POLICY ISSUE
INFORMATION

August 3, 2004 SECY-04-0141

FOR: The Commissioners

FROM: Luis Reyes
Executive Director for Operations

SUBJECT: ISSUANCE OF NUCLEAR REGULATORY COMMISSION GENERIC LETTER 2004-XX, "REQUIREMENTS FOR STEAM GENERATOR TUBE INSPECTIONS"

PURPOSE:

To inform the Commission of the staff's intention to issue the subject generic letter. In the generic letter, the staff asks all operating pressurized-water reactor (PWR) licensees to provide information that will enable the staff to determine whether their steam generator (SG) tube inspection programs comply with the existing tube inspection requirements (the plant technical specifications (TS) in conjunction with Appendix B to Title 10 of the *Code of Federal Regulations* Part 50 (10 CFR Part 50, Appendix B)).

BACKGROUND:

Steam generator tubes are an integral part of the reactor coolant pressure boundary and, also serve to isolate radiological fission products in the primary coolant from the secondary coolant and the environment. Tube integrity means that the tubes are capable of performing these functions in accordance with the plant licensing basis, including applicable regulatory requirements. Given the importance of SG tube integrity, all current PWR licensees have TS governing the surveillance of SG tubes. SG tube inspections are also subject to the quality assurance requirements of 10 CFR Part 50, Appendix B.

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The staff learned that several licensees were not fully implementing inspection methods capable of detecting circumferentially-oriented cracks at all locations where the potential for such cracks exists and where, based on available evidence, there was reason to believe such cracks might be present. Each of these licensees had performed an analysis indicating that any circumferential crack in the tubes in these particular areas would not be detrimental to tube structural and leakage integrity. Thus, the analyses effectively changed the acceptance criteria for steam generator tube inspections. Implementation of an alternate acceptance criteria may require a license amendment. These analyses, however, had not been provided to the Nuclear Regulatory Commission (NRC) staff for review and approval.

DISCUSSION:

In the aforementioned cases, tube inspections near the top of the tubesheet clearly indicated the potential for circumferential cracks to occur deeper into the tubesheet, beyond the region inspected with probes capable of detecting such cracks. In each case, the licensee was aware of the potential for such cracks to exist deeper into the tubesheet, but the licensee did not employ techniques capable of reliably detecting such cracks because the licensee's analysis concluded that such cracks did not have safety implications.

The NRC staff's position is that if a tube degradation mechanism is potentially occurring at a specific location within a SG (e.g., has occurred in other tubes, or has occurred at other plants with similarly designed and operated facilities), then the TS, in conjunction with 10 CFR Part 50, Appendix B, require that inservice inspection techniques capable of detecting this type of degradation be used to inspect this region.

In the cases cited above, some licensees have relied on licensee-approved analyses to justify not inspecting with probes capable of detecting certain types of degradation in areas where it had the potential to exist. By not inspecting such areas, the licensees have allowed flaws that might have been detected and that may exceed the repair or plugging limit to remain in service. These inspection practices are contrary to the requirements in the TS in conjunction with 10 CFR Part 50, Appendix B, that conditions adverse to quality be identified by using qualified techniques and adequate test information. Neither the TS nor Appendix B provides for limiting SG tube inspections in the manner described above. In addition, this practice appears contrary to the past practice of amending the TS in cases where existing TS plugging limits are determined to be overly conservative for certain flaw types at certain locations. It is the staff's position that, unless a license amendment has been approved that changes the inspection approach, licensees are required to employ inspection methods capable of detecting all flaw types that may be present at locations that the TS require to be inspected and where flaws may exceed the applicable TS tube repair criteria.

Although this specific example involves inspections in the tubesheet region at plants where cracking had the potential to occur, similar situations could exist at other tube locations for certain degradation mechanisms. As a result, the staff's position applies to all tube locations. In addition, it applies to all PWRs since tube degradation can occur in any SG and similar situations could exist at any plant.

Therefore, the NRC is issuing this generic letter to request addressees to provide information that will enable the staff to make a determination whether the licensees' SG tube inspection

programs comply with the existing requirements (the plant TS in conjunction with 10 CFR Part 50, Appendix B).

A draft of this Generic Letter was placed in the Federal Register and a response to public comments on that draft is provided with the Generic Letter.

COORDINATION:

The staff briefed the Committee To Review Generic Requirements (CRGR) on the proposed generic letter during a meeting on May 11, 2004, and has addressed the Committee's comments. The CRGR has endorsed the proposed generic letter.

The Office of the General Counsel has reviewed the proposed generic letter and has no legal objections to its content.

The Office of the Chief Financial Officer has reviewed the proposed generic letter and has no objections to its content.

The staff intends to issue the attached generic letter on August XX, 2004.

/RA/

Luis A. Reyes
Executive Director
for Operations

Attachments:
1. Generic Letter 2004-XX
2. Resolution of Public Comments

OMB Control No.: 3150-0011

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

NRC GENERIC LETTER 2004-XX: REQUIREMENTS FOR STEAM GENERATOR TUBE INSPECTIONS

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.

Purpose

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

(1) advise addressees that the NRC's interpretation of the technical specification (TS) requirements in conjunction with 10 CFR Part 50, Appendix B, raises questions as to whether certain licensee steam generator (SG) tube inspection practices ensure compliance with these requirements,

(2) request that addressees submit a description of the tube inspections performed at their plants, including an assessment of whether these inspections ensure compliance with the TS requirements in conjunction with 10 CFR Part 50, Appendix B,

(3) request that addressees who conclude they are not in compliance with the SG tube inspection requirements contained in their TS in conjunction with 10 CFR Part 50, Appendix B, propose plans for coming into compliance with these requirements, and

(4) request addressees to submit a tube structural and leakage integrity safety assessment that addresses any differences between their practices and the NRC's position regarding the requirements of the TS in conjunction with 10 CFR Part 50, Appendix B. A safety assessment should be submitted for all areas of the tube required to be inspected by the TS, where flaws have the potential to exist and inspection techniques capable of detecting these flaws are not being used. This assessment should include an evaluation of whether the inspection practices rely on an acceptance standard different from the TS acceptance standards and whether the technical basis for these inspection practices constitutes a change to the "method of evaluation" (as defined in 10 CFR 50.59) for establishing the structural and leakage integrity of the tube-to-tubesheet joint.

Pursuant to 10 CFR 50.54(f), addressees are required to submit a written response to this generic letter.

Attachment 1

Background

Steam generator tubes function as an integral part of the reactor coolant pressure boundary (RCPB) and, in addition, 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 basis.

Title 10 of the *Code of Federal Regulations* (10 CFR) establishes the fundamental regulatory requirements with respect to the integrity of the SG tubing. Specifically, the general design criteria (GDC) in Appendix A to 10 CFR Part 50 state that the 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 14), and "designed, fabricated, erected, and tested to the highest quality standards practical" (GDC 30), and that RCPB components shall be "designed to permit periodic inspection and testing of important areas and features to assess their structural and leaktight integrity" (GDC 32). For plants that were issued construction permits before the effective date of 10 CFR Part 50, Appendix A, the plant specific Principal Design Criteria (PDC) in the plant design basis established similar fundamental regulatory requirements pertaining to the integrity of the steam generator tubing.

Given the importance of SG tube integrity, all current PWR licensees have TS governing the surveillance of SG tubes. These TS typically do not prescribe nondestructive test methods for inspecting tubes or specify where a particular methodology should be used. For example, current TS may employ the following or similar general language:

> Tube inspection for tubes selected in accordance with Table [xxxx] means an inspection of the steam generator tube from the point of entry (hot leg side) completely around the U-bend to the top support of the cold leg, excluding sleeved areas.

Although the TS do not prescribe the use of particular nondestructive test methods, the NRC position identified in Regulatory Guide 1.83 states that "...the equipment should be capable of locating and identifying defects due to stress corrosion cracking and due to tube wall thinning by mechanical damage, chemical wastage, or other causes." In addition, the TS surveillance requirements specify acceptance limits for SG tubes (often called plugging or repair limits) to be applied to the inspection results. The surveillance requirements seek to ensure that enough information is obtained about imperfections (e.g., flaws) in the tubes to determine if TS plugging limits are being met. Tube imperfections are defined in the TS and include circumferential and axial cracks.

SG tubes are also subject to the quality assurance requirements of 10 CFR Part 50, Appendix B. Specifically, SG tubes are safety-related components, and, therefore, subject to the criteria of Appendix B. Notwithstanding that the TS do not specify nondestructive test methods or in what locations particular test methods must be employed, Criterion IX of 10 CFR Part 50, Appendix B, "Control of Special Processes," requires, in part, that nondestructive testing be controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special

requirements. In addition, Criterion XI, "Test Control," requires, in part, that test procedures shall include provisions for assuring that all prerequisites for the given test have been met, and that adequate test instrumentation is available and used. Moreover, Criterion XVI, "Corrective Action," requires, in part, that "measures shall be established to assure that conditions adverse to quality ... are promptly identified and corrected." This generic letter addresses the selection of appropriate inspection techniques for tube locations required to be inspected by plant TS, given the tubes selected for inspection based on plant TS sampling requirements, or for tube locations in which licensees have reason to believe a condition adverse to quality may be present.

Licensees currently employ an eddy current test bobbin probe, at least, to inspect the entire length of tubing required by the TS. The bobbin probe is a high-speed probe which the industry has demonstrated is capable of reliably detecting volumetric flaws and axially-oriented cracks in the absence of significant masking signals. Masking signals may be produced by tube geometry variations or irregularities along the tube axis (such as small-radius U-bends, dents and dings, and expansion transitions) or by tube surface irregularities. Masking signals can also be produced by deposits on the tube surface, adjacent support structures (such as the tubesheet), probe wobble, cold working, permeability variations, or electrical noise.

While the bobbin probe generally provides an effective means of SG tube inspection over much of the tube length, experience has shown that the bobbin probe may not be effective at locations where significant masking signals are present. In addition, the bobbin probe generally cannot detect circumferential cracks, which has been documented in previous NRC communications (e.g., Information Notices 90-49, 94-88, and Generic Letter 95-03). Circumferential cracks can occur at locations of high axial stress (e.g., small-radius U-bends and the tubesheet expansion region).

Plant TS for virtually all PWRs require inspection of the entire length of the hot leg tube within the tubesheet. With some exceptions where specified by the plant TS, the acceptance limits (plugging limits) for these inspections apply to all imperfections along the full length of the tube in the tubesheet on the hot leg side, including axial and circumferential cracks. To the staff's knowledge, however, the bobbin probe has not been demonstrated to be capable of reliably detecting axial or circumferential flaws in the expanded region of tubing inside the tubesheet. Specialized probes are available which have been demonstrated to be capable of detecting such flaws for this application.

Given the limitations of the bobbin probe, industry practice is to supplement the bobbin probe inspection with inspections by specialized probes, such as the rotating pancake coil or +Point™ probe. However, inspecting tubes with these specialized probes is slower than with the bobbin probe. Therefore, these slow-speed probes are typically not applied over the entire length of a tube that is subject to inspection, but only at tube locations where degradation which cannot be reliably detected with the bobbin probe (e.g., circumferential cracks, axial cracks in low-row U-bends and expansion transitions) is known to be present or considered to have a potential to occur. The practice of selecting the type of probe to be used at specific locations along the length of tube involves engineering analysis (termed "degradation assessment" in industry guidelines), which may include an element of judgment, to determine the potential for degradation to occur at various locations.

