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NRC Staff Perspective on NEI 97-06

**NRC/NEI Technical Issues Meeting
October 7, 1998**

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Outline

- Background
- GL Status
- Purpose of this discussion
- Possible Endgames
- Technical Issues
- Risk Considerations

Background

- Draft GL:
 - existing TS do not ensure tube integrity
 - requests licensees submit upgraded TS such as to ensure tube integrity
 - DG-1074, sample TS
 - or describe alternative approaches
 - requires response pursuant to 50.54f

Status/Draft GL

- Staff is now informing the Commission that unless otherwise directed:
 - staff intends to delay issuance of draft GL while staff works with industry to resolve issues relating to NEI 97-06 guidelines
 - staff is proceeding with issuance of DG-1074 and draft DPO Resolution for public comment
- Technical differences still exist between the staff and industry
 - including appropriate framework for implementing industry guidelines
- It is the staff's objective to endorse an industry initiative for ensuring SG tube integrity in lieu of issuing GL as currently drafted.

Purpose of This Discussion

- To identify regulatory and technical issues concerning NEI 97-06.
 - What is the endgame or regulatory structure that we are working to?
 - What technical issues need to be resolved to get there?

Possible Endgames

Option 1:

- Maintain existing TS
- Utilities commit to implementing industry guidelines endorsed by NRC

Possible Endgames

Option 2:

- Replace existing TS with new TS to include:
 - performance criteria
 - condition monitoring and operational assessment
 - level of conservatism must be addressed
 - repair criteria
 - approved repair methods other than plugging
- Utilities commit to implementing industry guidelines endorsed by NRC

Technical Issues

- Two types:
 - issues concerning NEI 97-06
 - issues concerning lower-tier NEI/EPRI guidelines (e.g., EPRI SG Examination Guidelines)
- Possible approach:
 - resolve all technical issues in NEI 97-06 leading to revised industry guidelines that the staff can endorse in context of options 1 or 2
 - staff would not formally endorse lower tier guidelines
 - such endorsement may be unnecessary given a performance-based approach in the top tier industry guidelines assuming sufficient box on what it means to satisfy these performance criteria

Key Technical Issues/NEI 97-06

- structural performance criteria
- accident leakage performance criteria
- tube inspections
- condition monitoring/operational assessment
- tube repair limits
- tube repair methods

Structural Performance Criteria

NEI 97-06:

- Criteria: SG tubes will maintain adequate margin against burst under normal and postulated accident for the operating cycle
 - EPRI Steam Generator Tube Integrity Assessment Guidelines (non-directive) provides guidance concerning evaluation methods, margin, and uncertainty considerations used to determine tube integrity.
- Non-probabilistic methods in the Assessment Guidelines include margins of safety against gross rupture or failure of the tubing consistent with ASME Code.
- Probabilistic methods in the Assessment Guidelines are based upon satisfying specified conditional probability of rupture criteria.

Structural Performance Criteria

NRC Staff Comments:

- The structural integrity criteria should be revised consistent with DG-1074. Specifically,
 - All tubes shall retain safety factors consistent with stress limit criteria of ASME Code, Section III, for all service level loadings.
 - consistent with design and licensing basis
 - Factor of 3 criterion for normal and 1.4 criterion for accident conditions should be specifically spelled out.
 - to ensure consistency of interpretation
- Definition of tube rupture and burst should be revised consistent with DG-1074.

Structural Performance Criteria

NRC Staff Comments (Cont):

- Alternative criteria may be applied for SGDSM-specific applications if reviewed and approved by NRC.
 - represents a change to safety factors in licensing basis
 - may have potential risk implications
- Licensees encourage to follow the risk-informed guidance in RG 1.174.
- Staff will consider risk when reviewing licensee proposals.

