

March 23, 2000

Mr. Craig G. Anderson  
Vice President, Operations ANO  
Entergy Operations, Inc.  
1448 S. R. 333  
Russellville, AR 72801

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT 1 RE: GENERIC LETTER 97-01,  
"DEGRADATION OF CONTROL ROD DRIVE MECHANISM NOZZLE AND  
OTHER VESSEL CLOSURE HEAD PENETRATIONS" (TAC NO. M98543)

Dear Mr. Anderson:

This letter provides the Nuclear Regulatory Commission (NRC) staff's assessment of your letters dated April 30, 1997 (OCAN049706), and July 29, 1997 (OCAN079703), which provided your 30-day and 120-day responses to Generic Letter (GL) 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations," and your letter dated February 24, 1999 (OCAN029908), which provided your response to the staff's request for additional information (RAI) dated December 8, 1998, relative to the issuance of the generic letter. Your responses provided your proposed program and efforts to address the potential for primary water stress corrosion cracking (PWSCC) to occur in the control rod drive mechanism (CRDM) nozzles at Arkansas Nuclear One, Unit 1 (ANO-1).

On April 1, 1997, the staff issued GL 97-01 to the industry, requesting that addressees provide a description of the plans to inspect the vessel head penetrations (VHPs) at their respective pressurized water reactor (PWR)-designed plants. In the discussion section of the generic letter, the staff indicated that it did not object to individual PWR licensees basing their inspection activities on an integrated, industry-wide inspection program.

The Babcock and Wilcox Owners Group (BWOG), in coordination with the efforts of the Nuclear Energy Institute (NEI) and the other PWR Owners Groups (the Westinghouse and Combustion Engineering (CE) Owners Groups), determined that it was appropriate for their members to develop a cooperative, integrated inspection program in response to GL 97-01. Therefore, on July 25, 1997, the BWOG submitted Topical Report BAW-2301, "BWOG Integrated Response to Generic Letter 97-01, Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations," on behalf of the members in the BWOG. In this report, the BWOG provided a description of the Electric Power Research Institute (EPRI)/Dominion Engineering CIRSE Model (crack initiation and growth susceptibility) that was used to rank the VHPs at the participating plants in the owners group. You provided your 30-day and 120-day responses for ANO-1 on April 30 and July 29, 1997, respectively. In these responses, you indicated that you were a participant in the BWOG's integrated program for evaluating the potential for PWSCC to occur in the VHPs of Babcock and Wilcox (B&W)-designed PWRs, and that you were endorsing the probabilistic susceptibility model in Topical Report BAW-2301 as being applicable to the assessment of VHPs at ANO-1.

The staff performed a review of both Topical Report BAW-2301 and your responses dated April 30 and July 30, 1997, and determined that additional information was needed for completion of the review. Therefore, on December 8, 1998, the staff issued an RAI requesting: (1) a description of the probabilistic susceptibility ranking for a plant's VHPs to undergo PWSCC relative to the rankings for the rest of the industry; (2) a description of how the respective susceptibility models were benchmarked; (3) a description of how the variability in the product forms, material specifications, and heat treatments used to fabricate a plant's VHPs were addressed in the susceptibility models; and (4) a description of how the models would be refined in the future to include plant-specific inspection results. As was the case for the earlier responses to the GL, the staff encouraged a coordinated, generic response to the requests in the RAI.

On December 11, 1998, NEI submitted a generic, integrated response to the RAIs on GL 97-01 on behalf of the PWR-industry and the utility members in the owners groups. In the generic submittal, NEI informed the staff that it normalized the susceptibility rankings for the industry based on a calculation of the time it would take for a VHP of a subject plant to have the same predicted probability of containing a 75 percent through-wall flaw relative to the "worst-case flawed" VHP at D.C. Cook, Unit 2. The normalized ranking for a plant's nozzles was then grouped by histogram into 1 of 3 time-dependent susceptibility groupings: (1) those plants whose 75 percent through-wall probability would occur within 5 years of January 1, 1997 (e.g., plants with high susceptibility VHPs), (2) those plants whose 75 percent through-wall probability would occur within 5-15 years of January 1, 1997 (e.g., plants with moderate susceptibility VHPs), and (3) those plants whose 75 percent through-wall probability would occur at a time beyond 15 years of January 1, 1997 (e.g., plants with low susceptibility VHPs).

