November 22, 2005

Mr. Paul A. Harden
Site Vice President
Nuclear Management Company, LLC
Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043-9530

SUBJECT: PALISADES PLANT — EVALUATION OF THE RESPONSE TO GENERIC LETTER (GL) 2004-01, "REQUIREMENTS FOR STEAM GENERATOR TUBE INSPECTIONS" (TAC NO. MC4836)

Dear Mr. Harden:

Nuclear Management Company's (NMC's) letter of October 29, 2004, to the Nuclear Regulatory Commission responded to Generic Letter (GL) 2004-01, "Requirements for Steam Generator Tube Inspections," for the Palisades Nuclear Plant. We concluded that NMC's response to the GL is acceptable, as discussed in our enclosed evaluation.

Sincerely,

/RA/

L. Mark Padovan, Project Manager
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-255

Enclosure: As stated

cc w/encl: See next page

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Palisades Plant

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EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RESPONSE TO GENERIC LETTER (GL) 2004-01,

"REQUIREMENTS FOR STEAM GENERATOR TUBE INSPECTIONS"

NUCLEAR MANAGEMENT COMPANY, LLC

PALISADES PLANT

DOCKET NO. 50-255

1.0 INTRODUCTION

On August 30, 2004, the Nuclear Regulatory Commission (NRC) issued GL 2004-01. The purpose of GL 2004-01, was to obtain information that would enable the NRC staff to determine whether licensee steam generator tube inspection programs comply with the existing tube inspection requirements (the plant Technical Specifications) in conjunction with Appendix B to Title 10 of the *Code of Federal Regulations*, Part 50 (10 CFR Part 50, Appendix B).

Nuclear Management Company, LLC's (NMC's), letter of October 29, 2004, responded to GL 2004-01 for the Palisades Nuclear Plant. NMC's letter of August 22, 2005, supplemented this response. Based on a review of the information provided, the NRC staff finds that NMC's response to GL 2004-01 is acceptable. However, the staff has several observations regarding NMC's response. The staff's observations, and the basis for its conclusion, are provided below.

1. Method of Evaluation

GL 2004-01 requested licensees to submit a safety assessment if they concluded that their steam generator tube inspections were not, or are not, being performed consistent with the NRC's position on Technical Specifications requirements in conjunction with 10 CFR Part 50, Appendix B. As part of this safety assessment, licensees were to address whether their safety basis for limiting inspections within the tubesheet constitutes a change to the "method of evaluation" for establishing the structural and leakage integrity of the tube-to-tubesheet joint. The staff requested this information since it expected that licensees' safety basis relied on a mechanical expansion joint rather than the tube-to-tubesheet weld. Since the original tube-to-tubesheet joint was probably designed by demonstrating that the stresses in the tube, weld, and tubesheet satisfy the allowable stress values in Section III of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) or other similar standard, the staff questioned whether the safety basis for limiting inspections relied on demonstrating that the expansion joint satisfied some criteria (e.g., minimum tube pullout load criteria, allowable leakage) beyond those specified in Section III of the ASME Code.

In NMC's letter of October 29, 2004, it concluded that its tube inspection approach does not constitute a change to the method of evaluation. This conclusion appears to be based, in part, on an assumption that the GL implied that the selection of non-destructive evaluation

techniques defines the limits of the reactor coolant pressure boundary. However, the GL's discussion of the original design basis was related to 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 relies on a mechanical interference fit between the tube and the tubesheet for establishing the tube-to-tubesheet joint (i.e., forming the reactor coolant pressure boundary). However, for most plants, the original design of the steam generator did not credit this interference fit since the weld between the tube and the tubesheet ensured the integrity of the tube-to-tubesheet joint. In fact, the ASME Code, Section III design rules do not address using an interference fit to maintain pressure-boundary integrity. As a result, the staff questioned whether licensees were using a different method of evaluation to assess the adequacy of the tube-to-tubesheet joint.

Although NMC's response to the "method of evaluation" item did not focus on the staff's area of concern, the staff concludes that NMC's overall response to the GL is acceptable for the reasons discussed below.

2. Potential Degradation Mechanisms

Axial and circumferential primary water stress corrosion cracking (PWSCC) was considered a potential degradation mechanism in the U-bend region of rows 1, 2, and 3 in steam generator E-50A, but was only considered a potential degradation mechanism in rows 1 and 2 for steam generator E-50B. The reason cited for the difference in classification, was historic inspection results. Historically, cracking of the U-bend region was only observed in rows 1 and 2 in steam generator E-50A, while no cracking has been observed in the U-bend region of rows 1 and 2 in steam generator E-50B. Similarly, oblique PWSCC was considered a potential degradation mechanism in the U-bend region of rows 4 through 18 in steam generator E-50A, while it was considered a potential degradation mechanism in the U-bend region of rows 3 through 18 in steam generator E-50B.

