January 24, 2008

MEMORANDUM TO: Jennifer L. Uhle, Director
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Office of Nuclear Regulatory Research

THRU: Robert O. Hardies, Chief ***/RA/***
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SUBJECT: SUMMARY OF THE JANUARY 9 THROUGH 11, 2008, CATEGORY 3 PUBLIC MEETING INVOLVING THE NUCLEAR REGULATORY COMMISSION STAFF, INTERNATIONAL RESEARCHERS AND INDUSTRY PARTICIPANTS ON ASSESSING LEAK-BEFORE-BREAK IN PRIMARY WATER STRESS CORROSION CRACKING-SUSCEPTIBLE COMPONENTS

On January 9 through 11, 2008, the U.S. Nuclear Regulatory Commission (NRC) staff conducted a Category 3 public meeting involving international researchers, NRC staff and contractors, and industry representatives. The meeting was held at the Hilton Hotel in Rockville, MD. A list of attendees and presentations from the international researchers, industry, NRC staff and contractors are enclosed. Purpose of the meeting was to discuss current state of knowledge for developing probabilistic fracture mechanics (PFM) tools necessary to determine that the probability of fluid system piping rupture is extremely low (per general design criterion 4 in Appendix A to Title 10, Code of Federal Regulations, Part 50) in reactor coolant system components in the presence of active degradation mechanisms. Primary water stress corrosion cracking (PWSCC) is of concern for piping systems in pressurized water reactor (PWR) plants.

Presentations were made regarding NRC's perspective on leak-before-break (LBB), international experience with LBB evaluation of components under active degradations, crack initiation models and crack growth rates in stainless steels and nickel-based alloys (Alloys 82/182, 52/152, 600/690), weld residual stress analysis and flaw evaluation, PWSCC mitigation techniques (mechanical stress improvement, weld overlays [pre-emptive and repair], weld inlays/onlays), inspections of dissimilar metal welds, leak rate analyses, quantification of fabrication flaw distributions in reactor vessels, and current features of PRO-LOCA (Probabilistic Loss of Coolant Accident) computer code for application to PWSCC-susceptible components.

Presentations focused on the current state of knowledge, potential knowledge gaps, identification of areas of conservatism/non-conservatism, and quantification of relevant uncertainties. Discussions at the meeting included the observation that the PWSCC of nickel-based alloys (Alloy 600 base metal and Alloy 82/182 weld materials) is well documented, and is dependent on stress, temperature, microstructure, material, and environmental conditions. Tensile stresses near Alloy 82/182 dissimilar metal welds arise from weld fabrication and repairs, weld shrinkage, thermal expansion, operating stresses, and piping loads.

An action item was identified to develop comprehensive root-cause flow/logic diagrams to identify potential knowledge gaps, areas of conservatism and non-conservatisms, and assess uncertainties (aleatoric and epistemic) and stochastic processes for use in developing modular PFM analytical tools to determine the probability of fluid system piping rupture for PWSCC-susceptible components. The Electric Power Research Institute (EPRI)/industry has a lead on developing initial root-cause logic diagrams after holding discussions with the subject matter experts that participated in the meeting in each of the major areas. These root-cause diagrams will be discussed in a follow-on joint NRC-industry meeting.

The information discussed was non-proprietary. Please direct any inquiries to me at (301) 415-6007 or snm@nrc.gov.

Enclosures:
1. List of Attendees
2. Presentations (29)

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