Probabilistic Structural Performance Criteria

NEI 97-06:

- Probability of rupture should not exceed:
 - $5 \times 10^{-2}/\text{yr}$ that 1 tube ruptures during accident
 - $2.5 \times 10^{-2}/\text{yr}$ that 2-10 tubes rupture during accident
 - $1 \times 10^{-3}/\text{yr}$ that more than 10 tubes rupture during accident

NRC Staff Comments:

- “/yr” is incorrect for conditional probability criteria

Probabilistic Structural Performance Criteria

NRC Staff Comments (Cont):

- Proposed criteria do not allow for:
 - unknown defect types
 - known defect types for which burst probabilities have not been quantified
- Proposed criteria represent a change to the safety factors in plant licensing basis and thus should be reviewed and approved by NRC staff
- Appropriate criteria may be plant and SGDSM-specific due to potential risk implications

Accident Leakage Performance Criteria

NEI 97-06:

- Potential p-s leakage rate during limiting postulated events should not exceed:
 - normal makeup capacity of the primary coolant system, and
 - offsite radiological doses per 10 CFR 100 guidelines and control room doses per GDC-19.

NRC Staff Comments:

- “Limiting postulated events” is not defined in NEI 97-06. However, NEI 97-06 defines “limiting accident” to be that resulting in the largest differential pressure across the SG tubes. This definition does not necessarily result in most limiting accident in terms of dose consequences or risk.

Accident Leakage Performance Criteria

NRC Staff Comments (Continued):

- "Limiting postulated events" should be revised consistent with DG-1074; i.e., postulated design basis accidents other than an SGTR.
- Allowing leakage in excess of the LCO operational leakage limits represents a change to the plant licensing basis with potential risk implications.
- The accident leakage performance criteria should be revised consistent with DG-1074.

DG-1074:

- Calculated p-s leakage rate during postulated design basis accidents other than SGTR should not exceed the TS LCO operational leakage rate limits (in terms of total leakage from all SGs and leakage from each individual SG).

Accident Leakage Performance Criteria

DG-1074 (Cont):

- Alternative criteria may be applied for SGDSM-specific applications if reviewed and approved by the NRC.
- Alternative accident leakage criteria may be applied to the component of calculated accident leakage associated with implementation of SGDSM programs.
- The balance of the calculated accident leakage rate (i.e., leakage rate for defect types not addressed by SGDSM programs) should not exceed the LCO operational leakage limits.
- As a maximum, the alternative accident leakage criteria should not exceed the value in the licensing basis accident analyses, minus the TS LCO operational leakage limits.

Accident Leakage Performance Criteria

DG-1074:

- For plants with flex incorporated in TS, the alternative accident leakage criteria may be determined from the value given in the flex plot as a function of dose equivalent I131 (minus the LCO operational leakage limits).
- Licensees are encouraged to follow the risk-informed guidance in RG 1.174 when submitting proposed alternative criteria for specific SGDSM program(s) or when proposing to extend the applicability of existing approved criteria to additional SGDSM program(s).
- Staff will consider risk when reviewing licensee proposals.

Tube Inspections

NEI 97-06:

- NEI 97-06 specifies that tube inspections shall be performed in accordance with the latest revision of the EPRI SG Examination Guidelines.
 - sampling using either a prescriptive or performance based approach

NRC Staff Comments:

- The NEI guidelines should specify that the frequency and level of sampling shall follow the EPRI guideline approach for performance based sampling rather than for the prescriptive approach.
- The NEI guidelines or EPRI Guidelines should specify guidelines for deviating from the EPRI guidelines.

Tube Inspections

NRC Staff Comments (Cont):

- The NEI and EPRI Guidelines should be revised to address the issues and objectives addressed in the DG-1074 guidelines for NDE validation, i.e. quantification of defect detection and sizing performance of the NDE system (technique and personnel) relative to ground truth expected under actual field conditions.
 - For example, NEI guidelines could address the definition and objectives of NDE validation. The EPRI guidelines could provide guidelines for validating NDE systems.
 - Approach being developed by TVA/PG&E to quantify NDE detection and sizing performance for PWSCC at TSPs appears promising.
- Definition of “active degradation mechanism” in EPRI Guidelines, Appendix F, should be revised consistent with definition of “active defect types” given in DG-1074, Definitions.