The NRC staff is not aware of any mechanistic reason why one steam generator at Palisades would behave differently than the other in terms of susceptibility to cracking in the U-bend region. In addition, operating experience at other plants indicates that cracking in the U-bend region does not necessarily initiate in row 1, then proceed to row 2, and so-on. If a mechanistic reason does not exist supporting the difference in susceptibility of the U-bend region of the two steam generators to cracking, a conservative inspection approach would be to consider both steam generators to be equally susceptible.

3. Use of WCAP-16208-P, "NDE Inspection Length for CE [Combustion Engineering] Steam Generator Tubesheet Region Explosive Expansions," After Adopting Technical Specification Task Force (TSTF)-449, "Steam Generator Tube Integrity"

In its letter of October 29, 2004, NMC committed to "perform a full tubesheet inspection with the +Point™ probe, or equivalent, on at least 3 percent of the active steam generator tubes on the hot-leg side until a license amendment request is approved for the Palisades Nuclear Plant." This commitment would remain in effect until TSTF-449 is approved for Palisades. Then, NMC would follow an owner-controlled program that incorporated WCAP-16208-P, and would maintain and update it, as required. The staff notes that when a plant adopts TSTF-449, plant technical specifications require utilities to inspect the entire length of tube within the tubesheet with a probe capable of detecting the flaws that may be present in the tubesheet. This means

inspecting with a probe capable of finding the forms of degradation that could be in this region of the tube, unless the utility's TSTF-449 submittal justifies limiting the length of tube inspected within the tubesheet region (e.g.,adopting a version of WCAP-16208-P acceptable to the NRC staff).

In its letter of August 22, 2005, NMC also committed to "use the methodology in WCAP-16208-P to determine the steam generator tubesheet inspections to be included in the surveillance program requirements starting in the 2007 refueling outage." The staff finds this commitment acceptable in light of NMC's other commitment to perform the full tubesheet inspection for at least 3 percent of the active tubes. The NRC staff notes that this initial sample may need to be expanded based on the results of NMC's inspection consistent with technical specification requirements.

4. Justification for Using Extent of Inspections in WCAP-15720, "NDE Inspection Length for CE Designed Units"

As discussed in an NRC request for additional information (RAI), the extent of the 2004 inspection at Palisades was developed based on WCAP-15720, which was superseded by WCAP-16208. The RAI requested NMC to confirm the adequacy of the extent of the inspection in light of the new information in WCAP-16208. NMC's response indicated that WCAP-16208 was not available at the time of the 2004 inspections at Palisades, and that NMC used operating experience available at that time, along with WCAP-15720, to derive the tubesheet-inspection depth. NMC's response also cited the following:

- a critical area from the top of tubesheet to 6-inches below the top of the tubesheet
- a buffer zone from 6 to 8 inches below the top of the tubesheet
- operating experience at other plants, which indicates that PWSCC is not likely present below the nominal inspection depth if no PWSCC is observed below the expansion transition within the nominal inspection distance
- NMC's operating conditions and history at Palisades

With respect to this response, the NRC staff is unaware of any technical justification that would indicate degradation in the tubesheet region would start near the top of the tubesheet and progress downward into the tubesheet supporting a critical area/buffer zone approach based on distance from the top of the tubesheet. In fact, recent operating experience (see NRC Information Notice 2005-09) indicates that degradation may occur a sufficient depth below the top of the tubesheet before it is observed near the top of the tubesheet. Furthermore, historic operating experience may not support the contention that no PWSCC is likely present below the nominal inspection depth since these original inspections may have been biased by focusing the inspections near the top of the tubesheet. In other words, a robust sampling program throughout the tubesheet may be needed to conclude that no PWSCC is likely present below the nominal inspection depth.

Given the limitations in NMC's response to the NRC staff's question regarding the adequacy of the extent of 2004 inspection, the NRC staff evaluated whether the tube inspections performed in the tubesheet region at Palisades in 2004, were adequate to ensure the structural and

leakage integrity of this portion of the tube bundle. With respect to structural integrity, the extent of tube inspected in 2004, exceeded the amount of non-degraded tubing needed to prevent tube pullout from the tubesheet, based on WCAP-16208. In addition, the likelihood that a large number of indications exist below the actual inspection extent in the tubesheet region is small (given plant-specific and generic operating experience and the operating conditions at Palisades) such that the accident-induced leakage limit should not be challenged as a result of indications existing in the non-inspected portion of tube in the tubesheet.

Notwithstanding the observations above, the NRC staff finds that NMC's response to GL 2004-01 is acceptable since NMC committed to perform a full tubesheet inspection with the +Point™ probe or equivalent on at least 3 percent of the active steam generator tubes on the hot-leg side until a license amendment request is approved for Palisades. As discussed above, the NRC expects that NMC will expand this initial inspection sample (at a minimum) based on the expansion criteria specified in the Palisades' technical specifications.

Principal Contributor: K. Karwoski

Date: November 22, 2005