

December 9, 2002

Dr. George E. Apostolakis
Chairman
Advisory Committee on Reactor Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: HUMAN FACTORS AND HUMAN RELIABILITY ANALYSIS RESEARCH PLANS

Dear Dr. Apostolakis:

This is in response to your letter of September 24, 2002, on the Human Factors (HF) and Human Reliability Analysis (HRA) Research Plans. Your recommendations along with the staff's responses are provided below.

- The Human Reliability Analysis Program needs to continue to articulate its long-term vision of the technology necessary to the agency. This vision should include the availability of a well-validated model for quantifying individual and team error rates.

The staff agrees with ACRS that it should continue to articulate its long-term vision for HRA technology development, including the availability of well validated models for quantifying individual and team error rates. The staff has efforts underway to evaluate the feasibility of using simulator experiments for better estimating human error probabilities, for individuals as well as teams. Furthermore, the staff plans to examine the usefulness of second generation HRA methods through cooperation with the international HRA community. One focus of this assessment will be on the capability of these methods to provide validated models for estimating individual and team errors.

- The past focus on overt, individual errors of omission is being augmented to include latent human errors and needs to be expanded to address explicitly team interactions both in the control room and elsewhere in the plant.

As noted in your letter, the staff has ongoing efforts to develop methods and tools appropriate for collecting information needed to develop human performance models and error estimates. Particular emphasis is placed on collaborative efforts of the two programs (HF and HRA) and the development of the capability in HRA to use methods, data, and results of HF work. HF research has over the years included measures of crew performance, e.g., Halden Work Report HWR-376, "Summary of Lessons Learned at the OECD Halden Reactor Project for the Design and Evaluation of Human-Machine System," and NUREG/CR-6208, "An Empirical Investigation of Operator Performance in Cognitively Demanding Simulated Emergencies." The staff continues to include control room team measures in its research and plans to address the performance of non-cohesive control room teams and team interactions in the control room as well as elsewhere in the plant.

- Human Factors and Human Reliability Analysis research programs should be expanded to search for leading indicators of degradation in human performance, both at the individual and group levels.

The staff plans to continue its work on errors from personnel outside of the control room during abnormal and normal operations (latent errors). We are currently reassessing how to best incorporate the ACRS recommendation on developing leading indicators of degradation of human performance (at the individual and group level) into the research programs.

- The NRC should consider development of a control room simulator devoted to support research on human factors and human reliability.

The staff agrees with the ACRS that a research simulation facility for human factors and human reliability research would be beneficial to both of these programs as well as to the NRC's Instrumentation and Control program. For your information, the attachment contains recommendations developed during a Department of Energy (DOE) workshop on this subject. The staff will determine the feasibility of cooperating in this effort with the DOE. In parallel, the staff is funding work to assess the feasibility for a research simulator for advanced reactors. Depending on the availability of resources, the staff may expand the scope of this effort to consider current generation reactors. As part of this, the staff will assess the resource implications of a change in the current practice of using Halden.

The ACRS expressed in the letter a concern regarding the use of simulator data for validating models of operator performance in a plant control room. The staff will consider expanding the scope of the work on assessing the feasibility for a research simulator to include a review of information available regarding the realism of simulator behavior. The Department of Transportation, NASA, the military, and the airline industry make extensive use of simulators and have performed such studies in the past. Subject to resource availability, we will assess their experience as we develop and implement our plans.

Sincerely,

/RA by Carl J. Paperiello Acting For/

William D. Travers
Executive Director
for Operations

Attachment: As stated

cc: Chairman Meserve
Commissioner Dicus
Commissioner Diaz
Commissioner McGaffigan
Commissioner Merrifield
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* Previously concurred

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ATTACHMENT

A report from a Department of Energy (DOE) sponsored workshop on Instrumentation, Controls and Human-Machine Interface Technology (IC&HMIT) dated September 2002 recommended:

Limitations exist in the research and development infrastructure that supports the advancement of the research issues discussed previously. The single biggest need is for a research simulation facility. The main simulation facilities available in the United States are the current training simulators. However, these simulators are not available and not suitable for research. ... Even if training simulators were available, performing research on existing training simulators for Generation IV development would be quite difficult. They are not designed to be flexible, especially in the area of human-system interfaces (HSI). Making modification to test novel HSI concepts and fundamentally changing the level of intelligence of the HSIs would be quite difficult.

Ideally, a national research facility should be established... Such an integrated facility will enable the development of integrated human-I&C (and Human Reliability) research. The facility would also provide a platform for proof-of-concept testing and evaluation of all of the research elements previously discussed. The facility should be developed for and dedicated to research which establishes a set of requirements quite different from training simulators (e.g., the need for flexible modification and data collection are quite different for a research simulator).