In 2002, the staff learned that several licensees were not fully implementing inspection methods capable of detecting circumferentially oriented cracks at all locations where the potential for such cracks exists and where, based on available evidence, there is reason to believe such cracks may be present. These licensees were conducting full-length bobbin probe inspections of the tubes and were performing additional inspections using specialized probes to inspect for axial and circumferential cracks at certain locations, including the tube expansion transitions near the top of the tubesheet. The licensees conducted the specialized probe inspections at the tube expansion transitions in an area that extended from 2 inches above the top of the tubesheet to about 5 inches below the top of the tubesheet. At several facilities, circumferential cracks were identified at tube expansion transitions, as well as below the transitions near the bottom of the zone being inspected. These results indicate a potential for circumferential cracks to exist in the tubing below the zone inspected with the specialized probe. However, each licensee also performed an analysis indicating that circumferential cracks below the zone being inspected with the specialized probe would not be detrimental to tube structural and leakage integrity. These licensees concluded, therefore, that additional inspections for circumferential cracks with the specialized probe were unnecessary. These analyses had not been provided to the NRC staff.

The staff became aware of these activities during SG inspections conducted during refueling outages and asked these licensees to submit TS amendment requests or safety analyses to obtain NRC approval of their inspection approaches. The staff reviewed the resulting submittals on a one-cycle basis before the plants restarted. Subsequent to these plant-specific actions, the staff evaluated the appropriate method to interact with licensees on this issue. Given new inspection information indicating that circumferential cracks were occurring in tubes below the expansion transition region, and the potentially generic nature of the issue, the staff decided to communicate the issue to licensees through this generic letter.

Discussion

As part of the inspection process, licensees perform an engineering (degradation) assessment to determine the potential for degradation at specific locations of the tube. The staff recognizes that the potential for degradation may vary from plant to plant based on tube material, operating hours, and other plant-specific factors. However, once licensees have determined what degradation may be present at various locations along the length of the tube, it is the staff position that they should use probes capable of detecting these forms of degradation. Not to do so raises questions about whether the tube inspection practices ensure compliance with the TS in conjunction with 10 CFR Part 50, Appendix B. This staff position is consistent with the position expressed in Section 2.a of Regulatory Guide 1.83, Revision 1, issued in 1975.

In the aforementioned cases, tube inspections with a specialized probe near the top of the tubesheet clearly indicated the potential for circumferential cracks to occur deeper into the tubesheet, beyond the region inspected with the specialized probes. In each case the licensee was aware of the potential for such cracks to exist deeper into the tubesheet, but the licensee did not employ techniques capable of reliably detecting such cracks because the licensee's analysis concluded that such cracks did not have safety implications.

In addition, the staff notes that not inspecting with techniques that are capable of detecting flaws of any type that may be present would allow any such flaws to remain in place. However, most plant TS state that only tubes with imperfections less than 40 percent of the nominal tube wall thickness are acceptable for continued service (there are exceptions specified in some plant TS). Therefore, if licensees do not use probes capable of detecting flaws that may potentially be present, licensees would be allowing flaws to remain inservice which may exceed the applicable TS acceptance criteria (i.e., tube repair or plugging limit). The staff notes that the acceptance or plugging limit for SG tube inspections is a specific TS limit that can only be changed through the license amendment process. Furthermore, even when a probe is capable of finding flaws potentially present, flaws may be inadvertently missed for a variety of reasons (e.g., the flaw size is below the threshold of detection). However, missing a flaw is different than using a probe which is not capable of detecting the forms of degradation that may be present. In other words, the objective of the inspection is to detect flaws of any type that may have the potential to be present along the length of the tube required to be inspected and that may meet or exceed the applicable tube repair criteria.

The staff acknowledges that there may be circumstances in which certain flaws at certain locations may not impair tube integrity even if the TS plugging limit is exceeded. In such circumstances, the staff has reviewed and approved TS amendment requests for alternative tube repair criteria (ARCs) applicable to specified flaw types and/or locations. Some of these ARCs have included special inspection requirements defining the method of inspection to be used when implementing the ARCs. It is the staff's position that if there are locations where certain flaw types can be allowed to exceed existing TS plugging limits, the TS need to be amended to allow the practice. In general, the amendment could include provisions for an ARC and sometimes accompanying special inspection requirements, consistent with past licensing practice. Alternatively, in the case of the aforementioned tubesheet inspection issue, such an amendment could simply clarify the extent of the tube to be inspected within the thickness of the tubesheet, if there is a supporting technical basis that flaws at locations not to be inspected will not impair tube integrity irrespective of the size of the flaws. Pending the submission of such amendment requests, it is the staff's position that licensees are required under existing requirements (TS in conjunction with 10 CFR Part 50, Appendix B) to employ inspection techniques capable of detecting all flaw types which may be present at locations which are required to be inspected pursuant to the TS.

Although this specific example involves inspections in the tubesheet region at plants where cracking had the potential to occur, similar situations could exist at other tube locations for certain degradation mechanisms. As a result, the staff's position applies to all tube locations. In addition, it applies to all PWRs since tube degradation can occur in any steam generator and similar situations could exist at any plant.

Also, for the instances cited above, the safety basis developed by the licensees for not expanding the scope of the specialized probe inspection beyond a specific distance (x-inches) into the tubesheet was that any cracks below that distance were not detrimental to tube integrity. This was based on analyses indicating that tubes only needed a minimum embedment of x-inches into the tubesheet to exhibit acceptable structural and accident leakage integrity. The staff notes that this is a different acceptance standard than the TS acceptance standards (i.e., plugging limits or tube repair criteria) that have been reviewed and approved by

the NRC staff. If the licensee is utilizing a less restrictive acceptance standard compared to the standards in the technical specifications, a license amendment will be needed in order to implement such a standard.

Furthermore, these analyses have been performed to demonstrate that cracks below this embedment distance do not impair SG tube integrity, even if these cracks cause complete severance of the tube. According to many plant final safety analysis reports (FSARs), the SGs were designed in accordance with Section III of the American Society of Mechanical Engineers (ASME) Code. In accordance with Section III of the Code, the original design basis pressure boundary for the tube-to-tubesheet joint included the tube and tubesheet extending down to and including the tube-to-tubesheet weld. The criteria of Section III of the ASME Code constitute the "method of evaluation" for the design basis. These criteria provide a sufficient basis for evaluating the structural and leakage integrity of the original design basis joint. However, the criteria of Section III do not provide a sufficient basis by themselves for evaluating the structural and leakage integrity of a mechanical expansion joint consisting of a tube expanded against the tubesheet over some minimum embedment distance. If a licensee is redefining the design basis pressure boundary and is using a different method of evaluation to demonstrate the structural and leakage integrity of the revised pressure boundary, an analysis under 10 CFR 50.59 would determine whether a license amendment is required.

In summary, for the cases discussed above, the TS required a tube inspection for the full length of the tube within the tubesheet (scope), and the findings from this inspection were required to be evaluated against a repair (plugging) criterion. Neither the scope nor the repair criteria in the TS contained provisions for limiting the inspections through a licensee-approved process.

For the cases cited above, the NRC cannot conclude that the licensees are in compliance with their TS in conjunction with Criteria IX, XI, and XVI of 10 CFR Part 50, Appendix B, with regard to the inspections they are performing. This concern stems, in part, from experience. Some licensees have relied on licensee-controlled analyses to justify not inspecting for degradation in areas where it had the potential to exist. By not inspecting such areas, the licensees have allowed flaws that may have been detected and that may exceed the repair or plugging limit to remain in service. These inspection practices are contrary to the requirements in the TS in conjunction with Criteria IX, XI, and XVI of 10 CFR Part 50, Appendix B, which require the identification of conditions adverse to quality by using qualified techniques and adequate test instrumentation and do not provide for limiting SG tube inspections in the manner described above. In addition, this practice appears contrary to the consistent past practice of amending the TS in cases where existing TS plugging limits are determined to be overly conservative for certain flaw types at certain locations. It is the staff's position that pending a license amendment clarifying the inspection approach to be followed, licensees are required to employ inspection methods capable of detecting all flaw types that may be present at locations that are required to be inspected by the TS, and where flaws at those locations may exceed the applicable TS tube repair criteria.

Based on these staff concerns, the NRC is issuing this generic letter, consistent with the requirements in 10 CFR 50.54(f), to obtain information necessary for the staff to determine if addressees are in compliance with the TS in conjunction with 10 CFR Part 50, Appendix B. In

addition, licensees who have not been implementing inspections consistent with the staff's position should submit a safety assessment that demonstrates their ability to ensure continued safe operation and addresses any differences between their practices and those called for by the staff's position. Safety assessments should be submitted to the NRC for all areas of the tube required to be inspected by the TS, where flaws have the potential to exist and inspection techniques capable of detecting these flaws are not being used.

Requested Information

Within 60 days of the date of this generic letter, addressees are requested to provide the following information to the NRC:

1. Addressees should provide a description of the SG tube inspections performed at their plant during the last inspection. In addition, if they are not using SG tube inspection methods whose capabilities are consistent with the NRC's position, addressees should provide an assessment of how the tube inspections performed at their plant meet the inspection requirements of the TS in conjunction with Criteria IX and XI of 10 CFR Part 50, Appendix B, and corrective action taken in accordance with Appendix B, Criterion XVI. This assessment should also address whether the tube inspection practices are capable of detecting flaws of any type that may potentially be present along the length of the tube required to be inspected and that may exceed the applicable tube repair criteria.

2. If addressees conclude that full compliance with the TS in conjunction with Criteria IX, XI and XVI of 10 CFR Part 50, Appendix B, requires corrective actions, they should discuss their proposed corrective actions (e.g., changing inspection practices consistent with the NRC's position or submitting a TS amendment request with the associated safety basis for limiting the inspections) to achieve full compliance. If addressees choose to change their TS, the staff has included in the Attachment suggested changes to the TS definitions for a tube inspection and for plugging limits to show what may be acceptable to the staff in cases where the tubes are expanded for the full depth of the tubesheet and where the extent of the inspection in the tubesheet region is limited.

3. For plants where SG tube inspections have not been or are not being performed consistent with the NRC's position on the requirements in the TS in conjunction with Criteria IX, XI, and XVI of 10 CFR Part 50, Appendix B, the licensee should submit a safety assessment (i.e., a justification for continued operation based on maintaining tube structural and leakage integrity) that addresses any differences between the licensee's inspection practices and those called for by the NRC's position. Safety assessments should be submitted for all areas of the tube required to be inspected by the TS, where flaws have the potential to exist and inspection techniques capable of detecting these flaws are not being used, and should include the basis for not employing such inspection techniques. The assessment should include an evaluation of (1) whether the inspection practices rely on an acceptance standard (e.g., cracks located at least a minimum distance of x below the top of the tube sheet, even if these cracks cause complete severance of the tube) which is different from the TS acceptance standards (i.e., the tube plugging limits or repair criteria), and (2) whether the safety

assessment constitutes a change to the "method of evaluation" (as defined in 10 CFR 50.59) for establishing the structural and leakage integrity of the joint. If the safety assessment constitutes a change to the method of evaluation under 10 CFR 50.59, the licensee should determine whether a license amendment is necessary pursuant to that regulation.

Required Response

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

(a) Addressees may choose to submit written responses providing the information requested above within the requested time period. (Addressees who are implementing SG tube inspections in accordance with the staff position set forth in this GL need only describe the last inspections of their SG tubes to allow the staff to verify this.)

(b) Addressees who cannot meet the requested completion date or who choose an alternate course of action are required to notify the NRC of these circumstances 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 generic letter requests addressees to submit information. The requested information will enable the NRC staff to determine whether licensees are implementing SG tube inspections in accordance with applicable requirements. In cases where licensees are not implementing inspections in such a manner, the requested information will allow the staff to determine whether the licensee's program complies with existing requirements (the plant TS in conjunction with 10 CFR Part 50, Appendix B, and the GDC or the plant-specific design basis, as appropriate).

