



August 22, 2005

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U.S. Nuclear Regulatory Commission  
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Palisades Nuclear Plant  
Docket 50-255  
License No. DPR-20

Response to Request for Additional Information on GL 2004-01, "Requirements for Steam Generator Tube Inspections"

By letter dated October 29, 2005, Nuclear Management Company, LLC responded to Generic Letter (GL) 2004-01 for the Palisades Nuclear Plant. After discussions with the NRC staff, it was determined that additional information was necessary. Enclosure 1 contains the additional information.

Summary of Commitments

This letter contains no new commitments and one revision to an existing commitment.

Commitment made by letter dated October 29, 2004:

NMC will submit a license amendment request, which limits the depth of inspection in the tubesheet, 90 days after the NRC approves a methodology applicable to the Palisades Nuclear Plant.

Revised commitment:

NMC will use the methodology in WCAP-16208-P to determine steam generator tubesheet inspections to be included in the surveillance program requirements starting in the 2007 refueling outage.

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I declare under penalty of perjury that the foregoing is true and correct. Executed on August 22, 2005.

A handwritten signature in black ink, appearing to read "Paul A. Harden", written over a horizontal line.

Paul A. Harden  
Site Vice President, Palisades Nuclear Plant  
Nuclear Management Company, LLC

Enclosure (1)

CC Administrator, Region III, USNRC  
Project Manager, Palisades, USNRC  
Resident Inspector, Palisades, USNRC

**ENCLOSURE 1  
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
GL 2004-01**

***Nuclear Regulatory Commission (NRC) Request***

- 1) *Your response to GL 2004-01 indicated that the steam generator tube inspection practices at Palisades are not consistent with the NRC's position with respect to inspections within the tubesheet. You stated a license amendment would be submitted as part of your corrective actions, once a methodology applicable to Palisades has been reviewed and approved by the NRC. You further stated that once WCAP-16208-P is approved, NMC will submit a license amendment to allow use of WCAP-16208-P. Given that WCAP-16208-P has not been submitted to the NRC for generic review and approval (i.e., it has been used as the technical basis supporting plant-specific amendments), please clarify the schedule (by providing a date) for a license amendment application for Palisades.*

**Nuclear Management Company, LLC (NMC) Response**

- 1) NMC had previously committed to submit a license amendment request to allow use of WCAP-16208-P, "NDE Inspection Length for CE Steam Generator Tubesheet Region Explosive Expansions," at Palisades Nuclear Plant (PNP). Subsequent to this commitment, the NRC published a notice of availability for TSTF-449, "Steam Generator Tube Integrity," which allows the relocation of the steam generator tube surveillance program requirements to an owner-controlled document. NMC intends to submit an amendment request for this consolidated line item improvement item. This does not support the original commitment to include the topical report in the Technical Specifications (TS). Therefore, the commitment is changed. The revised commitment is as follows:

NMC will use the methodology in WCAP-16208-P to determine steam generator tubesheet inspections to be included in the surveillance program requirements starting in the 2007 refueling outage.

***NRC Request***

- 2) *Table 2 in the NMC GL response letter provides a summary of potential degradation mechanisms within the Palisades steam generators. Clarify why axial and circumferential primary water stress corrosion cracking (PWSCC) are potential degradation mechanisms in Rows 1 to 3 for SG E-50A but only Rows 1 and 2 for SG E-50B.*

## **NMC Response**

- 2) PNP has identified three PWSCC indications in Steam Generator (SG) E-50A. One indication was identified in row 1 in 1996. Two indications were identified in row 2; one in 2001, and one in 2003. In the 2004 refueling outage, no indications were identified in SG E-50A in rows 1 through 3 U-bends. Conservatively, row 3 in SG E-50A was added for inspection.

No indications have been identified in SG E-50B, rows 1 and 2, in any refueling outage. PNP has kept the SG E-50B U-bend inspection to rows 1 and 2, due to no PWSCC indications identified.

