

## Chen, Qiao-Lynn

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**From:** Chawla, Mahesh  
**Sent:** Monday, March 04, 2013 1:12 PM  
**To:** GUSTAFSON, OTTO W  
**Cc:** Widrevitz, Dan; Rosenberg, Stacey  
**Subject:** Palisades - Request for Additional Information - ME9569 - Revised Program Plan for Aging Management of Reactor Vessel Internals

By letter dated September 13, 2012 (ML12257A352), Entergy Nuclear Operations, Inc. (ENO) submitted an aging management program (AMP) for the Palisades Nuclear Plant (Palisades) reactor vessel internals (RVI). The Vessels and Internals Integrity Branch is in the process of reviewing the Palisades AMP report and based on the review conducted thus far, the staff has developed a first request for additional information (RAI) as addressed in the enclosure. The MRP-227-A report, "Pressurized Water Reactor Internals Inspection and Evaluation Guidelines," and its supporting reports were used as technical bases for developing the subject AMP. The staff is currently reviewing information regarding the generic applicability of the MRP-227-A report and its associated technical basis and based on its review the staff may issue another RAI at a later date.

***Please arrange a teleconference to discuss the following requested information:***

**RAI-1** Table IV of NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Volume 2, Revision 1, identifies aging effects for some of the RVI components that were designed by Combustion Engineering. Aging effects that are pertinent to some of the RVI components that are considered part of RVI AMP are addressed in GALL Table IV B3. The following table provides information related to the aging effects which were not included in the AMP for the RVI components listed in GALL Table IV B3.

Aging Effect	RVI Component	GALL Report- Table ID number
Loss of fracture toughness/ neutron irradiation embrittlement, void swelling, loss of material	Core support barrel upper flange	IV.B3-16, 17
Loss of fracture toughness/thermal aging and neutron irradiation embrittlement	Core support column	IV.B3-18

Provide a supplement to your AMP that addresses these aging effects for these components.

**RAI-2** The inspection plan contains numerous examples where the licensee intends to implement visual testing (VT-3) examinations to identify cracking in some pressurized water reactor (PWR) RVI components. Historically, enhanced visual testing (EVT-1) or ultrasonic testing (UT) methods are used to effectively identify cracks. Explain why the use of a VT-3 inspection method should be considered acceptable for identifying cracking in some PWR RVI components.

**RAI-3** During the extended period of operation, some PWR RVI components are subject to high levels neutron radiation that may lead to irradiation embrittlement and a loss of fracture toughness and the potential for irradiation assisted stress corrosion cracking (IASCC). In combination, these effects may lead to the potential for component failure under some design basis loading conditions. Explain how the Palisades AMP will account for potential reduction in fracture toughness when evaluating cracks that are detected during the required inspections, in particular when establishing the frequency of subsequent inspections after cracking is identified.

**RAI-4** Loose parts could be generated due to deterioration of some PWR RVI components during the extended period of operation. Provide information that addresses how the following consequences of loose parts generation were considered in development of the inspection program given in the proposed AMP.

- (a) potential for fuel bundle flow blockage and consequential fuel damage,
- (b) potential for interference with control rod operation, and
- (c) potential for impact damage on reactor internals.

**RAI-5** Historically, the following materials used in the PWR RVI components were known to be susceptible to some of the aging degradation mechanisms that are identified in the MRP-227-A report. In this context, the NRC staff requests that the licensee confirm that these materials are not currently used in the RVI components at Palisades.

- (1) Nickel base alloys—Inconel 600; Weld Metals—Alloy 82 and 182 and Alloy X-750 (excluding control rod guide tube split pins)
- (2) Alloy A-286 ASTM A 453 Grade 660, Condition A or B
- (3) Stainless steel (SS) type 347 material (excluding baffle-former bolts)
- (4) Precipitation hardened (PH) stainless steel materials—17-4 and 15-5
- (5) Type 431 stainless steel material

**RAI-6** With respect to the management of cast austenitic stainless steel (CASS) aging and embrittlement, the licensee states that no CASS is present in the Palisades lower core support structures. No statement is provided for other possible locations. Either confirm that no CASS is present in any of the locations covered by the AMP, or provide a discussion of how the AMP adequately addresses the requirements specified in GALL AMP, XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)," and GALL AMP XI.M13, "Thermal Aging and Neutron Embrittlement of Cast Austenitic Stainless Steel (CASS)," for CASS materials used in PWR RVI components.

**RAI-7** When exposed to a light-water reactor temperature of approximately 500 °F or higher, the 17-4 precipitation hardened (PH) martensitic stainless steel (MSS) undergoes embrittlement and an increase in hardness (i.e., a reduction in Charpy "V" notch fracture toughness value). Operating experience from Oconee Nuclear Station shows that thermally embrittled 17-4 PH MSS is susceptible to failure when exposed to unexpected loading conditions. On March 7, 2007, the staff issued Information Notice (IN)-2007-02 (Agencywide Document Access and Management System Accession Number ML 0701004590), in which the staff recommends that the licensees can prevent the deleterious effects of thermal embrittlement in the 17-4 PH MSS components by identifying aging degradation (i.e., cracks), implementing early corrective actions, and monitoring and trending age-related degradation. The licensee did identify that none exists in the internals lower support structures but did not clarify if any exist elsewhere. Therefore, the staff requests that the subject AMP should include thermal embrittlement as an aging effect for any 17-4 PH MSS RVI components at Palisades if any exist.

**RAI-8** Note 5 of Table 2 lacks an actual minimum. Clarify the intent of Note 5.