Backfit Discussion

Under the provisions of Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f), this generic letter 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 applicable requirements (plant TS in conjunction

with 10 CFR Part 50, Appendix B) are being met. No backfit is either intended or approved in the context of issuance of this generic letter. Therefore, the staff has not performed a backfit analysis.

Federal Register Notification

A notice of opportunity for public comment on this generic letter was published in the *Federal Register* on May 14, 2003 (68 FR 25909). A total of 15 comments were received, 13 from the nuclear industry and two from the public. The staff considered all comments that were received. The staff's evaluation of the comments is publicly available through the NRC's Agencywide Documents Access and Management System (ADAMS) under Accession No. ML041690373.

Paperwork Reduction Act Statement

This generic letter 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 number 3150-0011, which expires on February 28, 2007.

The burden to the public for these mandatory information collections is estimated to average 60 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.

If you have any questions about this matter, please contact one of the persons listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

Bruce A. Boger, Director
Division of Inspection Program Management
Office of Nuclear Reactor Regulation

Attachment: As stated

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Sample Changes to the TS for Plants Limiting Inspections in the Tubesheet Region

Plugging Limit means the imperfection depth at or beyond which the tube shall be removed from service and is equal to 40% of the nominal tube wall thickness. All tubes with degradation in the portion of the tube from x-inches below the bottom of the expansion transition (or the top of the tubesheet, whichever is lower) to the bottom of the expansion transition (or the top of the tubesheet, whichever is lower), shall be removed from service.

Tube Inspection means an inspection of the steam generator tube from x-inches below the hot-leg expansion transition or the top of tubesheet, whichever is lower, completely around the U-bend to the top support of the cold leg.

Attachment

RESOLUTION OF PUBLIC COMMENTS ON
NRC DRAFT GENERIC LETTER 2004-XX:
REQUIREMENTS FOR STEAM GENERATOR TUBE INSPECTIONS

TABLE OF CONTENTS

A. List of Letters Providing Comments

The following letters provided comments on draft generic letter (GL) 2004-XX, "Requirements for Steam Generator Tube Inspections":

1. Tennessee Valley Authority (TVA) letter dated June 12, 2003, “Nuclear Regulatory Commission (NRC) - Comments on Proposed Generic Communication - Requirements for Steam Generator (SG) Tube Inspections (Vol. 68, No. 93, *Federal Register* 25909, Dated May 14, 2003),” ML031680648

2. SCE&G letter dated July 7, 2003, “Virgil C. Summer Nuclear Station (VCSNS); Docket No. 50/395; Operating License No. NPF-12; “Proposed Generic Communication; Requirements for Steam Generator Tube Inspections (May 14, 2003, 68 FR 25909),” ML031970039

3. Southern Nuclear Operating Company letter dated July 8, 2003, “Southern Nuclear Operating Company Comments on NRC Generic Letter 2003-XX: Requirements for Steam Generator Tube Inspections, 68 FR 25909, May 14, 2003,” ML031970042

4. Nuclear Energy Institute letter dated July 14, 2003, “Proposed Generic Communication; Requirements for Steam Generator Tube Inspections (68 Fed. Reg. 25909),” ML031970392

5. Duke Energy letter dated July 14, 2003, “Comments on Proposed Generic Letter GL 2003-XX, Requirements for Steam Generator Tube Inspections 68 FR 25909 dated May 14, 2003,” ML031970398

6. Florida Power and Light Company letter dated July 14, 2003, “Comments on Proposed Generic Communication, Requirements for Steam Generator Tube Inspections - 68 FR 25909,” ML031970401

7. Westinghouse Electric Company letter dated July 14, 2003, “Westinghouse Comments on Proposed Generic Letter 2003-XX, ‘Requirements for Steam Generator Tube Inspections,’” ML031970404

8. AmerenUE letter dated July 11, 2003, “Transmittal of AmerenUE Comments on Draft Generic Communication; Requirements for Steam Generator Tube Inspections (68 Fed. Reg. 25909),” ML031970406

9. Nuclear Information and Resource Service letter dated July 14, 2003, “Comments of Nuclear Information and Resource Service in Support of a Generic Communication Requiring Industry Adherence to Federal Codes for Effective Inspections to Better Evaluate Steam Generator Tube Integrity,” ML031970411

10. Kay Drey letter dated July 14, 2003, “re: Federal Register. May 14, 2003. Volume 68, Number 93, pp. 25909-25912,” ML031970414

11. Progress Energy e-mail dated July 15, 2003, "Proposed Generic Communication; NRC Generic Letter 2003-XX: Requirements for Steam Generator Tube Inspections," ML031980585

12. Exelon Nuclear letter dated July 9, 2003, "Comments on Proposed Generic Communication; Requirements for Steam Generator Tube Inspections," ML032110422

13. Entergy Nuclear letter dated July 9, 2003, "Comments on Proposed Generic Communication; Requirements for Steam Generator Tube Inspections - 68 FR 25909," ML032110426

14. Strategic Teaming and Resource Sharing letter dated July 17, 2003, "Strategic Teaming and Resource Sharing (STARS) Comments on Draft Generic Communication; Requirements for Steam Generator Tube Inspections (68 FR 25909)," ML032110429

15 Arizona Public Service letter dated July 16, 2003, "Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, and 3; Docket Nos. STN 50-528/529/530; Comments on Proposed NRC Generic Letter 2003-XX: Requirements for Steam Generator Tube Inspections," ML032040594

B. Comment Resolution

Provided below are abbreviated descriptions of the comments or sets of comments (when several comments are closely related) followed by the NRC staff's response. In some cases, the NRC staff paraphrased the comments, while in others the language is taken verbatim from the comments. It should be noted that the abbreviated descriptions are not intended to simplify or distort the issues raised by those who commented on the draft GL. The staff carefully considered each comment in its entirety. Following each comment is an identifier (i.e., a number) that enables the reader to refer back to the letters referenced above (also see item C, Public Comment Cross-Reference List).

1. Draft Generic Letter (GL) Is Unnecessary Given Industry's Steam Generator Initiative

Comment(s):

Several comments were received that the proposed GL is unnecessary since the industry's proposed generic changes to the steam generator technical specification (TS) will address the tube inspection issue. These comments also expressed concern that issuing the GL would divert NRC and industry resources from the generic TS initiative. (4A, 6A, 8A, 11A, 13A, 14J, 15A)

The NRC should monitor ongoing industry initiatives before deciding to publish a GL. (5A)

The framework of NEI 97-06 would define the steam generator inspection scope in the steam generator program procedures, not the TS. Inspection scope is defined by the degradation assessment that considers all potential degradation morphologies and locations. (7A)

The outdated steam generator (TS) deficiency should be resolved through the generic TS change process. (1A)

Response:

The staff agrees that completion of the ongoing initiative with industry will upgrade the existing TS. One of the purposes of the GL, however, is to advise licensees for pressurized-water reactors that the NRC's interpretation of the existing TS requirements in conjunction with Appendix B to Part 50 of Title 10 of the Code of Federal Regulations (10 CFR Part 50) raises questions as to whether steam generator tube inspection practices ensure compliance with the existing requirements. Since the staff's position is that the TS already define the portions of the SG tubes that must be inspected, and Appendix B sets forth requirements governing the selection of inspection techniques, the GL is necessary to ensure compliance with existing requirements. Questions concerning compliance with existing requirements need to be addressed even though the regulatory framework of steam generator tube inspection requirements may change in the future.

The staff believes there are potential safety implications if licensees' interpretations of the applicable regulatory requirements are different than the NRC's in that a condition (e.g., circumferential cracking) could exist at a given location such that SG tube structural or leakage integrity could be impaired, given conditions at a particular plant. Therefore, the staff needs to verify the adequacy of the licensee's inspection program. Accordingly, the staff concludes that issuance of the GL is necessary even while the staff is evaluating the proposals to revise the steam generator TS.

With respect to the comments that the GL will divert NRC and industry resources from the generic effort to improve the TS, the staff has concluded that issuance of the GL is necessary to ensure compliance and continued safe operation of the plants. Issuing the GL will not divert NRC staff efforts on the generic TS nor cause a delay in supporting this initiative.

2. TS Changes, Issue Should Be Addressed per Administrative Letter 98-10

Comment(s):

A comment indicated one path to resolution of this issue is to revise the tube inspection and tube plugging limit definitions in the plant technical specifications. (7A)

Comments received indicate that steam generator inspection requirements giving rise to the NRC staff's concern should be treated as broken TS per NRC Administrative Letter (AL) 98-10, "Disposition of Technical Specifications That Are Insufficient to Assure Plant Safety." (1C, 6D, 8C)

Response:

The NRC staff agrees that amendment of tube inspection or plugging limit definitions may be one path to resolution of this issue. Licensees that determine changes are

needed in their technical specifications are able to request a license amendment. In addition, NRC Administrative Letter 98-10 concerns the correction of facility TS when they are found to contain nonconservative values or specify incorrect actions. As discussed in this Administrative Letter, it is the NRC's expectation that in the case of a deficient TS, prompt actions are taken to correct the deficiency, including revising the TS. After the NRC identified the tube inspection issue to the industry in May 2002, there has only been one instance of a licensee declaring the steam generator tube inspection portion of their TS inadequate in accordance with the provisions of AL 98-10. That licensee subsequently withdrew its TS amendment request, pending the staff's review of the comments on the draft GL. Given that licensees have not proposed TS changes to address this issue in accordance with the guidance in AL 98-10, the staff concludes that (a) licensees have concluded their TSs are adequately addressing the inspection issue raised in the GL (i.e., the NRC interpretation of the requirements is appropriate and a TS amendment is only needed if the extent of inspection in the tubesheet is limited as discussed in the GL), or (b) licensees have not taken timely corrective action to address the issue, or (c) licensees have not recognized the issue. Accordingly, the GL is necessary for the NRC to determine if any licensees have not recognized the issue or not taken timely corrective action, and if so, whether any enforcement action is warranted with respect to such licensees.

3. Bobbin Coil Eddy Current Fulfills TS Requirements

Comment(s):

Several comments were received stating that the original plant licensing accepted bobbin coil eddy current examination; therefore, it should remain as an accepted inspection technique unless modified by license amendment. A typical comment related to this topic is as follows: "The basis for current TS remains rooted in Regulatory Guide 1.83, 'Inservice Inspection of Pressurized Water Reactor Tubes.' The exception to this rule is additional inspection provisions for certain regions of the steam generators that licensees have explicitly committed to in order to obtain alternate repair criteria or other steam generator license amendments. This Regulatory Guide establishes a relationship between the baseline inspections and subsequent inspections. Therefore, given that the tubes in the steam generator were inspected with bobbin coil eddy current probes to establish a baseline, the same eddy current technique should be the minimum requirement for subsequent inspections." (1B, 6C, 8E, 11F, 12D)

The NRC has long held that licensees cannot reinterpret TS requirements by issuing so-called "technical specification interpretations," but the proposed GL does precisely this. It reinterprets the TS of most pressurized water reactors to require the use of new eddy current technology or to expand the scope of steam generator tube inspections, and cites Appendix B requirements as the basis for the reinterpretation. (13G)

The current plant TSs regarding steam generator surveillance have been silent on the method of inspection technique since initial plant operation. While new inspection technology has brought the capability to use different techniques to monitor the condition of the tubing, this new technology does not invalidate the bobbin probe inspection used since initial plant operation. (11F)

Response:

Regulatory Guide (RG) 1.83, "Inservice Inspection of Pressurized Water Reactor Steam Generator Tubes," indicates, in part, that the baseline examination of steam generator tubes should be conducted under conditions and with equipment and techniques equivalent to those expected to be employed in subsequent inservice examinations. This practice is intended to permit a comparison of inspection data from one outage to the next, rather than preclude the use of other nondestructive test techniques. It has always been the staff's position that nondestructive examination inspection equipment and procedures should be capable of locating and identifying cracks and other forms of tube degradation.

