[7590-01 P]

NUCLEAR REGULATORY COMMISSION

Proposed Generic Communication

Steam Generator Tube Integrity and Associated Technical Specifications

AGENCY: Nuclear Regulatory Commission.

ACTION: Notice of opportunity for public comment.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) is proposing to issue a generic letter (GL) to request that addressees submit a description of their program for ensuring steam generator (SG) tube integrity for the interval between inspections and description of the methodology used to assess the effects of non-pressure-related loads such as bending on SG tube integrity. Addressees should also provide a safety assessment demonstrating that the SG tubes will have adequate structural and leakage integrity (with appropriate regulatory margins) at the time of their next SG tube inspection, taking into account the effects of non-pressure-related loads.

This *Federal Register* notice is available through the NRC's Agencywide Documents Access and Management System (ADAMS) under accession number ML042710075.

DATES: Comment period expires **[60 days after FRN is published]**. Comments submitted after this date will be considered if it is practical to do so, but assurance of consideration cannot be given except for comments received on or before this date.

ADDRESSEES: Submit written comments to the Chief, Rules and Directives Branch, Division of Administrative Services, Office of Administration, U.S. Nuclear Regulatory Commission, Mail Stop T6-D59, Washington, DC 20555-0001, and cite the publication date and page number of this *Federal Register* notice. Written comments may also be delivered to NRC Headquarters, 11545 Rockville Pike (Room T-6D59), Rockville, Maryland, between 7:30 am and 4:15 pm on Federal workdays.

FOR FURTHER INFORMATION, CONTACT: Kenneth Karwoski, NRR at 301-415-2752 or by email at kjk1@nrc.gov or Maitri Banerjee, NRR at 301-415-2277 or by email at mxb@nrc.gov.

SUPPLEMENTARY INFORMATION:

DRAFT NRC GENERIC LETTER 2004-XX: STEAM GENERATOR TUBE INTEGRITY AND ASSOCIATED TECHNICAL SPECIFICATIONS

Addressees

All holders of operating licenses for pressurized-water reactors (PWRs), except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel and {the following plants that have already modified their technical specifications to be consistent with those in the Attachment}.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this generic letter (GL) to:

(1) request that addressees submit a description of their program for ensuring steam generator (SG) tube integrity for the interval between inspections; and

(2) request that addressees submit a description of the methodology used to assess the effects of non-pressure-related loads such as bending on SG tube integrity. Addressees should also provide a safety assessment demonstrating that the SG tubes will have adequate structural and leakage integrity (with appropriate regulatory margins) at the time of their next SG tube inspection, taking into account the effects of non-pressure-related loads.

Discussion

Steam generator tubes function as an integral part of the reactor coolant pressure boundary (RCPB) and also serve to isolate radiological fission products in the primary coolant from the secondary coolant and the environment. For the purposes of this generic letter, tube integrity means that the tubes are capable of performing these functions in accordance with the plant design and licensing basis, including applicable regulatory requirements.

During operation, licensees are required to monitor and maintain the condition of the SG tubing with the objective of ensuring its continued integrity. Specifically, licensees are required by 10 CFR 50.55a(b)(2)(iii), 10 CFR 50.55a(g), or by the plant technical specifications to perform periodic inservice inspections and to repair (e.g., sleeve) or remove from service (by installing plugs in the tube ends) all tubes found to contain flaws exceeding the plugging limit (i.e., tube repair criteria).

The current technical specification requirements for inspection and repair of SG tubing were developed in the 1970s and define a prescriptive approach for ensuring tube integrity. This prescriptive approach involves inspecting the tubing at specified intervals, implementing specified tube inspection sampling plans, and repairing or removing from service by plugging all tubes found by inspection to contain flaws in excess of specified flaw repair criteria. However, as evidenced by operating experience, the prescriptive approach defined in the technical specifications may not be sufficient to ensure that tube integrity is maintained. For example, in cases of low to moderate levels of degradation, the technical specifications only require that 3- to 21-percent of the tubes be inspected, irrespective of whether the inspection results indicate that additional tubes need to be inspected to reasonably ensure that tubes with flaws

that may exceed the tube repair criteria or which may impair tube integrity are detected. In addition, the technical specifications (and Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code) do not explicitly address the inspection methods to be employed for different tube degradation mechanisms at specific tube locations, nor are the specific objectives to be fulfilled by the selected methods explicitly defined. Also, incremental flaw growth between inspections can in many instances exceed what is allowed for in the specified tube repair criteria. In such cases, the specified inspection frequencies may not ensure reinspection of a tube before its integrity is impaired. In short, current technical specification surveillance requirements may not require licensees to actively manage their SG programs so as to provide reasonable assurance that tube integrity is maintained. As a result of the above, licensees have frequently found it necessary to implement measures beyond the technical specification requirements to ensure adequate tube integrity. These measures are frequently accompanied by interaction with the NRC staff in an oversight or review capacity to ensure that adequate tube integrity is being maintained.

