March 19, 2008

MEMORANDUM TO: Patrick L. Hiland, Director
Division of Engineering
Office of Nuclear Reactor Regulation

Michael E. Mayfield, Director
Division of Engineering
Office of New Reactors

FROM: Jennifer L. Uhle, Director ***/RA/***
Division of Engineering
Office of Nuclear Regulatory Research

SUBJECT: ASSESSMENT OF DIGITAL INSTRUMENTATION AND CONTROLS OPERATING EXPERIENCE AND INVENTORY AND CLASSIFICATION STRUCTURE

In their letter to the Commission, dated May 18, 2007, the Advisory Committee on Reactor Safeguards (ACRS) recommended that the staff develop an inventory and classification structure (e.g., by function or other characteristics) for the various types of digital and software systems that are being used and are likely to be used in nuclear power plants. Additionally, the ACRS recommended that the staff should evaluate the operating experience (OE) with digital systems in the nuclear industry and other industries to obtain insights regarding potential failure modes. The ACRS recommended that the information obtained through performing these activities should be used in the development of regulatory guidance on diversity and defense in depth (D3) for digital Instrumentation and Control (I&C) systems.

Staff Requirements Memorandum, M070607, dated June 22, 2007, directed the staff to assure that the following actions are included in the Digital I&C Project Plan with appropriate dates to support the development of the final regulatory guidance on diversity and defense in depth;

1. Develop an inventory and classification structure (e.g., by function or other characteristics) for the various types of digital hardware and software systems that are being used and are likely to be used in nuclear power plants.

2. Evaluate the operating experience with digital systems in the nuclear and other industries to obtain insights regarding potential failure modes.

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These actions were added to the Digital I&C Project Plan for the D3 Task Working Group (TWG) under two milestones. In September, 2007 in response to the first milestone, The Office of Nuclear Regulatory Research (RES) issued a white paper, "Preliminary Assessment of Major Issues or Common Themes in Inventory and Classification and Operating Experience Evaluation for Digital I&C Systems" (ML072710480). The primary goal of the preliminary assessment was to validate the interim staff guidance (ISG) for D3 or recommend changes. No changes to the D3 Interim Staff Guidance were necessary.

To address the second milestone, and as summarized in the enclosed report, RES performed a more detailed evaluation of digital system OE data from nuclear and other industries and an evaluation of digital system classification structures. The OE evaluation found that while there is limited availability of high quality data, the data trends validate the credibility of software-induced common cause failures (CCFs). Digital system classification structures were evaluated with respect to their ability to support data analysis and provide insights into D3 regulatory guidance. Based on our assessment, RES intends to use a classification structure that will 1) map digital system classification to D3 diversity strategies and 2) improve digital system OE failure data categorization.

RES intends to perform additional reviews of non-nuclear industry digital system failure data and will periodically review nuclear digital OE as these systems become more prevalent in the nuclear industry. Sufficient information is not currently available to develop digital system inventories at this time. Therefore, RES intends to develop digital system inventories as vendor systems are selected for upgrades in operating reactors and for installation in new reactors. The additional reviews and inventory development will be used to support validation or modification of D3 regulatory guidance.

Based on the insights obtained and the current direction of D3 strategy development, there are no recommended changes for the final regulatory guidance for D3 at this point.

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