## **NRC Request**

- 3) *In your response to Requested Information #1, (page 5), you state the scope of recent inspections, including inspections within the tubesheet, has been sufficient to bound credible degradation and has been consistent with current Technical Specifications and 10 CFR Part 50, Appendix B requirements. Provide the basis for this statement given that an indication was detected below the tube-to-tubesheet expansion transition zone during the 2003 refueling outage inspection. This indication provides reason to believe tube degradation may be present below the expansion transition region. In addition, you indicated (page 4) that the NRC's position is that full tube inspection must be conducted with the +Point™ probe or equivalent on at least 3% of the active SG tubes if PWSCC may be present. The staff's position is 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. For the tubesheet region, this would include any potential degradation mechanism. The staff agrees that technical specifications can be used to identify an initial inspection scope and subsequent.*

## **NMC Response**

- (3) The PNP SG tube inspections are not 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, with respect to inspections conducted within the tubesheet region. This condition was entered into the corrective action program. Due to this inconsistency, by letter dated October 29, 2004, NMC committed to perform a full tubesheet inspection with the +Point™ probe, or equivalent, on at least 3% of the active steam generator tubes on the hot leg side until a license amendment request is

approved for the PNP. This commitment will remain in effect until TSTF-449 is approved for PNP. NMC will then follow the owner controlled program, which will incorporate WCAP-16208-P, and be maintained and updated as required.

The 2003 refueling outage tubesheet inspection depth was derived from WCAP-15720, "NDE Inspection Strategy for Tubesheet Regions in Combustion Engineering Designed Units." The 2003 refueling outage tubesheet inspection depth was five inches below the top of tubesheet. However, additional tube length is normally collected to ensure that the nominal inspection depth is achieved. Each of the steam generator eddy current +Point™ calibration groups in the 2003 refueling outage were reviewed to define an average inspection depth. This study showed that the average inspection depth below the top of tubesheet was eight inches, with some tubes examined to a depth of fourteen inches below the top of tubesheet. One PWSCC indication, located two inches below the top of the tubesheet, was reported.

#### **NRC Request**

- 4) *In the Basis section (page 8) of your safety assessment provided in response to Requested Information #3, you indicate the inspection depth in the tubesheet during the 2004 outage was derived from WCAP-15720. Some of the information contained in WCAP-15720, however, was superseded by information contained in WCAP-16208. Therefore, confirm that the 2004 tubesheet inspection depth at Palisades ensures tube pullout from the tubesheet will not occur and leakage limits under postulated accident conditions will be satisfied, considering the updated information provided in WCAP-16208.*

#### **NMC Response**

- 4) The information from WCAP-16208-P, "NDE Inspection Length for CE Steam Generator Tubesheet Region Explosive Expansions," had not been issued for Palisades use in the 2004 refueling outage. Palisades derived the tubesheet inspection depth using WCAP-15720, and current operating experience available at that time.

Based on the recent Combustion Engineering plant operating experience, and the 2003 refueling outage inspection depths, the 2004 refueling outage +Point™ top of tubesheet inspection depth below the top of tubesheet was established at eight inches, however, additional tube length is normally collected to ensure that the nominal inspection depth is achieved. Each of the steam generator eddy current +Point™ calibration

groups in the 2004 refueling outage were reviewed to define an average inspection depth. The average inspection depth below the top of tubesheet was nine inches.

The distance from the top of tubesheet to six inches below the top of tubesheet was defined as a critical area. A critical area is an area of steam generator tubing which, on the basis of inspection results, engineering evaluation and related experience, is defined by the type, cause and boundary of the degradation. The length from 6.01 to eight inches below the top of tubesheet was defined as a buffer zone. A buffer zone is a tube population immediately adjacent to a defined critical area, and is equal to 20% of the critical area tube population. Critical area and buffer zone are from EPRI document entitled, "PWR Steam Generator Examination Guidelines."

Operating experience (OE) below the top of tubesheet, obtained from Waterford 3, Palo Verde and San Onofre, indicates that if no PWSCC indications are observed below the expansion transition within the nominal inspection distance below the top of tubesheet, that no PWSCC is likely present below the nominal inspection depth. PNP has fewer effective full power years of operation, a lower  $T_{hot}$  temperature, and only one axial PWSCC indication fully in the tubesheet as compared to the OE listed above. PNP predicted one axial PWSCC indication per steam generator in the 2004 refueling outage. No PWSCC indications were identified in the 2004 refueling outage in 100% examination of all active tubes in both steam generators.