The NRC staff, with external stakeholder involvement, embarked on efforts to improve the SG tube integrity regulatory framework as discussed in SECY-03-0800, “Steam Generator Tube Integrity (SGTI) - Plans for Revising the Associated Regulatory Framework.” As a result of these efforts, the NRC and industry generically developed modified technical specifications for addressing steam generator tube integrity. These generically developed technical specifications were recently incorporated into one facility’s technical specifications. (Proposals to change the plant-specific technical specifications are reviewed in accordance with the license amendment review process to confirm their acceptability). These modified technical specifications are attached to this generic letter for your information. The approach taken in the modified technical specifications in the Attachment is conceptually similar to the approach

outlined in the industry initiative referred to as NEI 97-06, “Steam Generator Program Guidelines.” The modified technical specifications in the Attachment are performance-based in that they are focused on ensuring that the tubing satisfies performance criteria that are commensurate with tube integrity. This approach can be readily adapted to new or unexpected degradation mechanisms and advances in nondestructive examination technology. This approach also includes programmatic elements to ensure that tubes are being adequately monitored and maintained relative to the performance criteria.

The requirements pertaining to the integrity of the SG tubes are contained within Title 10 of the *Code of Federal Regulations* (10 CFR). Specifically, the general design criteria (GDC)[1] described in Appendix A to 10 CFR Part 50 contain, in part, requirements related to the RCPB (e.g., GDC 14, GDC 30, GDC 32). In addition to the GDC, 10 CFR 50.55a specifies that components that are part of the RCPB must meet the requirements for Class 1 components in Section III and XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code unless the plant technical specifications for surveillance differ from those specified in the ASME Code, in which case the technical specifications govern.

The requirements pertaining to the content of a plant’s technical specifications are given in 10 CFR 50.36, “Technical Specifications.” All currently operating PWR licensees have technical specifications governing the surveillance of the SG tubes. These technical specifications also include operational leakage limits so that if significant leakage develops, the plant is shut down. The plugging limits in the technical specifications were developed to ensure

[1]Or, for PWR facilities licensed before the issuance of 10 CFR Part 50, Appendix A, similar requirements in the plant-specific principal design criteria.

that degraded tubes: (1) maintain factors of safety against gross rupture consistent with the plant design basis (i.e., consistent with the stress limits of the ASME Code, Section III); and (2) maintain leakage integrity consistent with the plant licensing basis while, at the same time, allowing for potential flaw size measurement error and flaw growth between inservice inspections.

As part of the plant licensing basis, applicants for PWR licenses are also required to analyze the consequences of postulated design-basis accidents. Typical accidents analyzed are the SG tube rupture, the locked-rotor, control rod ejection, and a main steamline break. These analyses consider the potential primary-to-secondary leakage through the tubes during these events and must show that the offsite radiological doses do not exceed 10 CFR Part 100 limits (or some fraction thereof) and GDC 19 of Appendix A to 10 CFR Part 50.

Irrespective of technical specification requirements for SG tube inspection and repair, licensees are also required by 10 CFR Part 50, Appendix B Criterion XVI, “Corrective Action,” to ensure that conditions adverse to quality are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition.

The staff is requesting information as to: (1) actions licensees are taking or will take to ensure tube integrity is being maintained, and (2) contemplated changes to the technical specifications to reflect these actions.

As discussed above, the approach in the attached technical specifications is performance-based. There are three performance criteria for the SG tubes: (1) a structural integrity

performance criterion, (2) a primary-to-secondary leakage performance criterion for normal operation, and (3) a primary-to-secondary leakage performance criterion for postulated accident conditions.

During public interactions with stakeholders on the structural integrity performance criterion, the staff became aware that the effects of various non-pressure-related loads such as bending loads may not be fully addressed in industry guidance documents for assessing the integrity of degraded SG tubes. Non-pressure-related loads were assessed in the original design of the SG tubes so as to ensure that nondegraded tubes would have adequate integrity for the full range of operating conditions. As a result, this generic letter requests addressees to discuss how they have assessed the effects of non-pressure-related loads in their assessments of tube integrity and to discuss whether all tubes will have adequate structural integrity at the time of their next SG tube inspection, taking all loading conditions on the tube into account.

Requested Information

Addressees are requested to provide the following information to the NRC within 60 days of the date of this generic letter:

1. A description of the actions they are taking or will take to ensure tube integrity is being maintained and contemplated changes to the technical specifications to reflect these actions.

