, until repaired during or before the next Unit 1 and Unit 3 refueling outages (Unit 1 EOC [end-of-cycle] 18, and Unit 3 EOC 17 refueling outages, respectively). An analysis has been performed which confirms that operability of Units 1 and 3 will not be impacted with these tubes in service until the next refueling outage on each of these units.

2.0 BACKGROUND

During the recent ONS Unit 2 refueling outage, operating experience data based on events at Arkansas Nuclear One Unit 1 (ANO-1) were received by the licensee's Steam Generator Engineering staff. This information indicated that previous eddy current indications classified as TEAs had exhibited primary-to-secondary leakage at ANO-1, thus indicating they were in the pressure boundary. Subsequent evaluation of the ANO-1 data indicated a potential for indications to extend into the pressure boundary based on the licensee's guidelines that were in effect at the time of the original analysis. However, these guidelines were not specific in

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identifying the landmarks that should be used to determine that indications were outside the pressure boundary. A review of the eddy current data during the latter stages of the ONS Unit 2 refueling outage identified some indications that were reclassified from TEAs to repairable indications, in accordance with the ONS TS. These tubes were included in the reroll repairs that were performed during the Unit 2 outage.

Based on this new information, the licensee initiated a Problem Investigation Process (PIP) report on May 6, 1998, and immediately began an assessment of the operability implications of this information with respect to Units 1 and 3. An evaluation of the results of the previous steam generator inspection results from the refueling outages on Units 1 and 3 indicated a number of tubes with TEA indications that were not repaired during those respective outages. The operability evaluation for Units 1 and 3 conservatively assumed that all the identified TEAs would result in leakage at rates determined by previous measurements on mock-ups performed by Framatome Technologies, Incorporated (FTI). The operability evaluation, completed on May 9, 1998, concluded that the predicted leakage was well below the leakage assumed in design basis steamline break accident analysis.

An action plan was initiated to reanalyze the Units 1 and 3 data obtained during the previous outages to establish the extent of the TEA indications. The action plan used the operating experience based on the ANO-1 indications and the results of steam generator inspections during the recent Unit 2 refueling outage. The licensee performed the following steps to analyze the issue of TEA indications for Units 1 and 3.

- (1) FTI constructed mock-up for eddy current evaluation
- (2) Developed data analysis guidelines
- (3) Selected and trained data analysts
- (4) Performed site-specific testing
- (5) Performed review of eddy current test data for ONS Units 1 and 3
- (6) Resolved any indications as a result of review
- (7) Completed leakage evaluation of indications identified in the data review

While several activities were performed in parallel, the controlling activity for completing the data review was completion of the mock-up. This detailed mock-up of the upper tubesheet and clad was constructed with tubes installed with a geometry identical to the ONS steam generators. Machined defects were included in identified areas. FTI used the mock-up to verify the appropriateness of eddy current analyst guidelines. The results of the reanalysis of inservice inspection data found 372 indications out of 2951 TEAs not previously repaired for Unit 1 (including the two indications not associated with TEAs). In addition, 61 out of 66 TEAs not previously repaired on Unit 3 extended beyond the upper surface of the tubesheet clad. These indications would have met the licensee's criteria for repair by rerolling if they had been discovered during the outage. Ultimately, confirmation of eddy current testing indications in the rolled area that met the repair criteria prompted the licensee to generate an NOED request. Based on preliminary results from the review, the Operations Shift Manager was briefed on June 2, 1998, regarding the revised inspection results for Units 1 and 3 and logged the missed surveillance at 5:15 p.m. on June 2, 1998. Engineering completed its evaluation later that evening. The NOED was verbally granted on June 3, 1998, and followed up with a letter dated June 4, 1998.