The PNP smooth bore tubesheet drilling process creates fewer tube drilling abnormalities than the rough bore process used at the three Combustion Engineering plants above, which results in fewer stress risers or initiation sites for axial PWSCC indications.

The generic letter discusses steam generator tube inspections in general, and expresses a specific concern regarding inspections within the tubesheet. Degradation identified within the tubesheet at PNP has been limited to a depth of two inches below the top of tubesheet, whereas the inspection zone for the tubesheet extended to a depth of eight inches at the last inspection. Thus, the results did not challenge the depth of inspection, and did not indicate a potential for degradation to occur deeper into the tubesheet beyond the region inspected with the +Point™ probes.

The PNP Steam Generator Degradation Assessment for 2004 has been evaluated in accordance with GL 2004-01. The analyses performed with respect to determining the inspection extent limits for PNP supplementary exams are based on tube integrity requirements that confirm that structural and accident leakage integrity is assured per 10 CFR 50, Appendix A, General Design Criteria (GDC) 14 and 32. For these analyses, the guidance with respect to safety margins and performance

criteria is derived from Regulatory Guide 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes," and NEI 97-06, "Steam Generator Program Guidelines." Consideration is given to probability of detection (POD), nondestructive examination (NDE) sizing capability and error, flaw growth rate, burst and leakage resistance. These assessments and consequential NDE inspection plans are performed for multiple areas of the SG (e.g., U-bends, sludge pile, dents/dings etc.). The examination program, including qualification of techniques and analysts, are performed in accordance with applicable requirements of EPRI PWR Steam Generator Examination Guidelines, ASME Section XI, and ANST SNT-TC-1A, and therefore are considered to meet the requirements of Criterion IX of 10 CFR 50, Appendix B, "Control of Special Processes."

The inspection program within the tubesheet region is based on ensuring tube structural and accident leakage integrity. The program is not consistent with the position promulgated in GL 2004-01 in that the supplemental rotating coil exams are not conducted for the full tubesheet depth. Certain forms of degradation may exist in the tubesheet region that are not detectable by the bobbin coil. The steam generator 2004 condition monitoring and operational cycle 18 assessments, evaluate the collective detection capability of the bobbin and rotating coil, as well as the inspection extent. All potentially undetected flaws are evaluated for possible impact on tube integrity. In the case for undetected flaws in the tubesheet region below the rotating coil inspection, testing and analysis have shown that the tubing, tube-to-tubesheet expansion, and the tubesheet, provide resistance to burst and leakage. As such, credit is taken with respect to tube integrity.

### ***NRC Request***

- 5) *Page 9 of your GL response states that a single indication in the buffer zone plan, as defined in the 2004 degradation assessment, would have resulted in an increased inspection zone from 8 to 14 inches into the tubesheet for a 20% sample of tubes. Please provide the basis for the inspection expansion plan in the context of the Technical Specifications and 10 CFR Part 50, Appendix B requirements. The staff is unaware of any technical justification that would indicate tube degradation within the tubesheet (below the expansion transition region) initiates and progresses over time from higher elevations within the tubesheet to lower elevations within the tubesheet. If the inspection zone increase proposed but not used during the 2004 outage would not be implemented in future outages, the basis for that expansion plan need not be provided.*

## NMC Response

- 5) The basis for the inspection expansion plan, in the context of TS and 10 CFR Part 50, Appendix B requirements, was the EPRI PWR Steam Generator Examination Guidelines, Revision 6, which is an EPRI guideline document referenced in NEI 97-06.

The PNP tube repair limits are defined in a site specific engineering program procedure which states: "The tube plugging limit for Palisades is defined by Technical Specification 5.5.8.c1f or by EPRI PWR Steam Generator Examination Guidelines: Revision 6, whichever is the more conservative."

The PNP basis for expansion of the inspection is defined in a site specific engineering program procedure which states: "The required expansion of the examination beyond the period sample, based on the inspection categories, is summarized in Technical Specifications Table 5.5.8-1 or Table 6.1 and 6.2, of this document from, 'PWR Steam Generator Examination Guidelines: Revision 6,' whichever is the more conservative."