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

August 3, 2020

MEMORANDUM TO: Steven D. Bloom, Chief
Corrosion and Steam Generator Branch
Division of New and Renewed Licenses
Office of Nuclear Reactor Regulation

FROM: Paul A. Klein, Senior Materials Engineer **/RA/**
Corrosion and Steam Generator Branch
Division of New and Renewed Licenses
Office of Nuclear Reactor Regulation

SUBJECT: AUDIT PLAN FOR THE REGULATORY AUDIT OF ELECTRIC POWER RESEARCH INSTITUTE FOR STEAM GENERATOR TASK FORCE INFORMATION RELATED TO TECHNICAL SPECIFICATION TASK FORCE-577, "REVISED FREQUENCIES FOR STEAM GENERATOR TUBE INSPECTIONS" (EPID: L-2020-PMP-0005)

On June 8, 2020, the Technical Specification Task Force (TSTF) submitted TSTF-577, Revision 0, "Revised Frequencies for Steam Generator Tube Inspections" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20160A359), to the U.S. Nuclear Regulatory Commission (NRC) for review. TSTF-577 would revise the technical specifications related to steam generator (SG) tube inspections to extend the inspection interval for thermally treated Alloy 600 (Alloy 600TT) and Alloy 690TT SG tubing.

The NRC staff has identified a need to conduct a regulatory audit on the technical basis for extending the inspection interval for Alloy 600TT SG tubing. The purpose of the audit is to: (1) gain a better understanding of information underlying the application to evaluate the technical basis supporting the inspection interval extension proposed for Alloy 600TT SG tubing; and (2) identify information that will require docketing to support the basis of the regulatory decision.

The audit will take place remotely online. The audit entrance meeting will be held on August 17, 2020, via conference call. The content of the audit plan is provided as an enclosure.

Enclosure:
Audit Plan

CONTACT: Paul Klein, NRR/DNRL
301-415-4030

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**ADAMS Accession No.: ML20216A676** ***via e-mail** **NRR-106**

| **OFFICE** | NRR/DNRL/NCSG | NRR/DNRL/NCSG/BC |
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| **DATE** | 7/ 30 /2020 | 8/ 3 /2020 |

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# AUDIT PLAN FOR THE REGULATORY AUDIT OF ELECTRIC POWER RESEARCH INSTITUTE FOR STEAM GENERATOR TASK FORCE INFORMATION RELATED TO TECHNICAL SPECIFICATION TASK FORCE-577, "REVISED FREQUENCIES FOR STEAM GENERATOR TUBE INSPECTIONS"

**ENTITY:** Electric Power Research Institute (EPRI)

**ENTITY CONTACTS:** Helen Cothron (Steam Generator Management Program)
Various members of industry Steam Generator Task Force (SGTF)
Supporting personnel (as needed)

**DURATION:** 30 working days
August 17, 2020, through September 28, 2020

**LOCATIONS:** Remote Online Audit

**AUDIT TEAM:** Paul Klein (NRR/DNRL/NCSG, Senior Materials Engineer, Audit Lead)
Leslie Terry (NRR/DNRL/NCSG, Materials Engineer)
Andrew Johnson (NRR/DNRL/NCSG, Materials Engineer)
Gregory Makar (NRR/DNRL/NCSG, Materials Engineer)
Steven Bloom (NRR/DNRL/NCSG, Branch Chief)
Sasan Bakhtiari (Argonne National Laboratory, NRC Contractor)
Supporting staff (as needed)

## BACKGROUND AND OBJECTIVES

During a public meeting with the industry SGTF on February 13, 2019, industry representatives informed the U.S. Nuclear Regulatory Commission (NRC) staff that they planned to submit a new Technical Specification Task Force (TSTF) Traveler to revise the steam generator (SG) inspection intervals (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML19044A416).

On September 10, 2019, the TSTF submitted a draft of TSTF-577, "Revised Frequencies for Steam Generator Tube Inspections," that proposed extending the SG inspection intervals with a prescriptive limit between inspections (ADAMS Accession No. ML19254B397). However, on September 18, 2019, the TSTF submitted a revised draft TSTF-577 that proposed basing the SG inspection intervals on an operational assessment without a prescriptive limit between inspections (ADAMS Accession No. ML19301A001). The NRC staff has had several information exchanges with the TSTF and industry SGTF on draft TSTF-577, most recently during public meetings held on January 22, 2020 (Package ADAMS Accession No. ML20041E013), and February 24, 2020 (Package ADAMS Accession No. ML20066E421). During the February 24, 2020, public meeting,

the industry SGTF presented information on an operational assessment feasibility study for thermally treated Alloy 600 (Alloy 600TT) to support extending the inspection interval for Alloy 600TT SG tubing.