3.0 EVALUATION

The steam generators are ONS Quality Assurance Condition 1 components. They serve as part of the Reactor Coolant System pressure boundary and must meet the leakage requirements specified in the ONS TS. The pressure boundary function of the steam generator tubes, particularly the upper tubesheet rolled joints, has been evaluated by the licensee for continued operation of Units 1 and 3 under their present conditions. Findings at ANO-1 led the licensee to question previous conclusions regarding the location of indications classified as TEAs in ONS. TEAs are eddy current testing conclusions of indications located at the hot leg end of a tube. These indications were believed to exist between the primary face cladding and the protruding tube end outside the pressure boundary. To determine if tubes with repairable indications exist in the Unit 1 and 3 steam generators, the licensee conducted a review of the ONS Unit 1 EOC 17 and ONS Unit 3 EOC-16 steam generator tube eddy current data and performed an operability evaluation. Upon completion of a reevaluation of the TEAs in the Unit 1 and 3 steam generators using revised data analysis procedures, the licensee determined that some of the indications reside in the pressure boundary. Tubes with such indications are considered defective by the ONS TS. The licensee considered leak rates from repairable indications in the operability evaluation.

The analysis of Oconee Unit 1 eddy current data using updated analysis guidelines concluded that 372 indications were in tubes that were in operation, but should have been previously repaired. The licensee identified a total of 61 repairable indications in Unit 3. Two indications not associated with TEAs were identified in the Unit 1 steam generators during the analysis. The more significant of these two indications was an axial crack approximately 0.2 inch in length in the roll transition. All defects identified in the analysis were contained within the upper tubesheet. Therefore, all defective tubes cannot burst under postulated accident conditions due to the constraint provided by the surrounding tubesheet. However, these flaws could possibly leak under such conditions.

The licensee assessed the potential for all flaws identified in the reanalysis of data to leak under postulated accident conditions. Possible leakage from tubes repaired by rerolling and growth rates for the two axial cracks were also considered in the assessment. The results indicate that the postulated primary-to-secondary leak rate from all tubes confirmed with tube end flaws, bypass leakage from repaired tubes, and other flaws identified in the analysis is well below the leak rate considered in offsite dose analyses. The Unit 1 steam generators are limiting for the two units evaluated. The licensee reported that the postulated leak rate for this unit is primarily the result of the one roll transition crack identified during the reanalysis of eddy current inspection data. Roll transition flaws have a higher potential for leakage because there is no tube-to-tubesheet contact to restrict primary-to-secondary flow. The staff notes that the calculated contribution to leak rate from the one roll transition crack was approximately an order of magnitude greater than for all the identified tube end indications in the Unit 1 steam generators.

Steam generator tube degradation is managed through a combination of several defense-in-depth measures. Inservice inspections during plant outages are only one of these measures. Other steps taken by licensees to manage the potential for age-related degradation

of steam generator tubing include limitations on the amount of primary-to-secondary leakage during operation, control of secondary water chemistry, and reactor operator training and plant procedures to assess and respond to steam generator tube rupture events. The potential impact on safety due to operation of ONS Units 1 and 3 with defective tubes for the remainder of the operating cycle can be mitigated through other means. Leak rate monitoring is the primary vehicle by which licensees can assess the condition of steam generator tube integrity during operation. At present, the primary-to-secondary leak rate from the limiting steam generator at ONS is below the threshold for accurately measuring leakage and well below levels requiring compensatory actions by the licensee. Therefore, any contribution to the operational leak rate from the known tube end flaws is minimal.

The staff has reviewed the licensee's assessment of TEAs currently in service in ONS Units 1 and 3. The existence of confirmed cracking near the hot-leg end of a limited number of steam generator tubes and tubes previously repaired by rerolling will have a negligible impact on the postulated steamline break leak rate. The constraint provided by the surrounding tubesheet precludes structural failure initiating from any of the identified steam generator tube flaws. Therefore, there is no potential for steam generator tube burst from these indications. Based on these factors and the existence of other defense-in-depth measures to manage steam generator tube degradation, the staff concludes that the defective tubes confirmed in ONS Units 1 and 3 will have a negligible impact on the structural and leakage integrity of the steam generators for the remainder of the current operating cycles. Therefore, the proposed revision to the ONS Units 1 and 3 TS is acceptable for the duration of the current operating cycles or until the defective tubes can be repaired or removed from service.