RG 1.83 provides the following guidance under Section C.2, "Inspection Equipment and Procedures": "Inservice inspection should include nondestructive examination by eddy current testing or equivalent techniques. The equipment should be capable of locating and identifying stress corrosion cracks and tube wall thinning by chemical wastage, mechanical damage, or other causes." Thus, the regulatory position has been, in part, that inservice inspection techniques should be capable of detecting defects due to stress corrosion cracking (SCC). Although the bobbin coil is capable of detecting some defects due to SCC (i.e., axially oriented) in some tube locations, the Guidance in RG 1.83, Section C.2 is not limited to the defects that the bobbin coil can detect. Rather, that guidance applies to all crack orientations in all portions of the tube where inspection is required. Rotating probe eddy current techniques have been used for a long time in locations (e.g., at the top of the tubesheet) where the licensees have recognized the potential for defects and the limitations of the bobbin coil technique. Therefore, the position taken in the GL is consistent with past regulatory positions.

The staff's position does not preclude the use of the bobbin coil for many types of applications, although it has been documented in previous NRC communications (e.g., Information Notices 90-49, 94-88, and Generic Letter 95-03) that the bobbin probe generally cannot detect circumferential cracks. In fact, the staff recognizes that the bobbin coil is capable of detecting many forms of degradation, particularly those that were present early in the life of many steam generators (e.g., wear, pitting, wastage, wall thinning, etc.). The staff recognizes that the TSs were not based on any specific method of examination. Rather, the TS, in conjunction with 10 CFR Part 50, Appendix B, permit the use of any technique (e.g., ultrasound, eddy current, radiography) which is capable of detecting flaw types which may be present along the length of the tube.

In addition, the staff's position is not that one particular technique should be used to inspect for cracking over the full length of tubing. However, it would be unacceptable if the methods chosen for the inspection were incapable of detecting flaws of any type that may be present along the length of the tube required to be inspected and that may satisfy (meet or exceed) the applicable tube repair criteria.

4. Discouraging Future Technology Advancements

Comment(s):

Several comments stated that the proposed GL would have unintended negative effects on the development of improved inspection techniques. (1D, 4H, 8F, 14C, 15E)

Issuing this GL will discourage future advances in technology. The proposed GL undermines a stated objective of GL 95-05, "Voltage Based Repair Criteria For Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking." GL 95-05 states:

> *This action (GL 95-05) should not be construed to discourage licensees from using better or further refined data acquisition techniques, eddy current technology, and eddy current data analysis techniques as they become available. The staff strongly encourages the industry to continue its efforts to improve the nondestructive examination (NDE) of steam generator tubes and continues to believe that inspection methods and repair criteria based on physical dimensions (e.g., length and depth) of defects are the most desirable when they can be achieved.* (1D)

The proposed GL can be interpreted to construe that new techniques are de facto methods of compliance and would have the unintended consequence of discouraging future refinements in technology. (4H)

Inspection requirements continually change as advancements in technology are achieved. It is problematic to imply that utilities may find themselves in violation of their TS each time an improvement in technology is achieved. (8B)

Response:

The proposed GL does not request the use of new inspection technology. The current regulatory requirements, (TS and Appendix B) do not specify a particular technology for the inspection of steam generator tubes (ultrasonic, eddy current, radiography, etc.), nor do they specify a particular method (including probe) for the inspection of tubes. The longstanding practice of licensees has been to perform steam generator inspections using multiple eddy current techniques. The choice of technology and method is left to the licensee. However, as discussed in the GL, the technology and methods chosen by a licensee for inspecting their steam generator tubes shall have the objective of detecting flaws of any type that may be present along the length of the tube required to be inspected and that may satisfy (meet or exceed) the applicable tube repair criteria. The TS in conjunction with Appendix B requirements can be met without the development of new technology and do not require such development. In sum, the staff does not believe that issuance of the GL will discourage future advances in technology.

5. Probability of Detection

Comment(s):

Industry techniques cannot ensure that all flaws are found at the repair criterion. This issue has been addressed by the Generic License Change Package (GLCP) developed by the industry. The words in the GLCP are as follows: "The number and portions of the tubes inspected and 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." (5E)

The GL implies that detection of degradation at the repair limit (typically 40% through wall) is always expected when, in fact, detection is a function of many variables. (6G, 14B)

The parenthetical phrase under Item 1 of the "Requested Information" ["(i.e., discuss whether the techniques employed during the tube inspections ensured flaws could be detected such that the plugging or repair limits could be implemented)"] implies that all degradation is detectable at the repair limit. No mention is made of the potential for degradation or the probability of detection at the repair limit. (4N)

What is an acceptable detection capability? The proposed GL appears to imply that reliable detection at the repair limit is a condition of acceptance without defining a condition of reliability (i.e., probability of detection). (14B, 15C)

Response:

The staff did not intend the GL to imply that the probability of detection (POD) must be 100% for all flaws that meet or exceed the repair criterion. Rather, the staff intended to indicate that the scope and methods of licensee inspections should be performed with the objective of detecting flaws of any type that may be present along the length of the tube required to be inspected and that may meet or exceed the applicable tube repair criteria. That is, if the flaws were detected, the repair criteria would be implemented. This is different than the approach (discussed in the GL) in which the licensees used techniques that were not capable of finding the flaws that were potentially present in the tubesheet region based on plant-specific experience. Although every attempt should be made to detect and repair tubes with degradation that has reached the repair criterion, the staff recognizes the limits of inservice inspection techniques; therefore, the staff has revised the GL to recognize that the objective of tube inspections is to detect flaws of any type that may be present along the length of tube required to be inspected and that may meet or exceed the applicable tube repair criteria. The staff has revised item 1 of the requested information to avoid implying all degradation is detectable and to recognize the *potential* for degradation to occur.

6. Qualified Techniques

Comment(s):

The NRC staff in a number of places within the proposed GL refers to eddy current probe qualification, yet provides no reference that defines the term. How is the determination to be made as to whether a probe or technique is "qualified"? Is it the staff's intent to issue further guidance on how to qualify a technique for each location and type of degradation? (8G, 14A, 15B)

What are the code(s), standard(s), specification(s), criteria, and other special requirements endorsed by the NRC for steam generator tube inspections? (14A, 15B)

The proposed GL refers to the use of qualified inspection techniques, but does not provide any guidance on what standards should be used to establish qualification. We believe the methods and standards referenced in NEI 97-06 are acceptable for determining qualification and detection capability in accordance with 10 CFR Part 50 Appendix B. (4E)

The industry's examination techniques are and have been qualified in accordance with the ASME Code. The interpretation has always been that the technique has to be proven to be capable of detecting the required reference flaws in the required calibration standard. The industry is proving sensitivity to machined flaws as small as 20% through-wall during the Code procedure qualification process. Clarify what published/NRC endorsed/recognized documents other than ASME Code are applicable to qualification of steam generator examinations. The intent of this comment is to understand if there is a backfit issue associated with this proposed GL and to clearly understand the expected performance criteria. (12C)

Response:

In several places the proposed GL used the term "qualified" with respect to inspection techniques. This terminology has been removed from the final GL. The GL states the Appendix B, Criterion IX requirements that non-destructive testing be accomplished in accordance with qualified procedures and applicable standards or other requirements. The GL has also been modified to state the Criterion XI requirement that adequate test instrumentation is available and used. Insights into the NRC's position on what non-destructive examination techniques meet these requirements can be obtained from RG 1.83, "Inservice Inspection of Pressurized Water Reactor Steam Generator Tubes." Under Section C.2, "Inspection Equipment and Procedures," this regulatory guide indicates, in part, that inservice inspection should include nondestructive examination by eddy current testing or other equivalent techniques and that this equipment and the procedures should be capable of locating and identifying defects due to stress corrosion cracking and defects due to tube wall thinning by mechanical damage, chemical wastage, or other causes. Thus, the regulatory position has been, in part, that inservice inspection techniques should be capable of locating and identifying the types of degradation affecting a tube (e.g., stress corrosion cracks). Moreover, the TS define imperfections to include exceptions to the dimensions, finish, or contour of a tube

required by fabrication drawings or specifications. All imperfections exceeding the repair limit must be plugged or repaired.

Although RG 1.83 discusses the capabilities of an inspection technique, the staff recognizes that the industry has taken efforts to qualify probes and techniques through the qualification process discussed in the EPRI PWR Steam Generator Examination Guidelines and through the ASME Code. The staff historically has not taken a position on the adequacy of individual inspection technique qualification. Rather the staff has always focused on whether the inspection techniques chosen resulted in maintaining tube integrity for the period of time between inspections for the entire length of tube required to be inspected. This is accomplished by locating and identifying flaws of any type that may be present along the length of the tube and that may satisfy the applicable repair criteria.

RG 1.83 indicates, in part, that the inservice inspection program is essential to monitoring the integrity of the tubing. These inspections are required to ensure that flaws (imperfections) exceeding the tube repair criteria are plugged or repaired. The technical specification tube repair criteria are specifically applicable to all imperfections found by inspection, irrespective of the licensee's assessment of how or whether such imperfections may impair tube integrity. The staff has previously documented that the bobbin coil cannot detect circumferential cracks (see Response to topic 3, above) and believes that the bobbin coil exam does not meet Appendix B requirements with respect to such cracks. The staff does from time to time, identify what it believes are limitations in inspection techniques. Accordingly, the staff does not believe additional guidance on this issue is necessary.

Since the purpose of the GL is not to formally endorse or approve codes, standards, specifications, criteria or other special requirements related to steam generator inservice inspection, the GL will be modified to remove reference to a "qualified technique" and replace it with wording indicating that the inspections shall be performed with the objective of detecting flaws of any type that may be present along the length of the tube required to be inspected and that may satisfy the applicable tube repair criteria. This change recognizes that all techniques have an associated POD and is consistent with the industry's generic proposal for revising the steam generator portion of the TS.

The NRC does not believe the GL has raised a backfit issue. The NRC does not intend to develop additional requirements related to reliability of inspection techniques; rather, we plan to continue to use the long-held regulatory position that the scope and methods of licensee inspections shall be performed with the objective of detecting flaws of any type (recognizing a POD, see Comment 5) that may be present along the length of the tube required to be inspected and that may meet or exceed the applicable tube repair criteria.

