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

February 14, 2000

Item #5

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

FROM: Jack R. Strosnider, Director
Division of Engineering
Office of Nuclear Reactor Regulation

SUBJECT: PROPOSED STEAM GENERATOR TUBE INTEGRITY PERFORMANCE INDICATOR

As we discussed on February 10, 2000, I am transmitting this memorandum to you which contains a proposal developed by the Division of Engineering and Division of Systems Safety and Analysis staff to include new performance criteria for steam generators. We suggest consideration of steam generator indicators as part of program improvements planned for later this year.

In Attachment 2 to SECY-99-007, "Recommendations for Reactor Oversight Process Improvements," dated January 8, 1999, the staff provided the Commission with the results of the technical framework task group's efforts to identify and develop (1) the cornerstones of safety and the key attributes of performance within each cornerstone; (2) the performance indicators that can be used to assess performance in certain areas; (3) performance indicator thresholds intended to establish clear demarcation points for identifying fully acceptable, declining, and unacceptable levels of performance; and (4) aspects of risk-informed inspections that should supplement and verify the validity of the performance indicator data.

The cornerstones of safety were chosen to: (1) limit the frequency of initiating events; (2) ensure the availability, reliability, and capability of mitigating systems; (3) ensure the integrity of the fuel cladding, reactor coolant system, and containment boundaries; (4) ensure the adequacy of the emergency preparedness functions; (5) protect the public from exposure to radioactive material releases; (6) protect nuclear plant workers from exposure to radiation; and (7) provide assurance that the physical protection system can protect against the design basis threat of radiological sabotage.

In the discussion of the barrier integrity cornerstone, the task group's report stated that although steam generator tubes are a part of the barrier, they are being addressed under the initiating event cornerstone. In the discussion of the initiating event cornerstone, the report stated that the barrier-related initiating events (steam generator tube rupture, loss-of-coolant accident (LOCA), interfacing system LOCA, and fuel handling error) were judged to be unsuitable for monitoring by an indicator due to their low frequency and possible high risk. Risk-informed inspections will be performed to verify that the barriers have not degraded, particularly in those areas where the safety margins are smallest.

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However, the NRC staff and industry representatives are near agreement on an industry initiative (NEI 97-06, "Steam Generator Program Guidelines") to implement a performance based program to ensure tube integrity. This program utilizes performance criteria as a standard against which tube integrity can be measured and monitored at a frequency appropriate to provide reasonable assurance that tube integrity is being maintained at all times. Specifics of these performance criteria are provided in Attachment 1. One of these criteria involves minimum acceptable structural safety factors against burst of the tubing. Another involves the maximum leakage which can be tolerated during design basis accidents. Tube integrity relative to these criteria is monitored via inservice inspection and other tests (e.g., in-situ testing) which are typically performed at each plant refueling outage. A third criterion, the maximum acceptable operational leakage is equivalent to the limiting condition for operation (LCO) leakage limit in the proposed technical specifications (this leakage limit would become the new LCO limit in the standard technical specifications and would be in each licensee's technical specifications following the licensee's implementation of NEI 97-06 and incorporation of the proposed technical specification changes). Operational leakage is a useful, though not sufficient indicator of tube structural and accident leakage integrity. A key attribute of this indicator is that it can be monitored continuously.

Therefore, we believe that tube integrity performance indicators are available, that these indicators are measurable relative to appropriate criteria, and that these indicators can be monitored at a sufficient frequency such as to ensure that adequate tube integrity is being maintained. Further, we believe that the performance criteria developed in the context of the forthcoming agreement with industry on the new approach for ensuring SG tube integrity can be adapted to defining appropriate thresholds for entry into the various regulatory response bands of the oversight process. One possible approach is attached (Attachment 2).

In SECY-99-007, the staff stated that it recognized the need to accommodate future changes to the processes in response to issues such as the identification of new, risk-significant generic safety issues and lessons learned from implementation. With the development of the new steam generator regulatory framework, we believe that licensee steam generator tube integrity inspection results, when measured against the performance criteria defined above, can be used as a performance indicator for steam generator tube integrity. By monitoring steam generator tube integrity, significant problems with steam generator programs can be dealt with promptly and before steam generator tube integrity degrades to the point of unacceptable risk. Further, we recommend that the proposed performance indicator be included under the barrier integrity cornerstone since the steam generator tubes are part of the reactor coolant system and containment boundaries.

Inspection Program Branch staff has been informed of this proposal; however, more detailed discussions are necessary. The purpose of this memorandum is to provide a starting point for those discussions. Further, once the NRC reaches final agreement with the nuclear industry on the new regulatory framework, my staff proposes to update related inspection procedures to incorporate the new framework and provide guidance on how to inspect against the performance criteria.

Jim Andersen (415-1437) is the contact on my staff for this subject.

STEAM GENERATOR PERFORMANCE CRITERIA

(1) Structural Criterion

Steam generator tubing shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby, and cooldown and all anticipated transients included in the design specification) and design basis accidents. This includes retaining a margin of 3.0 against burst under normal steady state full power operation and a margin of 1.4 against burst under the limiting design basis accident concurrent with a safe shutdown earthquake.

(2) Accident Induced Leakage Criterion

The primary to secondary accident induced leakage rate for the limiting design basis accident, other than a steam generator tube rupture, shall not exceed the leakage rate assumed in the accident analysis in terms of total leakage rate for all steam generators and leakage rate for an individual steam generator. Leakage is not to exceed 1 gpm per steam generator, except for specific types of degradation at specific locations where the tubes are confined, as approved by the NRC and enumerated in conjunction with the list of approved repair criteria in licensee design basis documents.

(3) Operational Leakage Criterion

The reactor coolant system operational primary to secondary leakage through any one steam generator shall be limited to 150 gallons per day.

PROPOSED STEAM GENERATOR TUBE INTEGRITY PERFORMANCE INDICATOR

Conceptual Model for Evaluating Licensee Performance Indicators	Proposed Steam Generator Tube Integrity Performance Indicator

Green - Acceptable Performance - Licensee Response Band

• Cornerstone objectives fully met • Nominal risk/nominal deviation from expected performance • ΔCDF<E-6 or ΔLERF<E-7	

White - Acceptable Performance - Increased Regulatory Response Band

• Cornerstone objectives met with minimal reduction in safety margin • Outside bounds of nominal performance • Within technical specification limits • ΔCDF<E-5 or ΔLERF<E-6	• More than 1% of tubes inspected found to need repair during most recent inspection • One tube does not meet 3xnop* • Plant shutdown due to SG leakage (TS limits not exceeded)

Yellow - Acceptable Performance - Required Regulatory Response Band

• Cornerstone objectives met with significant reduction in safety margin • Technical specification limits reached or exceeded • ΔCDF<E-4 or ΔLERF<E-5	• More than one tube does not meet 3xnop • One tube does not meet 3xnop in 2-out-of-3 inspections • Plant shutdown due to SG leakage exceeding TS limit

Red - Unacceptable Performance - Plants not Normally Permitted to Operate Within this Band

• Plant performance significantly outside design basis • Loss of confidence in ability of plant to provide assurance of public health and safety with continued operation • Unacceptable margin to safety	• SGTR • One tube cannot sustain MSLB ΔP** • One tube cannot sustain 1.2xMSLB ΔP in 2-out-of-3 inspections • More than one tube cannot sustain 1.2xMSLB ΔP

* Three times normal plant operating pressure
** Plant design basis differential pressure for the MSLB accident

Attachment 2

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