3.0 EXIGENT CIRCUMSTANCES

The Commission's regulations, as stated in 10 CFR 50.91, contain provisions for issuance of amendments when the usual 30-day public notice period cannot be met. One type of special exception is an exigency. An exigency is a case where the Commission and licensee need to act promptly and that time does not permit the Commission to publish a Federal Register notice allowing 30 days for prior public comment, and it is determined that the amendment involves no significant hazards considerations.

Under such circumstances, the Commission notifies the public in one of two ways: by issuing a Federal Register notice providing an opportunity for hearing and allowing at least 2 weeks from the date of the notice for prior public comments, or by using the local media to provide reasonable notice to the public discussing the proposed changes. In this case, the Commission used the first approach.

The licensee submitted its request for amendments on June 4, 1998. The amendment request was noticed in the Federal Register on June 17, 1998 (63 FR 33097), at which time the staff proposed a no significant hazards consideration determination. The licensee requested that the amendments be issued on an exigent basis in accordance with the staff's policy for processing an NOED.

During the recent ONS Unit 2 refueling outage, operating experience data based on events at ANO-1 were reviewed by the licensee's Steam Generator Engineering staff. This information

indicated that previous eddy current indications at ANO-1 classified as TEAs had exhibited primary-to-secondary leakage, thus indicating they were in the pressure boundary. The guidelines for analyzing these anomalies that were in effect at the time were not specific enough to determine that the indications were in a section of the tubes that were outside the pressure boundary. Applying the information to a review of the eddy current data during the latter stages of the Unit 2 outage using updated criteria resulted in some indications being reclassified from TEAs to repairable indications. These tubes were included in the reroll repairs that were performed during the Unit 2 outage.

Based on this new information, the licensee initiated an investigation on May 6, 1998, to assess its operability implications with respect to Units 1 and 3 by evaluating the steam generator inspection results from the most recent refueling outages on Units 1 and 3. The result was that TEA indications were found on a number of tubes and not repaired during the respective unit outages. An operability evaluation was completed on May 9, 1998, assuming that all of the identified TEAs would leak at rates determined by previous mock-up measurements. The conclusion reached was that the predicted leakage was well below the leakage assumed in design basis steamline break accident analysis.

The licensee then initiated a reanalysis of the Units 1 and 3 data obtained during the previous outages to establish the extent of the TEA indications using the operating experience based on the ANO-1 indications and results of steam generator inspections during the recent Unit 2 refueling outage.

While several activities were performed in parallel, the controlling activity for completing the data review was the need to use a mock-up of the ONS steam generator tubes to verify that the eddy current analysis guidelines were appropriate and comprehensive. The results of this reanalysis found 372 indications out of 2951 TEAs not previously repaired for Unit 1 (including the two indications not associated with TEAs). In addition, 61 out of 66 TEAs not previously repaired on Unit 3 extended beyond the upper surface of the tubesheet clad. These indications, had they been discovered during the respective refueling outages, would have met the criteria for repair during the outage. Once the licensee had confirmation that the indications in the rolled area met the repair criteria, action was promptly taken to request the NOED. Based on the results of the review, the Operations Shift Manager was briefed on June 2, 1998, regarding the revised inspection results for Units 1 and 3, and logged the problem as a missed surveillance at 5:15 p.m. on June 2, 1998. The engineering evaluation was completed later that evening. Since both Unit 1 and Unit 3 were operating at full power, repair of these indications could not be performed without shutting both units down.

These findings were discussed with the staff on June 3, 1998, and an NOED was issued verbally that allowed the exercise of discretion not to enforce compliance with TS 4.17.2 for the steam generator tubes on Units 1 and 3 with TEA indications for the period from 12:25 p.m. on June 3, 1998, until issuance of these amendments. The NOED was confirmed in writing on June 4, 1998, and the licensee promptly submitted the proposed amendments on that same date.