7. Degradation and Engineering Assessments

Comment(s):

It is not clear by this discussion that the staff approves of the guidance in the EPRI Guidelines for determining "potential" degradation (Degradation Assessment). The staff should clarify that they approve of the current methodology in the EPRI Guidelines for performing a degradation assessment. (1E, 6J)

Paragraphs in the draft GL (one in the Background section and one in the Discussion section) indicate that the determination of the potential for degradation to occur involves "engineering judgment" and that the Steam Generator Examination Guidelines provide guidance for assessing the potential for degradation to occur. Confusion may arise by having this discussion split between two different sections. A clearer statement of the staff's position can be developed by including the two passages together in the same section of the generic letter. (3A)

We believe the degradation assessment as defined in NEI 97-06 and its referenced EPRI Guidelines is the appropriate method for determining the scope of inspection. (4F)

The proposed GL promulgates conflicting positions with respect to the type of engineering assessment permitted by the licensee. In one respect, the licensee is encouraged to determine, through degradation assessment, the locations of potential damage mechanisms and determine the scope and appropriate inspection technique to facilitate the inspection. Conversely, elsewhere in the GL the staff identifies concerns with respect to licensee-controlled analyses to limit scope. (4J, 14E, 15F)

The proposed GL should be clarified to permit responses to reflect each plant's commitment to NEI 97-06. The extent of inspections is chosen based on the guidance set forth in NEI 97-06 and the EPRI Guidelines based on the individual plant's operating experience and the particular steam generator material fleet's operating experience. (11D)

As proposed, the GL does not ask licensees to assess their steam generator tube integrity programs against their TS and Appendices A and B of 10 CFR [Part] 50. Rather, it asks licensees to evaluate themselves against an interpretation of regulatory requirements where engineering judgment by a licensee is not acceptable. (13F)

Response:

The GL has been modified to clarify that it is acceptable to consider applicable and relevant operating experience, engineering analysis, laboratory studies, etc., when determining the potential for various degradation modes to occur at specific locations of the tube. The GL has also been clarified to state that applying these considerations will frequently involve an element of judgment as to whether the tube is subject to specific degradation modes at specific locations. Once a licensee has concluded that a specific degradation mode may be present at a particular tube location, however, the use of engineering analysis to justify not inspecting that specific region for flaws resulting from

that type of degradation raises questions as to whether the tube inspection practices ensure compliance with the TS in conjunction with 10 CFR Part 50, Appendix B.

As discussed in the GL, the staff recognizes and accepts that engineering analysis and judgment is used by licensees to determine the potential for degradation to occur at specific locations along a tube. Use of such assessments to support selection of appropriate inspection techniques does not pose a compliance issue with respect to current TS. However, the staff has identified a potential compliance issue with the practice of using engineering analyses (and judgment) to determine that inspections need not be performed to identify flaws that licensees have determined may be present along the length of tube required to be inspected and that may satisfy the applicable tube repair criteria. This compliance issue is articulated in the GL.

The EPRI Guidelines include some limited guidance on assessing potential degradation mechanisms as part of a degradation assessment. The GL does not intend to endorse the EPRI Guidelines.

In summary, licensees can use engineering analysis (including judgment) to determine when and where degradation may occur. However, once this determination is made, the NRC's interpretation of the TS in conjunction with 10 CFR Part 50, Appendix B, is that licensees shall use techniques capable of detecting flaws of any type that may be present along the length of the tube required to be inspected. Given that the staff has historically interpreted the TS in this manner and has made safety conclusions based on this interpretation, the staff is asking licensees to assess their practices against the staff's interpretation so that the staff can verify whether differing interpretations comply with the regulations.

With respect to including the two paragraphs together in the same section, the staff's format for a GL calls for a Background section summarizing the issue. The Discussion section is used to provide the staff's perspective on the issue. As a result, the staff did not include the two paragraphs together; however, as discussed above, the staff has clarified that it is acceptable to use engineering judgment to determine the potential for degradation to occur at specific locations of the tube, but that the use of engineering analysis to determine that inspections need not be performed to identify flaws resulting from these forms of degradation raises questions on whether the tube inspection practices ensure compliance with the TS in conjunction with 10 CFR Part 50, Appendix B.

8. General Design Criteria Wording

Comment(s):

Understandably, the GL only included short excerpts from [10 CFR Part 50] Appendices A and B. However, some of the words omitted from the quotes in the GL significantly affect how the requirements are implemented. For example, the following quote, with the **bolded** phrases omitted, from General Design Criterion (GDC) 14 appeared in the draft GL:

> …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.

The draft GL also quotes from GDC 32, stating that the RCPB shall be

> ... designed to permit (1) periodic inspection and testing **of important areas and features** to assess **their** structural and leaktight integrity ...

In both of these cases, the phrases in bold significantly affects the meaning of the criterion and were omitted from the GL. These omitted phrases acknowledge the possibility of failure, and that inspection and testing should focus on important areas and features. The omitted text also supports the use of engineering judgment when conducting steam generator inspections.

Appendix B defines "quality assurance" as "those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service." This is further amplified in Criterion XI, where test programs are required to "demonstrate that structures, system, and components will perform satisfactorily in service..." (13E)

Response:

As discussed in the response to Comment 7, the staff agrees that some degree of engineering judgment is necessary as part of an engineering analysis to determine which areas of the tubes are susceptible to degradation. However, the "important areas" of the tube are defined in most plant TS as starting from the hot-leg tube end. Therefore, the staff does not believe that including the words omitted from the GL to characterize GDC 32 above alters the message or requested information concerning tube inspection contained in the GL. In addition, as is evident from the design and licensing basis of the facility, the staff recognizes that failures can occur even when inspections are performed. The quoted language of GDC 14 explicitly requires that the RCPB be designed and tested so as to have an extremely low probability of rapidly propagating failure, and this includes SG tube design and testing. Therefore, the staff does not believe including the words omitted from the GL to characterize GDC 14 alters the message or requested information concerning tube inspection contained in the GL. Nonetheless, the staff has modified the GL to include the omitted words.

9. Inspection Scope/Industry Guidelines/Sampling

Comment(s):

The staff should clarify that they approve of the current methodology in the EPRI Guidelines for sampling critical areas where degradation is not currently active, but is a potential. (1G, 6H)

It should be clear in the generic letter that use of sampling plans is acceptable for determining the inspection scope for potential damage mechanisms and determining the extent of condition when tube degradation is identified. This should include sampling of a partial length of the tube. (2A)

The draft GL does not take a clear position on inspection sampling, therefore, the following interpretation will be made: It remains acceptable to perform a sample in accordance with industry guidance (e.g., 20% sample to determine if potential degradation is occurring). (3B)

The proposed GL is not clear on inspection sampling. It should be the intent of the GL to permit sampling in accordance with industry guidance or the TS (e.g., 20% sample) to determine if degradation is occurring and critical area inspections as defined by the EPRI Steam Generator Examination Guidelines. (4G)

For the industry to understand the full implications of this proposed generic letter, it needs to address the staff's position on the use of sampling to determine whether potential degradation exists. (11G)

The GL does not address the inspection sample expansion criteria in the TS that specify sample classifications based on detection of flaws less than the repair limit. (14D, 15D)

Response:

The GL was intended to address the selection of appropriate inspection techniques once tubes have been selected for inspection according to sampling plans provided in plant TS. The GL has been modified accordingly to clarify that it is not intended to address sampling plan development according to the TS requirements. With respect to the EPRI Guidelines, these provide some guidance on sampling, including sampling critical tube areas. Evaluation of the acceptability of a specific sampling plan, however, is beyond the scope of the GL. Therefore, the staff will not address the adequacy of EPRI Guidelines or other specific sampling plans within the GL.

10. Potential Degradation Mechanisms

Comment(s):

It should be clear that the terms potential or potentially are equivalent to the term "potential damage mechanism" as defined in the EPRI steam generator inspection and integrity assessment guidelines. (2B)

In order for the licensees to reach a lasting agreement with the staff, via the license amendment process, the proposed generic letter should establish clear guidance on what potential degradation mechanisms may occur over the life of a steam generator. (11E)

The proposed GL should provide clarification on the meaning of "may potentially be present" with regard to TS and 10 Part CFR 50, Appendix B, compliance. (4O, 14L, 15J)

Response:

As discussed in the GL, it is the licensee's responsibility to determine what potential degradation mechanisms may occur, when they will occur, and at what locations. It is not the intent of the GL to identify all potential degradation mechanisms that may occur over the life of a steam generator since degradation assessments are performed by the licensee and can be plant-specific. Thus, the staff concludes that no changes are needed to the GL to address this comment.

The term "may be present" is used to indicate that there is evidence that a location is susceptible to a specific form of degradation. In certain cases, this may be so even though no such degradation may have been observed at that location in the past. This evidence can come from a variety of sources. Evaluation of potential degradation would involve an engineering assessment (e.g., industry experience, plant-specific operating experience, engineering analysis which takes into consideration tube stress, tubing alloy and microstructure, fabrication processes, relevant laboratory test results, etc.).

For example, if a previous inspection at a plant resulted in the detection of a specific form of degradation in the expanded region of the tube, there is reason to believe other tubes may be susceptible to this degradation at this location. In this case there is plant-specific evidence that this degradation "may be present." A second example is when the licensee of one plant detects a specific form of degradation in the expanded region of the tube and it can not be reasonably ruled out (e.g., similar SG design, operating times are similar, water chemistry is similar, etc.) that a second plant's tubes may be affected by this degradation mechanism. In this case, there is industry evidence that this degradation "may be present."

The term "may be present" was used since it would be inappropriate to indicate that inspections only need to be performed when degradation "is known to be present" since this could result in the false interpretation that one must know that degradation is occurring at a specific location in a tube before an inspection is necessary. The term "is known to be present" reflects that a specific location is known to contain a flaw. The terms "may be present" and "considered to have a potential to occur" can be used interchangeably. The staff has revised the GL to substitute the phrase "may be present" or similar language for the phrase "may potentially be present." Such changes are intended to improve clarity, but are not intended to change the meaning of the GL, which is explained in this response. Therefore, the staff concludes that no further changes to the GL are necessary to address this comment.

Once a determination is made by the licensee that a certain degradation mechanism has the potential to exist along the length of tube required to be inspected, it is the

staff's position that if a licensee does not want to inspect that region with a technique capable of detecting that form of degradation, they should submit that request via a license amendment.

The terms "potential," "potentially," and "may be present" are used interchangeably throughout the GL and this document and are equivalent. They are similar, but not identical to the references to "potential degradation" in the EPRI "Steam Generator Integrity Assessment Guidelines: Revision 1," which indicates that potential degradation are those forms of degradation that may occur in a plant's steam generator but to date have not occurred. Since the GL is not intended to endorse the EPRI Guidelines and the use of "potential" and/or "potentially" is self-explanatory, the staff has concluded that further revisions to the GL to address this comment are not necessary.

11. Expansion of Tubesheet Inspections Based on Results

Comment(s):

The draft GL does not take a clear position on inspection sampling, therefore, the following interpretation will be made: Sample expansion into the tubesheet is acceptable as opposed to inspecting the entire tubesheet when degradation is found. For example, if a sample of ± 3 inches at the top of the tubesheet is inspected with a rotating coil probe and a flaw is found in the lower inspection region of the tubesheet, it is acceptable to expand the inspection by 3 inches to -6 inches instead of inspecting the entire tubesheet depth with a rotating probe. Accordingly, if the draft GL does not clearly address inspection sampling, then current industry sampling practices as stated above will continue. (3C)

It is unclear as to whether the staff expects licensees to inspect the entire depth of the tubesheet with specialized probes regardless of previous inspection results, or only if cracking is detected in the portion typically inspected with specialized probes. (6F)

Response:

Inservice inspection techniques should be capable of detecting flaws of any type that may be present along the length of the tube required to be inspected and that may satisfy (meet or exceed) the applicable tube repair criteria. In those instances where there is no known degradation and partial inspection within the tubesheet with a specialized probe reveals no flaws, then available evidence would provide no compelling reason to inspect the entire tubesheet with a specialized probe. However, if there were flaws, or operating experience indicates a potential for flaws to exist in the expanded portion of the tube, then inspection deeper into the tubesheet to encompass the area of degradation activity, possibly to include the entire length of the tube within the tubesheet, would be appropriate.

In one comment an example was provided in which ± 3 inches at the top of the tubesheet was inspected with a rotating coil probe and a flaw was found in the lower inspection region of the tubesheet, resulting in expansion of the inspection by 3 inches to include the top 6 inches of the tubesheet region. With respect to this example, the

staff recognizes that a licensee will use an engineering assessment to determine the potential for specific types of degradation to occur at various portions of the tube and then use techniques capable of finding those forms of degradation along the length of the tube required to be inspected. As a result, a licensee, on the basis of a sound engineering assessment, could limit the length of a tube to be inspected with a certain type of probe. With respect to the hypothetical example in which inspection with a rotating probe is limited to the top six inches of the tubesheet, the staff is unaware of any technical justification that would indicate such degradation could be observed in a tube and only occur in the top 6 inches of the tubesheet region.