- This is consistent with the objective of being performance-based.

EPRI SG Examination Guidelines

- The NRC staff has not formally reviewed Rev 5 of the guidelines in their entirety.
 - However, DG-1074 incorporates some of these EPRI guidelines, e.g.,
 - maximum inspection frequencies
 - initial inspection sample size
 - NDE qualification per EPRI Guidelines Appendices G and H constitute a minimum acceptable approach
- Formal NRC endorsement of the EPRI SG Examination Guidelines may not be necessary given development of a satisfactory performance-based NEI top tier guideline.

Condition Monitoring and Operational Assessment

NEI 97-06:

- Licensees shall perform condition monitoring and operational assessments after each SG inspection.
- The EPRI SG Tube Integrity Assessment Guidelines and In-Situ Pressure Test Guidelines (non-directive) provide guidance concerning evaluation methods, margins, and uncertainty considerations.

NRC Staff Comments:

- The EPRI sub-tier guidelines should be directive guidelines, not non-directive.
 - Note: NRC staff does not have copy of these sub-tier guidelines.

Condition Monitoring and Operational Assessment

NRC Staff Comments (Cont):

- Formal NRC endorsement of these sub-tier guidelines may not be necessary given development of a satisfactory top tier NEI guideline. However, the staff would like the opportunity to look at these guidelines prior to reaching a position on this point.
- The NEI guidelines or the sub-tier guidelines should contain specific guidelines for any deviations from these sub-tier guidelines.
- The NEI Guidelines should provide guidance concerning the treatment of uncertainties and variabilities associated with each of the input parameters affecting the outcome of these assessments. The level of conservatism to be achieved with these assessments should be identified in qualitative or quantitative terms, consistent with staff draft guidance (sample TS, DG-

1074).

Condition Monitoring and Operational Assessment

NRC Staff Comments (Cont):

- If NEI guidelines specify level of conservatism in qualitative terms, then the sub-tier guidelines should quantify level of conservatism to be achieved, consistent with DG-1074.
- NEI guidelines should state that tube integrity assessments may be based on NDE sizing defect sizing measurements only if the sizing performance of the NDE system has been validated per definition in DG-1074 for the subject defect type.
- NEI guidelines should state that condition monitoring and operational assessment is to be performed for each active defect type.

- NEI guidelines should address need for corrective actions in event condition monitoring indicates performance criteria have been exceeded.

Tube Repair Limits

NEI 97-06:

- Licensees shall establish repair criteria for each active degradation mechanism.
- These repair criteria shall be the existing TS depth-based criteria, a voltage-based criteria per GL 95-05, or other alternative repair criteria (ARC).
- Development and implementation of ARCs should be performed as part of SGDSM strategies.
 - Guidelines for developing ARCs are contained in the SG Tube Integrity Assessment Guidelines.
- For defect mechanisms for which no depth sizing capability exists with NDE, affected tubes should be plugged on detection and integrity assessed.

Tube Repair Criteria (Cont)

NRC Staff Comments:

- NEI guidelines should state that the tube repair criteria are contained in the plant TS.
- NEI guidelines should state that “plug on detection” applies when NDE systems are not validated for given defect type.
- The TS may be amended to include new ARCs to be implemented as part of SGDSM programs referenced or described in the TS subject to NRC review and approval.
 - Implementation of new ARCs may have potential risk implications.
 - Licensees are encouraged to follow the risk-informed guidance in RG 1.174 when submitting proposed ARCs.
 - The staff will consider risk when reviewing licensee proposals.

Tube Repair Methods

NEI 97-06:

- Licensees shall qualify and implement repair methods in accordance with industry standards.
- The EPRI PWR SG Tube Plug Assessment Document and the EPRI PWR Sleeving Assessment Document provide further guidance.

NRC Staff Comments:

- The NEI guidelines should also state that repair methods other than plugging shall be in accordance with the plant TS.