On June 8, 2020, the TSTF submitted TSTF-577, Revision 0 (ADAMS Accession No. ML20160A359) to the NRC for review. TSTF-577 would revise the technical specifications related to SG tube inspections to extend the inspection interval for Alloy 600TT and Alloy 690TT SG tubing.

To better understand the technical basis for extending the inspection interval for Alloy 600TT SG tubing, the NRC staff determined it would be advantageous to audit information related to the Alloy 600TT operational feasibility study. The staff will conduct this audit in accordance with the guidance in NRR-LIC-111, Revision 1, "Regulatory Audits" (ADAMS Accession No. ML19226A274).

The audit will begin with an entrance meeting on August 17, 2020, via conference call. The audit will be performed via review of documents provided before the audit and with remote interactions online. During this audit, the NRC staff will examine the documents and analyses listed in the Regulatory Audit Scope section of this audit plan and have discussions with the document authors and other U.S. industry SG personnel. These documents and analyses are not referenced in TSTF-577, Revision 0, but support information in the TSTF. The staff may conduct interviews with SGTF members and other individuals that worked on developing the technical basis.

The objectives of this audit are to enable the NRC staff to:

- Gain a better understanding of information underlying the application to evaluate the technical basis supporting the inspection interval extension proposed for Alloy 600TT SG tubing; and

- Identify information that will require docketing to support the basis of the regulatory decision.

## REGULATORY AUDIT BASIS

An audit is required to examine detailed information related to extending the inspection interval for Alloy 600TT SG tubing and reach a safety conclusion on TSTF-577. The NRC staff must have sufficient information to ensure that acceptable risk and reasonable assurance of safety can be documented in the NRC staff's safety evaluation.

This regulatory audit is based on the following regulations:

- General Design Criteria (GDC) 14, "Reactor Coolant Pressure Boundary," in Appendix A, "General Design Criteria for Nuclear Power Plants," of Part 50, "Domestic Licensing of Production and Utilization Facilities," in Title 10 of the *Code of Federal Regulations* (10 CFR), "Energy," requires that the reactor coolant pressure boundary (RCPB) shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.

- GDC 15, “Reactor Coolant System Design,” in Appendix A of 10 CFR Part 50, requires that the reactor coolant system and associated auxiliary, control, and protection systems shall be designed with sufficient margin to assure that the design conditions of the RCPB are not exceeded during any condition of normal operation, including anticipated operational occurrences.

- GDC 30, “Quality of Reactor Coolant Pressure Boundary,” in Appendix A of 10 CFR Part 50, requires, in part, that components which are part of the RCPB shall be designed, fabricated, erected, and tested to the highest quality standards practical.

- GDC 31, “Fracture Prevention of Reactor Coolant Pressure Boundary,” in Appendix A of 10 CFR Part 50, requires, in part, that the RCPB shall be designed with sufficient margin to ensure that – when stressed under operating, maintenance, testing, and postulated accident conditions – the boundary behaves in a nonbrittle manner and the probability of rapidly propagating fracture is minimized.

- GDC 32, “Inspection of Reactor Coolant Pressure Boundary,” in Appendix A of 10 CFR Part 50, requires that the RCPB be designed to permit periodic inspection and testing to assess structural and leakage integrity.

- 10 CFR 50.36, “Technical Specifications,” as it relates to the Steam Generator Program in the technical specifications.

- Paragraph (g) in 10 CFR 50.55a, “Codes and Standards,” requires that inservice inspection programs meet the applicable inspection requirements in Section XI of the ASME Boiler and Pressure Vessel Code.

- 10 CFR 50.65, “Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” requires that licensees be able to monitor the condition of the SG tubes to provide reasonable assurance that the tubes are capable of fulfilling their intended functions.

- Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” of 10 CFR Part 50 applies to implementation of the Steam Generator Program.

## REGULATORY AUDIT SCOPE

The specific scope of this audit is information related to the technical basis for extending the inspection intervals for Alloy 600TT SG tubes. This information supports the NRC staff’s review of TSTF-577.

The documents supporting the technical areas listed above are to be made available to the NRC staff before the audit (see Special Requests section of this audit plan). The documents already identified by the staff are listed below. Additional documents will be requested by the staff as needed (when referenced by a document being audited by the staff, for instance), and these documents will be added to the audit summary prepared by the staff following the conclusion of the audit.

**Documents and Information Requested**

1. Document(s) describing the technical basis to extend inspection intervals for Alloy 600TT SG tubing.

2. Document(s) detailing crack trending. At a minimum, the document(s) should discuss the following:

   a. Crack inventory, including dimensions.

   b. Crack selection criteria for comparison (why data was or was not included).

   c. Eddy current historical review.

   d. Number of trended cracks.

   e. Applying crack data from one tube location to other tube locations or from one plant to other plants.

3. Document(s) describing how the crack trending information supports operational assessment assumptions (e.g., crack initiation, PODs, crack growth). Examples would include but are not limited to, with regards to slide 35 from the February 24, 2020, public meeting with the industry SGTF, how were industry POD curves conservatively adjusted? What was role of the X-Probe POD simulation?

