June 27, 2003

Dr. Edward Siegel
6333 La Jolla Boulevard
La Jolla, CA 92037

SUBJECT: E-MAIL DATED MARCH 6, 2003, FROM DR. ED SIEGEL to A. HISER, B. BATEMAN AND T. CHAN, *FWD: FYI: QUESTIONS? COMMENTS?*

Dear Dr. Siegel:

This letter is in response to your e-mail dated March 6, 2003, to A. Hiser, B. Bateman and T. Chan, *Fwd: FYI: Questions? Comments?*, in which you provided remarks on NRC Order EA-03-009. In your e-mail, you stated that you did not believe the eddy current non-destructive evaluation technique would provide quality results due to Alloy 600 base metal and Alloy 182/82 welds becoming ferromagnetic when aged. Additionally, you suggested that the root cause for cracks in Alloy 600 base metal and Alloy 182/82 welds was not stress corrosion cracking. Rather, you explained that stress corrosion cracking is an effect of the following radiation damage, embrittlement, and aging mechanisms: Wigner's Disease, Overageing Embrittlement, Ostwald Ripening, and Spinodal Decomposition.

Eddy current testing is an adequate method to provide surface flaw detection in Alloy 600 base metal and Alloy 182/82 welds. Under conditions in which the alloy might become locally or globally ferromagnetic, the effect in either alloy would be detected as a positive indication by the eddy current method and further characterization of the indication would be required. If the positive indication could not be characterized by eddy current testing, additional nondestructive evaluation and analysis would be performed. NRC Order EA-03-009 sections IV.C(1)(b)(ii), IV.C(2)(b)(ii) and IV.C(3)(b)(ii) require that the non-destructive evaluation method used, either eddy current testing or dye penetrant testing, be able to discern surface flaws.

The NRC staff's approach to assessing aging effects on RPV head nozzles is to rely on a diversity of examination methods, scope and frequency of inspections, including leakage detection, to assure discovery of cracks in a reactor pressure vessel head penetration before a loss of intended function of the component. As part of this strategy, NRC Order EA-03-009 uses a susceptibility ranking to establish a prioritized inspection plan based on "time at temperature," acknowledging the recent evidence which suggests a thermal aging factor. Several plants have discovered indications of cracking in Alloy 600 base metal and Alloy 182/82 welds. These results have tracked well within the bounds of the susceptibility model.

Since 1991, the NRC has expended and continues to expend resources to address the issue of stress corrosion cracking in Alloy 600 and Alloy 182/82. Research on inservice aging effects to these alloys at normal reactor operating temperatures is ongoing under the direction of NRC's Office of Nuclear Regulatory Research. Material properties tests of alloys from the J-weld sections removed from the discarded Davis Besse Reactor head are underway at Argonne National Laboratory in Illinois. The results will be publicly available upon completion of the research effort.

Your comments and research have been reviewed by several members of the NRC staff. Based on information obtained to date through research and field experience regarding the role of PWSCC degradation in Alloy 600 class materials, there is no information which would indicate that NRC Order EA-03-009 requirements are unable to adequately protect public health and safety. Thank you for your interest on this issue.

Sincerely,

/RA/

William H. Bateman, Chief
Materials and Chemical Engineering Branch
Division of Engineering
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission

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