12. Applicability to New Tube Materials

Comment(s):

The proposed GL is ambiguous regarding the implementation of the staff's position for new generation steam generators (e.g., thermally treated Alloy 600 and thermally treated Alloy 690) or for locations other than those described in the Background section of the GL. (4B, 14M, 15I)

The scope of this proposed GL is very broad and does not adequately accommodate diverse material types and industry operating experience and inspection methods that have been developed based on these factors. (5B)

Revise the requested information as follows:

> "Addressees using Alloy 600 mill annealed, high temperature mill annealed or sensitized tubing should provide a description of the steam generator tube inspections performed at their plant during the last inspection. Specifically, these addressees should describe their tubesheets (i.e., length of expansion, expansion method and depth), and address how the inspections are performed in the tubesheet (the technique, the inspection extent, and the number of tubes inspected). If the expansion and the expanded region is not being inspected full length, the addressees should discuss their proposed corrective actions (e.g. changing inspection practices consistent with the NRC's position, or submitting a TS amendment request with the associated safety basis for limiting the inspections). The Staff has included Attachment 1, if addressees choose to change their TS. Attachment 1 suggested changes to the TS definitions for a tube inspection and for plugging limits to show what may be acceptable to the Staff in cases where the extent of the inspection in the tubesheet region is limited.
>
> Addressees using Alloy 600 TT and Alloy 690 TT tubing should provide a description of the steam generator tube inspections performed at their plant during the last inspection. Specifically their plants should describe their tubesheets (i.e. length of

expansion, expansion method and depth), and address how the inspections are performed in the tubesheet (the technique, the inspection extent, and the number of tubes inspected)." (5C)

The proposed GL primarily addresses concerns with those plants with susceptible tubing. The industry is aware that the NRC is not as concerned with plants having advanced materials. The NRC should resolve the issues with plants of concern and communicate the lessons learned to the rest of the industry via an Information Notice. Alternately, the proposed GL should require responses to provide different levels of detail based on the level of concern. For plants with advanced materials, the required response might be limited to a description of the inspection program, a safety assessment would be unnecessary. (11C)

Response:

The GL indicates that if a degradation mechanism is potentially occurring at a specific location (e.g., has occurred in other tubes and/or has occurred at other similarly designed and operated facilities), the TS in conjunction with Appendix B, require that inservice inspection techniques capable of detecting this type of degradation be used to inspect this region. This position does not depend on tube material or on the location of the degradation. However, this position could result in different inspection techniques being used based on licensee assessments regarding the types of degradation that may be occurring at specific locations in their steam generators. In summary, the issue discussed in the GL is pertinent to all PWRs (tube materials) and to all locations where tube inspections are required. This has been clarified in the GL.

The staff recognizes that degradation assessments (i.e., assessments of the forms of degradation that may occur at a plant) will vary from plant to plant based on parameters such as tube material, operating hours, and plant-specific experience and could change with time (as a result of the time dependence of some forms of degradation and/or additional operating experience). For example, a degradation assessment at one plant may result in a conclusion that there is no potential for tube degradation to occur at a specific location given the age of the plant; whereas a degradation assessment performed at another plant may result in a conclusion that the potential for degradation at a specific location exists even though there is no prior history of degradation at this location. The staff does not believe the GL should be revised to address this issue since the staff has recognized that engineering analysis (which may include an element of judgment) can be used to determine when and what forms of degradation may be occurring at a specific location along the length of the tube required to be inspected. Further information pertaining to the issue of degradation assessments is provided in response to Comment 7.

With respect to limiting the required response from plants with advanced tube materials, the staff concludes this issue is adequately addressed in the GL. For these plants, if they have concluded that their program is in compliance with the requirements, they would presumably neither propose corrective action nor submit a safety assessment. That is, if a licensee has been inspecting all locations along the length of the tube with probes capable of detecting the types of degradation that have the potential to occur at

these locations (recognizing that a sample of tubes may be selected for examination consistent with the TS), it would be expected that these licensees would conclude that they are in compliance with the regulations and there is no need for corrective action or a TS amendment.

In summary, the issue being discussed in the GL is relevant to all tube materials and all tube locations. That is, it is equally applicable to plants with thermally treated tubes and is not limited just to inspections in the tubesheet region. The staff concludes that the wording in the GL is appropriate and addresses the issue generically (i.e., it recognizes that the practice of limiting inspections could be occurring elsewhere in the steam generator).

13. Method of Evaluation

Comment(s):

Per 10 CFR 50.59, if the activity represents a change from the method of evaluation described in the Updated Final Safety Analysis Report (UFSAR), then NRC approval is required. The GL discusses the original design basis of the tube-to-tubesheet joint and tube-to-tubesheet weld as meeting ASME Section III and, as such, constituting a "method of evaluation" for the design basis. Industry concurs with this statement. However, the analysis of tube integrity of inservice, degraded steam generator tubing is not covered under ASME Section III, which does not address mechanical joints such as the tube-to-tubesheet joint. As an appurtenance, only the tube-to-tubesheet weld is addressed in the ASME Section III Code report. The tubing within the tubesheet is treated the same as the remainder of the entire tube length. Additionally, the TS definition of the tube inspection does not mention the tube-to-tubesheet weld and inservice inspection of the weld is excluded per ASME Section XI. As such, the analyses performed with respect to determining the inspection scope for supplementary exams are based on tube integrity requirements that confirm that structural and leakage integrity is assured per 10 CFR Part 50, Appendix A, GDCs 14 and 32.

For these analyses, the guidance with respect to safety margins is derived from Draft Regulatory Guide 1.121, Draft Regulatory Guide DG-1074, and NEI 97-06. Consideration is given to probability of detection, sizing capability and error, flaw growth rate, and burst and leakage resistance. These analyses and analysis parameters are not identified in ASME Section III, ASME Section XI, or in the UFSAR, and therefore would not constitute a change/departure in the method of evaluation. These assessments and consequential inspection plans are performed for multiples areas of the steam generator and are performed in accordance with 10 CFR Part 50, Appendix B. For these types of assessments, a license amendment pursuant to 10 CFR Part 50.59 is not needed nor is it applicable. (4K, 14F, 15H)

Response:

It is important to understand that the discussion in the GL concerning the original design basis of the tube-to-tubesheet joint involves a different issue than that of the TS and 10 CFR Part 50, Appendix B requirements concerning the needed inspection method

capabilities. Instead, the discussion of the original design basis is directed at the "safety analysis" performed by certain licensees to support a conclusion that flaws located a certain distance below the top of the tubesheet do not have any safety implications. This safety basis, by accepting any flaw (including a through-wall circumferential flaw) below a certain distance, essentially changes the pressure boundary.

ASME Section XI indicates that if acceptance standards for a particular component, Examination Category, or examination method are not specified in the appropriate Section XI Division, flaws that exceed the acceptance standards for materials and welds specified in the Section III Edition applicable to the construction of the component shall be evaluated to determine disposition. Section XI further indicates that such disposition shall be subject to review by the regulatory and enforcement authorities having jurisdiction at the plant site.

The design basis primary pressure boundary includes the tube extending to the tube-to-tubesheet weld, the weld itself, and the tubesheet. This pressure boundary, including the weld, was designed and analyzed in accordance with the ASME Code, Section III. Satisfaction of Section III, including the stress limits therein, ensures the structural and leakage integrity of this pressure boundary joint.

To justify not inspecting the entire portion of the tube within the tubesheet using techniques capable of detecting flaws that may be present, an evaluation was developed by certain licensees that relies on the mechanical tube-to-tubesheet joint to provide structural and leakage integrity. This evaluation, which permits tube defects below a certain depth in the tubesheet to include through-wall circumferential flaws, essentially changes the pressure boundary. The mechanical joint, however, was not evaluated during original design and licensing of the facility, nor are requirements for the design and analysis of mechanical joints addressed in ASME Section III. For this type of joint, satisfaction of the stress limits in Section III of the Code is not sufficient to ensure the structural and leakage integrity of the joint. For example, meeting the Section III stress limits does not ensure against a tube pullout. Therefore, one must resort to a method of analysis criteria that goes beyond that described in Section III of the Code. As a result, this analysis represents a new method of evaluation of the steam generator tube. In summary, if a new method of evaluation is being used to redefine the pressure boundary, a license amendment is required.

Moreover, even without the above discussion concerning a change to the method of evaluation, use of a licensee-approved analysis to permit flaws of any type below a certain distance from the top of the tubesheet raises questions concerning compliance with the TS and 10 CFR Part 50, Appendix B requirements. The plant TS list the acceptance criteria applicable to steam generator tubes and these acceptance criteria apply to the entire length of tube within the hot-leg tubesheet (since, as the comment points out, the tubing within the tubesheet was treated the same as the remainder of the entire tube length during the design and licensing of the facility). Therefore, the tube inspection and repair requirements established by the TS in conjunction with 10 CFR Part 50, Appendix B, apply to the entire portion of the tube within the tubesheet.

One approach to addressing this issue is to amend the repair criteria in the TS (as opposed to the inspection requirements). To justify such an approach, the licensee's

analysis must be adequate to establish a new acceptance criterion for flaws that may be in the lower portion of the tube within the tubesheet region. A licensee, however, may not implement a new acceptance standard (i.e., all flaws are acceptable) that has not been approved by the regulatory authority. If a licensee wishes to implement a less restrictive tube acceptance criteria relative to what the staff has previously approved or endorsed for that plant, a license amendment is necessary. This is consistent with the past licensing practice for plants seeking an alternate repair criteria at certain tube locations.

14. Safety Assessments and Inspections for Areas Other Than the Tubesheet Region

Comment(s):

Several comments were received raising questions about whether the draft GL pertained only to the tubesheet region or to all areas of the tube (e.g., geometry variations, U-bends, dents, dings, probe wobble). Some of these comments requested clarification on whether the GL would call for safety assessments for these "other" areas. (1F, 4N, 6E, 12A)

The staff should clarify that their concern is with cases where degradation is known to exist, the utility has documentation that there are no structural or leakage concerns associated with the degradation, but has not submitted the documentation to the NRC for their review. The staff should clarify that they are requesting safety assessments on tubesheet inspections. (1F, 6E, 6H)

The proposed GL is ambiguous regarding the implementation of the staff's position for locations other than described in the background section of the GL. (14K)

Response:

Although the discussion in the draft GL focuses on the tube inspections performed within the tubesheet, the GL is generic in that questions it raises apply to all tube locations.

Since the staff is not aware of tube locations other than the tubesheet region where licensees have not been inspecting with a technique capable of finding the flaws that may be present, the staff focused the discussion in the GL on the inspections in the tubesheet region. However, given the logic presented by the licensees in 2002, these plants (and possibly others) may be applying similar logic to other portions of the tube outside the tubesheet region. Therefore, safety assessments should be submitted for all areas where licensees are not following the staff's position since the staff will use this information to assess compliance with the TS and Appendix B. This is irrespective of whether the licensee may have concluded there are no structural or leakage concerns (i.e., in some cases the licensees may have evaluated the structural and leakage integrity of the tubes, in others they may not have). If the staff determines that inspection practices do not comply with the requirements, the staff will consider analysis

of tube structural and leakage integrity provided in the safety assessment when determining whether enforcement action is warranted, and, if so, the appropriate action.