4. Document(s) describing how cracking detected during recent outages (e.g., fall 2019 and spring 2020) was considered. In addition, the document(s) should discuss the relation of the recent cracking detected to historical data and ongoing model validation.

5. Document(s) describing high stress tube cracking identification, including potential differences between vendor assessments of high stress tube classifications.

6. Analyst interview(s) to discuss the eddy current look back comparison criteria and walk through the crack data.

**SPECIAL REQUESTS**

The NRC staff asks that the requested documents be available to the auditors before the audit. Receiving the documents before the audit increases the efficiency of the audit duration period and allows the auditors sufficient time to prepare for technical discussions with U.S. industry SG personnel. If the need to extend the duration of the audit emerges, then the staff will work with EPRI to establish a new audit exit date. The staff requests that they have access to the materials until the staff's regulatory decision on TSTF-577 is made so that the staff may refer to the materials while reviewing TSTF-577 and when drafting the audit summary. The staff also requests that personnel knowledgeable in the audit topics be available to the staff on a mutually agreeable schedule.

## AUDIT ACTIVITIES AND DELIVERABLES

The NRC staff acknowledges the proprietary nature of the information requested. It will be handled appropriately throughout the audit. Any NRC contractors participating in the audit will be evaluated and approved through standard NRC processes for handling sensitive material.

Status calls with EPRI will be held throughout the audit to identify issues that have been closed or will be resolved by another mechanism, such as requests for additional information issued as part of the TSTF process, coordination on the development of a SG reporting requirement template, or public meetings. In the status calls, staff will also identify any emerging information needs. The staff will hold a conference call to exit the audit. The staff will issue an audit summary within 90 days following the audit exit.

If necessary, any circumstances related to the conduct of the audit will be communicated to the Audit Lead, Paul Klein at 301-415-4030 or Paul.Klein@nrc.gov.

## REFERENCES

1. U.S. *Code of Federal Regulations*, "Domestic Licensing of Production and Utilization Facilities," Part 50, Chapter 1, Title 10, "Energy," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion 14, "Reactor Coolant Pressure Boundary."

2. U.S. *Code of Federal Regulations*, "Domestic Licensing of Production and Utilization Facilities," Part 50, Chapter 1, Title 10, "Energy," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion 15, "Reactor Coolant System Design."

3. U.S. *Code of Federal Regulations*, "Domestic Licensing of Production and Utilization Facilities," Part 50, Chapter 1, Title 10, "Energy," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion 30, "Quality of Reactor Coolant Pressure Boundary."

4. U.S. *Code of Federal Regulations*, "Domestic Licensing of Production and Utilization Facilities," Part 50, Chapter 1, Title 10, "Energy," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion 31, "Fracture Prevention of Reactor Coolant Pressure Boundary."

5. U.S. *Code of Federal Regulations*, "Domestic Licensing of Production and Utilization Facilities," Part 50, Chapter 1, Title 10, "Energy," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion 32, "Inspection of Reactor Coolant Pressure Boundary."

6. U.S. *Code of Federal Regulations*, "Technical Specifications," § 50.36, Chapter 1, Title 10, "Energy."

7. U.S. Code of Federal Regulations, "Codes and Standards," § 50.55a, Chapter 1, Title 10, "Energy."

8. U.S. *Code of Federal Regulations*, “Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” § 50.65, Chapter 1, Title 10, “Energy.”

9. U.S. *Code of Federal Regulations*, “Domestic Licensing of Production and Utilization Facilities,” Part 50, Chapter 1, Title 10, “Energy,” Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants.”

10. U.S. Nuclear Regulatory Commission, NRR-LIC-111, Revision 1, “Regulatory Audits,” dated October 31, 2019, ADAMS Accession No. ML19226A274.

11. “Steam Generator Task Force Public Meeting 2-13-2019,” Package ADAMS Accession No. ML19044A416.

12. “January 22 2020 – Steam Generator Task Force – Meeting Summary,” Package ADAMS Accession No. ML20041E013.

13. “February 24, 2020 Meeting with Industry Steam Generator Task Force,” Package ADAMS Accession No. ML20066E421.

14. “Draft of TSTF-577, ‘Performance Based Frequencies for Steam Generator Tube Inspections,’” dated September 10, 2020, ADAMS Accession No. ML19254B397.

15. “Draft of TSTF-577, Revision 0a, ‘Performance Based Frequencies for Steam Generator Tube Inspections,’” dated September 18, 2020, ADAMS Accession No. ML19301A001.

16. “Technical Specifications Task Force – Transmittal of TSTF-577, Revision 0, ‘Revised Frequencies for Steam Generator Tube Inspections,’” dated June 8, 2020, ADAMS Accession No. ML20160A359.