2. A description of the methodology used to assess the effects of non-pressure-related loads such as bending on SG tube integrity. In addition, addressees should provide a safety assessment demonstrating that the SG tubes will have adequate structural and leakage integrity at the time of their next SG tube inspection, taking into account the effects of non-pressure-related loads.

Required Response

In accordance with 10 CFR 50.54(f), addressees are required to submit written responses to this generic letter. Two options are available:

(a) Addressees may choose to submit written responses providing the information requested above within the requested time period.

(b) Addressees who cannot meet the requested completion date or who choose an alternate course of action are required to so notify the NRC in writing as soon as

possible but no later than 30 days from the date of this generic letter. The response must address any alternative course of action proposed, including the basis for the acceptability of the proposed alternative course of action, and the basis for finding that the SGs remain operable. If the information requested in the previous section of this GL will be subsequently provided, the response must set forth the schedule for submitting the information.

The required written response should be addressed to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, 11555 Rockville Pike, Rockville, Maryland 20852, under oath or affirmation under the provisions of Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f). In addition, a copy of the response should be sent to the appropriate regional administrator.

Reasons for Requested Information

This GL requests addressees to submit information. The requested information will enable the NRC staff to determine whether addressees' SG tube integrity programs provide reasonable assurance of tube integrity consistent with their design and licensing basis and applicable regulatory requirements (10 CFR Part 50, Appendix A[1]; 10 CFR Part 50, Appendix B). In addition, the requested information will enable the NRC staff to determine whether SG tube integrity is being maintained under all loading conditions consistent with the design and licensing basis and applicable regulatory requirements (10 CFR Part 50, Appendix A[1]).

The NRC staff will review the responses to this GL in order to determine whether additional actions are necessary.

Backfit Discussion

Under the provisions of Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f), this GL transmits an information request for the purpose of verifying compliance with applicable existing requirements. Specifically, the requested information will enable the NRC staff to determine whether the applicable requirements discussed above are being met. No backfit is either intended or approved in the context of issuance of this GL. Therefore, the staff has not performed a backfit analysis.

Federal Register Notification

To be done after the public comment period.

Small Business Regulatory Enforcement Fairness Act

The NRC has determined that this action is not subject to the Small Business Regulatory Enforcement Fairness Act of 1996.

Paperwork Reduction Act Statement

This GL contains information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). These information collections were approved by the Office of Management and Budget, approval no. 3150-0011, which expires on February 28, 2007.

The burden of these mandatory information collections on the public is estimated to average 200 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of these information collections, including suggestions for reducing the burden, to the Records and FOIA/Privacy Services Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by Internet electronic mail to INFOCOLLECTS@NRC.GOV; and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0011), Office of Management and Budget, Washington, DC 20503.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

Sample Technical Specifications

Steam Generator (SG) Program

A SG Program shall be established and implemented to ensure that SG tube integrity is maintained. The SG Program shall include the following provisions:

a. Provisions for condition-monitoring assessments. A condition-monitoring assessment is an evaluation of the "as-found" condition of the tubing with respect to the performance criteria for structural integrity and accident-induced leakage. The "as-found" condition refers to the condition of the tubing during a SG inspection outage, as determined from the inservice inspection results or by other means, prior to the plugging of tubes. Condition-monitoring assessments shall be conducted during each outage during which the SG tubes are inspected or plugged to confirm that the performance criteria are being met.

b. Performance criteria for SG tube integrity. SG tube integrity shall be maintained by meeting the performance criteria for tube structural integrity, accident-induced leakage, and operational LEAKAGE.

1. Structural integrity performance criterion: All inservice SG tubes shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby, and cooldown and all anticipated transients included in the design specifications) and design-basis accidents. This

includes retaining a safety factor of 3.0 against burst under the normal steady state full-power operation primary-to-secondary pressure differential and a safety factor of 1.4 against burst applied to the design-basis accident primary-to-secondary pressure differentials. Apart from the above requirements, additional loading conditions associated with the design-basis accidents, or combination of accidents in accordance with the design and licensing basis, shall also be evaluated to determine if the associated loads contribute significantly to burst or collapse. In the assessment of tube integrity, those loads that do significantly affect burst or collapse shall be determined and assessed in combination with the loads due to pressure with a safety factor of 1.2 on the combined primary loads and 1.0 on axial secondary loads.

2. Accident-induced leakage performance criterion: The primary-to-secondary accident-induced leakage rate for any design-basis accident, other than a SG tube rupture, shall not exceed the rates assumed in the accident analysis for total leakage rate from all SGs and leakage rate from an individual SG. Accident-induced leakage is not to exceed [*licensee to insert value]* gallons per day through each SG and [*licensee to insert value*] gallons per day through all SGs.