The GL has been clarified to indicate that safety assessments are needed in cases where licensees are not using inspection methods capable of detecting flaws of any type that may be present along the length of the tube and that may satisfy the applicable tube repair criteria. The staff further notes that consistent with the staff response to Comment 9, this does not preclude the use of a sampling strategy at these locations.

15. Advanced NDE at Locations Other Than the Tubesheet Region

Comment(s):

Extending the logic of the proposed GL could lead to the imposition of RPC, ultrasonic, or any other inspection technology at the tubesheet, U-bends, free spans, etc., of the steam generator tubes regardless of the cost/schedule impact or the safety significance, subject only to "the staff's position." (8I)

Literal interpretation of having a fully qualified technique for possible cracking over the full length of tubing would mean that expanded tubing, dents, and other areas of interfering signals such as manufacturing burnishing marks (MBM's), support structures, and U-bends would have to be examined with diagnostic probes (e.g., rotating pancake coil or array probes). (12F)

The GL, as written, implies that only 100% inspection with a qualified technique is adequate. (14N, 15K)

Response:

As discussed in other comments (e.g., 3, 4, 6), the staff's position regarding tube inspections has not changed nor does it call for the use of the "latest technology" to inspect the full length of tubing. Engineering analysis and judgment may be used by licensees to determine the potential for degradation to occur at specific locations along a tube. However, the staff's position is that the TS in conjunction with Appendix B require that methods licensees choose for inspection shall be capable of detecting flaws (see Comment 5 for POD discussion) of any type that may be present along the length of the tube required to be inspected and that may satisfy (meet or exceed) the applicable tube repair criteria. In addition, the staff's position in the GL does not preclude a licensee from submitting a technical justification (in the form of a license amendment) to limit the scope and extent of inspection to be performed.

16. Revised TS Definition for Tube Inspections

Comment(s):

Two comments suggested that the technical insight from inspections and analysis to date be used to modify the existing TS definition of tube inspections for plants limiting inspections in the tubesheet region. The proposed TS words were: "Tube inspection

means an inspection of the steam generator tube from the point of entry (hot leg side) completely around the U-bend to the top support of the cold leg excluding the portion of the tube within the tubesheet below XX inches (as measured from the top of the tubesheet)." The commenters state that the exclusion length (XX) would be established based on steam generator model and physical characteristics. The commenters believe this revision will remove any misinterpretation or misunderstanding of NRC expectations. (1H, 6I)

Response:

The wording in the comment above may be acceptable depending on how the exclusion length (referred to as "xx" inches) is determined. That is, it should account for the fact that the bottom of the expansion transition for some tubes may be below the top of the tubesheet. In addition, given that the commenter did not propose to modify the definition for the plugging limit (as indicated in the draft GL), the "xx" inches would have to account for degradation in the expanded region of the tubing. Lastly, it is not clear why parentheses are used to separate the "as measured from the top of the tubesheet" clause from the remainder of the sentence.

Since licensees can provide alternative TS proposals to the one identified by the staff in the GL, changes to the GL are not necessary to address this comment.

17. Information Requested by GL Already Supplied to NRC

Comment(s):

We believe that this GL would not provide the NRC, or licensees, with any new information or insights about steam generator tube inspections. It is our understanding that much of the information requested by the GL has already been voluntary submitted by affected licensees in accordance with an NEI letter dated February 4, 2003. (4D)

Licensees routinely provide the staff with steam generator inspection results via required reports and informally during mid-outage conference calls. Information requested by the proposed GL is similar to previous requests for information from the NRC (e.g., GL 95-03 also asked for an assessment of steam generator tube inspection programs). (13B)

Response:

The staff did receive a voluntary submittal of information by some licensees in accordance with the NEI letter dated February 4, 2003. Information requested by the GL, however, goes beyond the information provided in the voluntary submittal, which specifically addressed the issue of inspections in the tubesheet region. The staff is also aware that some licensees have changed inspection practices within the tubesheet since their information was voluntarily submitted. In addition, the only licensees who were asked to respond with a voluntary submittal were the ones identified by the NRC staff as high priority (i.e., ones whose plants had mill annealed tubes, but whose TS did not have an alternate repair criterion for degradation in the tubesheet region). Voluntary

responses also provided inspection information only, (i.e., most licensees have not submitted TS changes to request approval to limit the inspection scope). Given the limited scope of the NEI request for the voluntary submission of information, the staff concludes that a GL is still necessary and that no changes to the GL are needed to address this comment. Licensees who voluntarily provided information to the staff may reference these submittals in their response to the GL.

The staff acknowledges there are some similarities in the information requested by GL 95-03, "Circumferential Cracking of Steam Generator Tubes," and the proposed GL. There are also distinct differences between the two information requests. For example, GL 95-03 focused specifically on circumferential cracking, whereas the proposed GL is broader and addresses all degradation modes and all tube locations. In addition, the most significant difference is that the proposed GL is addressing an issue where licensees are knowingly not inspecting for certain forms of degradation at certain locations because they have concluded such degradation is not safety significant.

18. Pre-Generic Design Criteria (GDC) Plants

Comment(s):

The draft GL correctly notes that the GDC do not apply to commercial reactors licensed before Appendix A to 10 CFR Part 50, pointing out that similar requirements exist in their licensing basis. If this GL is issued, it should be revised to take these pre-GDC plants into full consideration and explicitly permit the use of plant-specific licensing basis in lieu of the GDC. (4I, 13H)

Response:

The GL has been revised to indicate that for plants for which construction permits were issued before the effective date of 10 CFR Part 50, Appendix A, the plant-specific Principal Design Criteria in the design basis establishes the fundamental regulatory requirements pertaining to the integrity of the steam generator tubing. These requirements are similar to those in 10 CFR Part 50, Appendix A.

Although 10 CFR Part 50, Appendix A, and the plant-specific design basis (for pre-GDC plants) provide the fundamental regulatory requirements pertaining to the design of steam generator tubes, the plant technical specifications in conjunction with Appendix B contain specific requirements pertaining to steam generator tube inspections as discussed in the GL. In responding to information requests 1 and 2 in the GL, licensees should assess their compliance with the TS in conjunction with Appendix B. If a response to information request 3 is necessary, the safety assessments should demonstrate how the licensee's inspection practices (if not consistent with the NRC's position) ensure that tube integrity is being maintained consistent with the fundamental regulatory requirements (i.e., 10 CFR Part 50, Appendix A, or the plant-specific design basis, as appropriate).

19. Backfit Analysis

Comment(s):

The proposed GL states that a backfit analysis is not necessary because the letter only transmits an information request for verifying compliance. This statement is consistent with information request 1, but is not consistent with information requests 2 and 3 which require a safety assessment, corrective actions and a possible TS amendment when the NRC's generic letter position is not met. Industry suggests that if information requests 2 and 3 are retained in the final generic letter, either the statement in the backfit analysis should be changed to account for the actions required by items 2 and 3, or a backfit analysis should be performed. (4M)

Response:

As discussed below, information requests 2 and 3 do not require licensees to perform a safety assessment, to take corrective actions, or to submit a license amendment.

Information request 2 simply indicates that if addressees conclude that they are not in full compliance, they should discuss their proposed corrective actions. Since 10 CFR Part 50, Appendix B, Criterion XVI, would require corrective actions to be taken and documented with respect to a condition adverse to quality such as circumferential cracking of SG tubes, the request to submit this information is not a backfit. In other words, the staff has asked for information to assess whether an addressee is in compliance with the criteria of 10 CFR Part 50, Appendices A (or PDC for pre-GDC plants) and B as discussed in the GL. If during the reporting of this information, the addressee concludes that they are not in compliance, the staff asks the addressee to submit their documented corrective action plans. The request does not ask licensees to take corrective actions irrespective of whether Appendix B or another requirement is satisfied; therefore, it is not a backfit.

With respect to the need for a TS amendment, the staff has only provided an example of a TS definition for a tube inspection and for plugging limits to show what may be acceptable to the staff in those instances when an addressee chooses to change their TS. This information does not require addressees to submit a TS amendment; therefore, it is not a backfit.

For information request 3, the safety assessment is requested to verify compliance with the regulations (i.e., 10 CFR Part 50, Appendix A, GDCs 14, 30, and 32, or the plant-specific design basis for plants licensed prior to the promulgation of 10 CFR Part 50, Appendix A). This information (i.e., the safety assessment) is only requested in cases where licensees are not performing inspections consistent with the NRC's position regarding the requirements contained in the TS in conjunction with Criteria IX and XI of 10 CFR Part 50, Appendix B. This information is only needed for this set of addressees since if licensees are not inspecting for flaws that may exist (as discussed in the GL) or if they have departed from the method of evaluation described in the FSAR, they may not be able to ensure tube integrity consistent with GDCs 14 and 32 of 10 CFR Part 50, Appendix A, or the plant-specific design basis for plants licensed prior to promulgation of

10 CFR Part 50, Appendix A. Therefore, the addressee is requested to verify that the tube inspection practices being employed will ensure tube integrity consistent with the general design criteria of 10 CFR Part 50, Appendix A, or the plant-specific design basis for plants licensed prior to promulgation of 10 CFR Part 50, Appendix A.

20. Staff Knowledge of Previous Inspection Practices

Comment(s):

The GL states: "In 2002, the staff learned of several instances in which licensees were not fully implementing inspection methods capable of detecting circumferentially oriented cracks at all locations where the potential for such cracks exists...." This statement may create the erroneous impression that the staff was unaware of the practice prior to 2002, and that this letter is a result of new information rather than a change in the staff's position. In fact, steam generator inspection activities (with results) have been routinely provided to the staff in required inspection reports, site visits by regional inspectors, outage phone calls, and utility meetings/conferences with the NRC. (4C, 8D)

Response:

It is correct that the NRC knew that the scope of inspection with specialized probes was being limited to several inches above the top of the tubesheet to several inches below the top of the tubesheet. In addition, the staff was aware that flaws were being detected at the expansion transition which is located near the top of the tubesheet; however, the staff was unaware that licensees were finding circumferential flaws significantly below the expansion transition. When the staff became aware that circumferential flaws were being observed significantly below the expansion transition in 2002, the staff questioned the licensees' practice of limiting the scope of the specialized inspections since it now knew that (1) the bobbin coil could not detect circumferential flaws, (2) circumferential flaws were occurring below the expansion transition, and (3) there was no reasonable basis to conclude that circumferential flaws were not occurring further down into the tubesheet. As a result of the above, the staff disagrees that this is a change in staff position; rather it is the result of recognizing that circumferential flaws were present below the expansion transition in some plants.

In summary, the GL was drafted when it became apparent that some licensees had reason to believe that circumferential cracking was occurring further into the tubesheet than was being inspected with "specialized probes" capable of detecting these cracks.

21. Appendix B Qualification Basis

Comment(s):

The proposed GL asks that licensees assess their inspection practices in comparison to the "NRC's position." The "NRC's position" is unclear because it does not define the basis of the Appendix B qualification. One possible interpretation would be the ASME Code qualification; another possible interpretation could be that all axial, circumferential,

and volumetric flaws over the entire tube length have to be detectable; another possible interpretation could be that expected flaws in areas of concern have to be detectable. (12E)

Response:

The staff's position is that except for locations otherwise addressed by a license amendment, the TS in conjunction with Appendix B require that inservice inspection methods licensees choose for inspection shall be capable of detecting flaws (see Comment 5 for POD discussion) of any type that may be present along the length of the tube required to be inspected and that may satisfy (meet or exceed) the applicable tube repair criteria. This is consistent with the NRC's position taken in Regulatory Guide 1.83, which indicates, in part, that nondestructive examination inspection equipment and procedures should be capable of locating and identifying cracks and other forms of tube degradation. As discussed in the responses to other comments, it is not the staff's intent that licensees inspect for cracks (or any other forms of degradation) where the potential for such forms of degradation does not exist. For example, if circumferential cracking does not have the potential to occur in free span tubing that is not dinged, a licensee need not use a technique capable of detecting circumferential cracks at these locations. This position is consistent with Appendix B of 10 CFR Part 50.

