August 5, 2004

MEMORANDUM TO: Ledyard B. Marsh, Director
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

FROM: Michael E. Mayfield, Director **/RA/**
Division of Engineering Technology
Office of Nuclear Regulatory Research

SUBJECT: NUREG/CR-6842, "ADVANCED REACTOR LICENSING: EXPERIENCE WITH DIGITAL I&C TECHNOLOGY IN EVOLUTIONARY PLANTS"

Attached is a copy of NUREG/CR-6842, "Advanced Reactor Licensing: Experience with Digital I&C Technology in Evolutionary Plants," for your information and use. This report presents the findings from a study of experience with digital instrumentation and controls (I&C) technology in evolutionary nuclear power plants. The study evaluated regulatory approaches employed by the international nuclear power community for licensing advanced I&C systems and identified lessons learned. The report (1) gives an overview of the modern I&C technologies employed at numerous evolutionary nuclear power plants, (2) identifies performance experience derived from those applications, (3) discusses regulatory processes employed and issues that have arisen, (4) captures lessons learned from performance and regulatory experience, (5) suggests anticipated issues that may arise from international near-term deployment of reactor concepts, and (6) offers conclusions and recommendations for potential activities to support advanced reactor licensing in the United States.

Development of these lessons is the first part of a multi-year program to develop the regulatory infrastructure (review methods and tools) to support the review of advanced I&C systems in future reactors. RES performed this review to determine if we could develop any insights based on the experience that other countries have had in licensing evolutionary reactors. This report will be used to further develop the regulatory infrastructure plan and reassess the planned research program in advanced reactor I&C. The next program planned in the development of the regulatory infrastructure is the development of models for the quantitative evaluation of performance and safety of new I&C systems for future reactors. Based on the recommendations in this NUREG, this project will focus on the assessment of system dependability, diversity, and reliability.

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The recommendations presented in this report will be used as an input to the development of the digital I&C research plan. NRR can use this report as one input for the determination of the parts of Chapter 7, “Instrumentation and Control” of the standard review plan that should be revised or revisited. This report is intended to be applicable to all proposed future nuclear power plant instrumentation and control systems and for some future updates to operating plants for which the licensee voluntarily initiates a significant update of their systems.

This research supports the agency’s performance goal of maintaining safety by investigating the areas of research and the regulatory guidance needed to support future licensing of safety-related digital systems in nuclear power plants. By working to develop the needed regulatory infrastructure now, in parallel with conducting pre-application reviews, the research programs will improve public confidence in NRC licensing of new reactors and technologies. This research, if completed and implemented before the first new license applications are received, will improve the effectiveness and efficiency of the licensing process.

Attachment: NUREG/CR-6842

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