The generic response to the RAIs also provided sufficient information to answer the information requests in the RAIs, and emphasized that the integrated program is an ongoing program that will be implemented in conjunction with EPRI, the PWR Owners Groups, the participating utilities, and the Material Reliability Projects' Subcommittee on Alloy 600. By letter dated March 21, 1999, the staff informed NEI that the integrated program was an acceptable approach for addressing the potential for PWSCC to occur in the VHPs of PWR-designed nuclear plants, and that licensees responding to the GL could refer to the integrated program as a basis for assessing the postulated occurrence of PWSCC in PWR-designed VHPs.

To date, all utilities have implemented VT-2 type visual examinations of their VHPs in compliance with the American Society of Mechanical Engineers requirements specified in Table IWB-2500 for Category B-P components. Most utilities, if not all, have also performed visual examinations as part of plant-specific boric acid wastage surveillance programs. In addition, the following plants have completed voluntary, comprehensive augmented volumetric inspections (eddy current examinations or ultrasonic testing examinations) of their control rod drive mechanism (CRDM) nozzles:

- 1994 - Point Beach, Unit 1 (Westinghouse design)
- 1994 - Oconee, Unit 2 (B&W design)
- 1994 - D.C. Cook, Unit 2 (Westinghouse design)
- 1996 - North Anna, Unit 1 (Westinghouse design)
- 1998 - Millstone, Unit 2 (a CE design)
- 1999 - Ginna (a Westinghouse design)

In addition, the following plants have completed voluntary, limited augmented volumetric inspections of their VHPs as well:

- 1995 - Palisades - eight instrument nozzles (CE design)
- 1996 - Oconee, Unit 2 - reinspection of two CRDM nozzles (B&W design)
- 1997 - Calvert Cliffs, Unit 2 - vessel head vent pipe (CE design)

The majority of these plants have been ranked as having the more susceptible VHPs in the industry. Of these inspections, only the inspections at D.C. Cook, Unit 2 have resulted in the identification of any domestic PWSCC-type flaw indications. The current program includes additional commitments to perform further volumetric inspections of the CRDM nozzles at Oconee, Unit 2 (a reinspection of 2-12 nozzles in 1999), Crystal River, Unit 3 (in 2001, a B&W design), Diablo Canyon, Unit 2 (in 2001, a Westinghouse design), Farley, Unit 2 (in 2002, a Westinghouse design), and San Onofre, Unit 3 (in 2002-2008, a CE design). These plants are currently ranked in either the high or moderate susceptibility categories.

By letter dated February 24, 1999, you provided your response to the staff's RAI dated December 8, 1998. In your letter, you endorsed the NEI submittal of December 11, 1998, and indicated that you were a participant in the NEI/BWOG integrated program. Since the additional volumetric inspections performed to date have confirmed that PWSCC is not an immediate safety concern with respect to the structural integrity of VHPs in domestic PWRs, and since we have approved the integrated program for implementation, we conclude that the integrated program provides an acceptable basis for evaluating your VHPs. You may refer to the integrated program when submitting VHP-related licensing action submittals for the remainder of the current 40-year licensing period. Furthermore, if you are considering applying for license renewal of your facilities, your application will need to address the following items: (1) an assessment of the susceptibility of your VHPs to develop PWSCC during the extended license terms for the facilities, (2) a confirmation that the VHPs at your facilities are included under the scope of your boric acid corrosion inspection program, and (3) a summary of the results of any inspections that have been completed on your VHPs prior to the license renewal application, as appropriate.

This completes the staff's efforts relative to your responses to GL 97-01. Thank you for your consideration and efforts in addressing this issue.

Sincerely,

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M. Christopher Nolan, Project Manager, Section 1  
Project Directorate IV & Decommissioning  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-313

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Russell, J. (1998). *Journal of Business Ethics*, 17(1), 1-15.

Jackman, S. (1995). *Journal of Business Ethics*, 14(1), 1-10.