These amendments complete the review process and implement the proposed TS changes, pursuant to the NRC's policy regarding exercising discretion for an operating facility set out in

Section VII.c of the "General Statement of Policy and Procedures for NRC Enforcement Actions" (Enforcement Policy), NUREG-1600, for processing NOEDs. The staff has determined that, because compliance with the surveillance requirement for the steam generator tubes with TEA indications would necessitate immediate shutdown of the units, and in light of the NOED, issuance of these amendments is needed in less than the 30-day comment period normally allowed for processing amendments to the TS. In addition, the licensee used its best efforts to promptly request the proposed amendments after completing its investigation of the location of the TEA indications. Therefore, pursuant to 10 CFR 50.91(a)(6), the staff has determined that exigent circumstances exist and the amendments are being processed accordingly.

4.0 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 license amendments involve no significant hazards consideration if operation of the facility, in accordance with the proposed amendments, 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 any accident previously evaluated; or (3) involve a significant reduction in a margin of safety. As required by 10 CFR 50.91(a), the licensee has provided its analysis of the issue of no significant hazards consideration, which is presented below:

[This proposed change has been evaluated against the standards in 10 CFR 50.92 and has been determined to involve no significant hazards, in that operation of the facility in accordance with the proposed amendments would not:]

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

This evaluation addresses the potential effects of a missed surveillance and repair opportunity for steam generator tubes. As described in the technical justification, operating with some steam generator tubes with TEAs and repairable indications in Units 1 and 3 does not increase the probability of an accident evaluated in the SAR [Safety Analysis Report] because this condition is not an accident initiator. There is no physical change to the plant SSCs [structures, systems, components] or operating procedures. Neither electrical power systems, nor important to safety mechanical SSCs will be adversely affected. The steam generators have been evaluated as operable for normal and accident conditions. There are no shutdown margin, reactivity management, or fuel integrity concerns.

This activity will not adversely affect the ability to mitigate any SAR described accidents. The total evaluated main steamline break leakage from the areas evaluated is 0.023 gpm for Unit 1 which is the limiting unit. The resulting leakage was considerably less than that assumed in the off site dose analysis of 0.7 gpm for each unit. Therefore both Units 1 and 3 met the MSLB leakage requirements for steam generator integrity with no compensatory actions required. There is no adverse impact on containment integrity, radiological release pathways, fuel design, filtration systems, main steam relief valve setpoints, or radwaste systems.

There is no increase in accident initiation likelihood or consequences, therefore analyzed accident scenarios are not impacted.

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

There is no increased risk of unit trip, or challenge to the RPS [Reactor Protection System] or other safety systems. There is no physical effect on the plant, i.e., none on RCS [Reactor Coolant System] temperature, boron concentration, control rod manipulations, core configuration changes, and no impact on nuclear instrumentation. There is no increased risk of a reactivity excursion. No new failure modes or credible accident scenarios are postulated from this activity. The MSLB scenario has been evaluated and the potential for damage to the steam generator tubes is not increased.

3. Involve a significant reduction in a margin of safety:

No function of any important to safety SSC will be adversely affected or degraded as a result of continued operation. No safety parameters, setpoints or design limits are changed. There is no adverse impact to the nuclear fuel, cladding, RCS, or required containment systems. Therefore, the margins of safety as defined in the bases to any Technical Specifications are not reduced as a result of this change.

Based on the above considerations, the NRC staff concludes that the amendments meet the three criteria of 10 CFR 50.92. Therefore, the staff has made a final determination that the proposed amendments do not involve a significant hazards consideration.

5.0 STATE CONSULTATION

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

6.0 ENVIRONMENTAL CONSIDERATION

The amendments change surveillance requirements. The NRC staff has determined that the amendments involve 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 finding that the amendments involve no significant hazards consideration. Accordingly, the amendments meet 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 amendments.

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 amendments will not be inimical to the common defense and security or to the health and safety of the public.

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