3. The operational LEAKAGE performance criterion is specified in limiting condition for operation (LCO) [*licensee to insert reference to appropriate LCO. For limits currently greater than 150 gallons per day, the LCO limit should be lowered to a value less than or equal to 150 gallons per day.]*

c. SG tube repair criteria. Tubes found by inservice inspection to contain flaws with a depth equal to or exceeding 40 percent of the nominal tube wall thickness shall be plugged.

d. Provisions for SG tube inspections. Periodic SG tube inspections shall be performed. The number and portions of the tubes inspected and the method of inspection shall be performed with the objective of detecting flaws of any type (for example, volumetric flaws, axial and circumferential cracks) that may be present along the length of the tube, from the tube-to-tubesheet weld at the tube inlet to the tube-to-tubesheet weld at the tube outlet, and that may satisfy the applicable tube repair criteria. The tube-to-tubesheet weld is not part of the tube. In addition to meeting requirements d.1, d.2, and d.3 below, the inspection scope, inspection methods, and inspection intervals shall be such as to ensure that SG tube integrity is maintained until the next SG inspection. An assessment of degradation shall be performed to determine the type and location of flaws to which the tubes may be susceptible and, based on this assessment, to determine which inspection methods need to be employed and at what locations.

1. Inspect 100 percent of the tubes in each SG during the first refueling outage following SG replacement.

2. Inspect 100 percent of the tubes at sequential periods of [*for licensees with thermally treated Alloy 690 tubes, insert* "144, 108, 72, and thereafter 60 effective full-power months;" *for licensees with thermally treated Alloy 600 tubes, insert* "120, 90, and thereafter 60 effective full-power months;" *for licensees with mill-annealed Alloy 600 tubes, insert* "60 effective full-power months"]. The first sequential period

shall be considered to begin after the first inservice inspection of the SGs. In addition, inspect 50 percent of the tubes by the refueling outage nearest the midpoint of the period and the remaining 50 percent by the refueling outage nearest the end of the period. No SG shall operate for more than [*for licensees with thermally treated Alloy 690 tubes, insert* "72 effective full-power months or three refueling outages;" *for licensees with thermally treated Alloy 600 tubes, insert* "48 effective full-power months or two refueling outages;" *for licensees with mill-annealed Alloy 600 tubes, insert* "24 effective full-power months or each refueling outage" (whichever is less)] without being inspected.

3. If crack indications are found in any SG tube, then the next inspection for each SG for the degradation mechanism that caused the crack indication shall not exceed 24 effective full-power months or one refueling outage (whichever is less). If definitive information, such as from examination of a pulled tube, diagnostic nondestructive testing, or an engineering evaluation indicates that a cracklike indication is not associated with a crack or cracks, then the indication need not be treated as a crack.

e. Provisions for monitoring operational primary-to-secondary leakage.

Steam Generator (SG) Tube Inspection Report

A report shall be submitted within 180 days of the initial entry into MODE 4 following completion of the inspection. The report shall include:

a. The scope of inspection performed on each SG.

b. Active degradation mechanisms found.

c. Nondestructive examination techniques utilized for each degradation mechanism.

d. Location, orientation (if linear), and measured sizes (if available) of service-induced indications.

e. Number of tubes plugged during the inspection outage for each active degradation mechanism.

f. Total number and percentage of tubes plugged to date.

g. The results of condition monitoring, including the results of tube pulls and in-situ testing.

END

Documents may be examined, and/or copied for a fee, at the NRC's Public Document Room at One White Flint North, 11555 Rockville Pike (first floor), Rockville, Maryland. Publicly available records will be accessible electronically from the Agencywide Documents Access and Management System (ADAMS) Public Electronic Reading Room on the Internet at the NRC Web site, http://www.nrc.gov/NRC/ADAMS/index.html. If you do not have access to ADAMS or if you have problems in accessing the documents in ADAMS, contact the NRC Public Document Room (PDR) reference staff at 1-800-397-4209 or 301-415-4737 or by e-mail to pdr@nrc.gov.

Dated at Rockville, Maryland, this 30 day of September 2004.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Francis M. Costello, Acting Branch Chief
Reactor Operations Branch
Division of Inspection Program Management
Office of Nuclear Reactor Regulation

a. The scope of inspection performed on each SG.

b. Active degradation mechanisms found.

c. Nondestructive examination techniques utilized for each degradation mechanism.

d. Location, orientation (if linear), and measured sizes (if available) of service-induced indications.

e. Number of tubes plugged during the inspection outage for each active degradation mechanism.

f. Total number and percentage of tubes plugged to date.

g. The results of condition monitoring, including the results of tube pulls and in-situ testing.

END

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Dated at Rockville, Maryland, this 30 day of September 2004.

FOR THE NUCLEAR REGULATORY COMMISSION
/RA/
Francis M. Costello, Acting Branch Chief
Reactor Operations Branch
Division of Inspection Program Management
Office of Nuclear Reactor Regulation

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