22. Inspections Instead of License Amendment

Comment(s):

One commenter is concerned with any proposed communication that might serve to obfuscate regulatory compliance issues without actually better assuring the public's safety through prompt, thorough, and effective steam generator tube inspections. The commenter contends that the license amendment process does not carry the same level of confidence for reasonably assuring the public safety as does adherence to the TS requirements through inspection of steam generator tubes. (9B)

The commenter states that given the staff observations in NUREG/CR-6365 and NUREG-1740, the NRC should enforce the requirement of "complete and thorough steam generator tube inspections." (9B)

Response:

Changes to the steam generator TS are reviewed by the NRC staff to ensure that the proposed changes satisfy NRC regulations and will provide reasonable assurance that the public health and safety will be adequately protected. Therefore, the staff concludes that the GL does not need to be modified to indicate that license amendments cannot be submitted to change the scope/extent of steam generator tube inspections.

23. Perform State of the Art Inspections

Comment(s):

The emphasis of any proposed generic communication must be placed on actual steam generator tube inspections utilizing state of the art non-destructive evaluation technology. (9C)

The focus of the generic communication must be to require all affected licensees to conduct the enhanced and qualified inspections to better evaluate steam generator tube integrity rather than NRC merely providing the industry with a road map for legally maneuvering their stations into a deceptive regulatory compliance. (9C)

The NRC should require the use of best available technologies for the inspection of steam generator tubes in America's nuclear power plants. Steam generator tube leakage can lead to a radioactivity release. Degradation of PWR steam generator tubing integrity has been one of the unresolved safety issues of greatest concern to the public. (10A)

Response:

See the complete responses to Comments 3 and 4. In summary, current regulations specify neither a particular technology for the inspection of steam generator tubes (ultrasonic, eddy current, radiography, etc.) nor a particular method (including probe) for the inspection of tubes. The choice of technology and method is left to the licensee. However, as discussed in the GL, the scope and methods of inspection should be performed with the objective of detecting flaws of any type that may be present along the length of the tube required to be inspected and that may meet or exceed the applicable tube repair criteria. That is, if the flaws were detected, then the repair criteria would be implemented. The staff concludes that no changes to the GL are necessary to address this comment.

24. Operational Safety Issue

Comment(s):

The staff's "compliance issue" is recognized as an operational safety issue where the continued absence of the regulatory required enhanced inspection is representative of an undue and unacceptable increased risk to the public health and safety. (9D)

There is an immediate need for requiring strict compliance backed up by strict regulatory enforcement. (9D)

Response:

In determining the appropriate generic communication to use to address this issue, the staff assessed the inspection practices at the plants referenced in the GL. In both cases, the plant's scope of inspection in the tubesheet region was determined to be

adequate from a safety perspective for one cycle of operation (based on the staff's safety evaluation report prepared as part of a license amendment); however, it did raise a compliance issue as discussed in the GL. In addition, the staff reviewed the inspection practices at those plants most susceptible to cracking in the tubesheet region. The staff determined that some had alternate repair criteria* to address the issue; others were in the process of replacing their steam generators, and/or had (or were) performing inspections to sufficient depths within the tubesheet region to ensure no immediate concerns with tube integrity. As a result, given the staff's understanding of the inspections being conducted, the staff concluded (and still concludes) that a GL is the appropriate vehicle to address this issue given the potential safety consequences.

If during the review of licensee responses to the generic letter, the staff determines that inspection practices do not comply with the TS and Appendix B, the staff will consider analysis of tube structural and leakage integrity provided in the safety assessment when determining whether enforcement action is warranted, and, if so, the appropriate action.

(* Alternate Repair Criteria are limited, location-specific exceptions to the standard TS repair criteria which staff have reviewed and approved on a plant-specific basis.)

25. Growing Risks From Defective Steam Generator Tubes

Comment(s):

The growing risks associated with continued reactor operation with defective steam generator tubes continue to increase uncertainties already recognized regarding age-related degradation mechanisms associated with steam generator tubes. Attempts to analytically bound steam generator tube degradation given these uncertainties are as much guesswork as a reliable analytical assessment. (9E)

Response:

The operating experience with steam generator tubes has improved since the 1970s. This is evidenced, in part, by a reduction in the number of forced outages due to steam generator related issues. The improvement in operating experience is a result of several factors, including improvements in industry steam generator management programs, improvements in the NRC oversight of industry programs, and the replacement of steam generators at a number of plants. More corrosion resistant tube materials (thermally treated Alloy 600 and thermally treated Alloy 690) are used in over half the PWRs.

With respect to the assessments to analytically bound steam generator tube degradation, the staff will continue to evaluate the adequacy of license amendments and licensee approaches to ensure there is reasonable assurance that the public health and safety will be adequately protected. Accordingly, the staff concludes that no changes to the GL are necessary to address this comment.

26. Full-Length Tube Inspections and Inspection of Plugs

Comment(s):

The proposed generic communication should be expanded to cover the inspection of the entire length of all in-service steam generator tubes. In addition, periodic inspection of all plugs in out-of-service plugged tubes to insure their continued integrity should be required. (9G)

Response:

The changes being proposed by the commenter represent a backfit with respect to plugs and are beyond the scope of the proposed GL. Insofar as the commenter believes that the NRC should require 100% specialized probe inspection of a tube, this would also be a backfit. If the commenter seeks specialized probe inspection in other areas where degradation may be present, the staff addressed this above (see Comments 10, 11, and 15). Accordingly, the staff concludes changes to the GL are not necessary.

With respect to the technical concerns raised in the comment, the staff has concluded that the current framework (SECY-03-0080) for addressing steam generator tube integrity provides assurance that tube integrity is being maintained. Nonetheless, the staff is currently evaluating changes to the steam generator TS requirements to provide additional assurance that the condition of the tubes remains adequate for the period of time between inspections. Given that there has been no recent operating experience (with tubing or plugs) to suggest that inspections actually being performed have been inadequate to ensure tube integrity, the staff concludes that no immediate actions are necessary at this time to address these issues.

27. Reporting Time Too Short

Comment(s):

The reporting time frame proposed in the GL (30 days) is too short and not commensurate with the implications of the described condition. (4L, 6B, 8H, 11B, 13I, 14H, 15L)

Thirty days would be unreasonably taxing to most utilities, especially those with multiple damage mechanisms present. As an alternative, it may be appropriate to request that utilities provide a brief preliminary report within 30 days, with a longer term to provide a detailed follow-up report. (2C)

Other comments proposed a 90 day response time since there does not appear to be a safety issue warranting a shorter response period. (5D, 11B, 12B)

Response:

Given the comments and the information provided by licensees regarding their inspection practices in the tubesheet region (through phone calls and formal submittals), the staff has increased the GL reporting time to 60 days. This time frame should be sufficient to develop a response and is commensurate with the possible safety implications, recognizing that the issue involves more than inspections in the tubesheet region.

28. Tube Integrity Based Inspections

Comment(s):

The rotating coil techniques do in many cases provide improved detection capability. Therefore, a 100% full tube length inspection with a Plus Point probe is likely to find a larger number of flaws (over the entire flaw size range) than a 100% bobbin coil exam. Does this mean that the Plus Point exam was required to comply with TS despite analysis that would indicate that such detection capability is not necessary to ensure tube integrity? The NRC should provide additional information with respect to this item in order to support licensee response to requested items 2 and 3 of the proposed GL. (14I, 15G)

Response:

As discussed in the response to Comment 5, the staff recognizes inspection techniques have a probability of detection. It is not the staff's position, in the GL or elsewhere, that specialized coil (e.g., rotating pancake or +Point™) inspection is required over the full tube length to ensure the detection of the most flaws possible. Rather, as discussed in response to Comments 5 and 6, the objective of the inservice inspection program is to identify flaws of any type that may be present along the length of the tube and that may satisfy the applicable repair criteria.

Specialized probe inspections are needed only at those locations along the tube length where flaw types not generally detectable by bobbin coil may potentially be present. For example, circumferential cracks are not detectable by the bobbin coil probe. However, current engineering analysis indicates that only certain locations along the length of the tube are potentially susceptible to circumferential cracks. Typically, these are locations with high residual axial stress. Licensees need only inspect for circumferential cracks using specialized probes at locations where the licensee has determined that such circumferential cracks may exist. Such inspections, with probes capable of detecting these cracks, ensure that flaws (imperfections) meeting or exceeding the tube repair criteria, when detected, are plugged or repaired. The technical specification tube repair criteria are specifically applicable to all imperfections found by inspection, irrespective of the licensee's assessment of how or whether such imperfections may impair tube integrity.

Should licensees desire not to inspect certain locations with probes appropriate to detect certain flaws which may be present, it is the staff's position that the evaluation supporting such an approach should be submitted to the NRC for review and approval as a license amendment. The reason for this is to ensure tube integrity for these areas.

The staff will modify the GL to clarify its position as discussed in the responses to Comments 5 and 6.

C. Public Comment Cross-Reference List

1. Draft Generic Letter (GL) Is Unnecessary Given Industry's Steam Generator Initiative
   1A, 4A, 5A, 6A, 7A, 8A, 11A, 13A, 14J, 15A
2. Issue Should Be Addressed per Administrative Letter 98-10
   1C, 6D, 7A, 8C
3. Bobbin Coil Eddy Current Fulfills TS Requirements
   1B, 6C, 8E, 11F, 12D, 13G
4. Discouraging Future Technology Advancements
   1D, 4H, 8B, 8F, 14C, 15E
5. Probability of Detection
   4N, 5E, 6G, 14B, 15C
6. Qualified Techniques
   4E, 8G, 12C, 14A, 15B
7. Degradation and Engineering Assessments
   1E, 3A, 4F, 4J, 6J, 11D, 13F, 14E, 15F
8. General Design Criteria Wording
   13E
9. Inspection Scope/Industry Guidelines/Sampling
   1G, 2A, 3B, 4G, 6H, 11G, 14D, 15D
10. Potential Degradation Mechanisms
    2B, 4O, 11E, 14L, 15J
11. Expansion of Tubesheet Inspections Based on Results
    3C, 6F
12. Applicability to New Tube Materials
    4B, 5B, 5C, 11C, 14M, 15I
13. Method of Evaluation
    4K, 14F, 15H
14. Safety Assessments and Inspections for Areas Other Than the Tubesheet Region
    1F, 4N, 6E, 12A, 14K
15. Advanced NDE at Locations Other Than the Tubesheet Region
    8I, 12F, 14N, 15K
16. Revised TS Definition for Tube Inspections
    1H, 6I
17. Information Requested by GL Already Supplied to NRC
    4D, 13B
18. Pre-Generic Design Criteria (GDC) Plants
    4I, 13H
19. Backfit Analysis
    4M
20. Staff Knowledge of Previous Inspection Practices
    4C, 8D
21. Appendix B Qualification Basis
    12E
22. Inspections Instead of License Amendment
    9B
23. Perform State of the Art Inspections
    9C, 10A

C. Public Comment Cross-Reference List (continued)

24. Operational Safety Issue
    9D
25. Growing Risks From Defective Steam Generator Tubes
    9E
26. Full-Length Tube Inspections and Inspection of Plugs
    9G
27. Reporting Time Too Short
    2C, 4L, 5D, 6B, 8H, 11B, 12B, 13I, 14H, 15L
28. Tube Integrity Based Inspections
    14I, 15G