

January 16, 2001

Mr. Charles M. Dugger
Vice President Operations
Entergy Operations, Inc.
17265 River Road
Killona, LA 70066

SUBJECT: ASSESSMENT OF THE LONG-TERM SOLUTION PLAN FOR
REACTOR COOLANT SYSTEM INCONEL 600 NOZZLE CRACKING AT
WATERFORD STEAM ELECTRIC STATION, UNIT 3
(TAC NO. MA9335)

Dear Mr. Dugger:

This response addresses your letter dated March 28, 2000, in which Entergy Operations, Inc. (Entergy) submitted a summary of its long-term plan for solution to Inconel 600 reactor coolant system (RCS) instrument nozzle cracking,

1.0 BACKGROUND

In a telephone conference that took place on March 5, 1999, Entergy requested relief to permit installation of Mechanical Nozzle Seal Assemblies (MNSAs) at Waterford Steam Electric Station, Unit 3 (Waterford 3), as an interim repair for three leaking Inconel 600 instrument nozzles on the two RCS hot legs, and two leaking instrument nozzles on the top head of the pressurizer. These leaks were identified during Refueling Outage (RFO) 9 and were determined to be caused by axial cracks near the heat-affected zone of the nozzle partial penetration welds, resulting from Primary Water Stress Corrosion Cracking (PWSSC).

By letter dated March 10, 1999, as supplemented by letter dated March 12, 1999, Entergy submitted a formal relief request pursuant to 10 CFR 50.55a(a)(3)(i).

By letter dated March 25, 1999, the staff approved the installation of the MNSAs at Waterford 3, as an interim measure for repairing the leaking instrument nozzles until RFO 10. During RFO 9 (March 1999), the two pressurizer nozzles were permanently repaired using welded partial nozzle replacements, and the three leaking nozzles on the RCS hot legs were temporarily repaired using MNSAs.

2.0 PLANS FOR RFO 10 AND BEYOND

- 2.1 Entergy outlined its plans to perform leakage inspections on the Inconel 600 nozzles of the Pressurizer (top, bottom, side, and heater sleeves), Steam Generators, and the RCS hot and cold legs, during RFO 10.
- 2.2 Entergy plans to permanently repair the remaining two nozzles on top of the Pressurizer (with the same weld heat numbers as the two pressurizer nozzles repaired in RFO 9), since they are more susceptible to future leakage.

- 2.3 If no new leaks are detected in the 19 nozzles on the RCS hot legs, Entergy plans to perform permanent repairs using welded partial nozzle replacements on six of these nozzles; three of which will be nozzles that were fitted with MNSA clamps during RFO 9, and three of which include nozzles located below mid-loop of the RCS hot legs. The repair of the last three require a core off-load to allow draining the RCS down to a level necessary to permit welding.
- 2.4 If, during RFO 10, more than six nozzles on the RCS hot legs were identified to have signs of leakage, Entergy's alternate plan is to permanently repair six nozzles using welded partial nozzle replacements and to request NRC concurrence (as necessary) to extend the use of the MNSAs currently installed, and to install additional MNSAs as temporary repairs on the remaining leaking nozzles.
- 2.5 Entergy stated that, during RFO 11, it intends to 1) repair as many of the remaining RCS hot leg nozzles as the outage will support, and 2) inspect Control Element Drive Mechanism nozzles, instrument nozzles, and the vent piping nozzle on the Reactor Vessel head. The staff agrees that these nozzles should be inspected for leakage at the earliest upcoming RFO. Any instrument nozzles found to leak should be permanently repaired using welded partial nozzle replacements. Those instrument nozzles that cannot be permanently repaired may be temporarily repaired using MNSAs until the next RFO, when the permanent repairs can be implemented.
- 2.6 Entergy also indicated that it is currently developing a new seal assembly design jointly with Framatome Technologies, and that it is planning to request its use, in lieu of the existing MNSA design.
- 2.7 Entergy stated that during RFO 9, in addition to experiencing considerable difficulty in meeting the diametric clearance criteria when field machining was performed for the "partial nozzle replacement" repairs, the requirements also caused increased radiation dosage to the machinist. Entergy stated that it is currently evaluating the possibility of requesting an exemption to Subsection NB-3337 of the American Society of Mechanical Engineers Boiler & Pressure Vessel Code, which governs diametrical clearance on partial penetration welded nozzles in the RCS.
- 3.0 CONCLUSION
- 3.1 Entergy's plans for RFO 10, stated in preceding sub-sections 2.1, 2.2, and 2.3, are acceptable.
- 3.2 The staff finds Entergy's plan, as stated in sub-section 2.4, to request Nuclear Regulatory Commission concurrence to extend the use of the MNSAs currently installed, and to install additional MNSAs as temporary repairs on the remaining leaking nozzles (as required) acceptable.
- 3.3 The staff recommends that the instrument nozzles be inspected for leakage at the earliest upcoming RFO and any nozzle found to leak should be permanently repaired using welded partial nozzle replacements. Those instrument nozzles that cannot be

- permanently repaired may be temporarily repaired using MNSAs until the next RFO, when the permanent repairs can be implemented.
- 3.4 Due to the uncertainty of the long term effects of the RCS environment on internal components (Grafoil seals) of the MNSAs, the staff considers MNSAs as temporary repairs. Entergy's request to use, in lieu of the existing MNSA design, a new seal assembly design which is currently in development with Framatome Technologies in future application for temporary repairs, will require prior staff evaluation and approval. However, no information has been provided on this assembly which is under development.
- 3.5 Entergy's possible request, stated in sub-section 2.7 above, for an exemption to Subsection NB-3337 of the ASME Code, will be evaluated when the request is made and the justifications provided.

This concludes our assessment of the subject submittal under TAC No. MA9335.

Sincerely,

/RA/

Robert A. Gramm, Chief, Section 1
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-382

cc: See next page

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This concludes our assessment of the subject submittal under TAC No. MA9335.

Sincerely,

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Robert A. Gramm, Chief, Section 1
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

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*Except for reformatting, no change from staff review of 12/14/2000.

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