February 3, 2003

MEMORANDUM TO: Ashok C. Thadani, Director
Office of Nuclear Regulatory Research

FROM: Martin J. Virgilio, Director***/RA/***
Office of Nuclear Material Safety and Safeguards

SUBJECT: USER NEED - REQUEST FOR RESEARCH ASSISTANCE IN DEVELOPING HUMAN RELIABILITY ANALYSIS CAPABILITY SPECIFIC TO MATERIALS AND WASTE APPLICATIONS

As part of the agency wide efforts to risk inform various NRC regulated activities, the Office of Nuclear Material Safety and Safeguards (NMSS) has been steadily increasing the use of risk information, as appropriate, in the waste and materials safety arenas. Because human actions play such an important role in most of the materials and waste activities, to develop and use the risk insights, we need to have a simple and robust tool to analyze human reliability that is suitable for the whole range of materials and waste activities. We note that much work has been done in the development of methods, models, data and guidance for performing human reliability analysis (HRA) in the reactor arena. However, after a cursory review of previous HRA research efforts conducted for the reactor arena, it is not apparent that these methods, models, data and guidance are directly applicable to NMSS needs. Therefore, NMSS requests assistance from the Office of Nuclear Regulatory Research (RES) in the development of HRA capability that tailors to materials and waste applications.

Background

In the Staff Requirements Memorandum (SRM) [1] for SECY-99-100 [2], the Commission directed the staff to implement the proposed approach to risk-inform the materials and waste safety arenas. During Phase I of NMSS' risk-inform initiatives, we have identified important gaps in the methods, data and tools available to perform risk analyses for NMSS applications [3]. We concluded that "One of the major gaps in the methods is the identification and development of a robust and simple method for incorporating human factors and estimating human reliability in the very wide range of situations and activities encountered and performed by NMSS licensees."

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From our operating experience, human actions play a dominant role in most of the NMSS regulated activities. The overall risk of these activities is strongly influenced by human performance. Hence, an improved understanding of human error, its causes and context and HRA can provide better risk insights to risk-inform, as appropriate, NMSS regulated activities. As stated previously, one important conclusion from our Phase I risk-inform initiative is that NMSS staff, e.g., license reviewers, event assessors, etc., needs a simple, easy-to-use tool so they can estimate the risk contribution from the human activities in the day-to-day work.

Much of the HRA work done in the reactor arena focuses on the cognitive models associated with errors of commission. In particular, in a typical reactor risk assessment where human performance is an issue, the analysis focuses on complicated human-hardware interactions. In most of NMSS regulated activities, the hardware involved is nowhere near the complexity of a reactor and much of the risk resides with human performance. Therefore, while the same thought process associated with the development of the reactor HRA models may be applicable to a broad range of NMSS applications, it is not apparent that the specific HRA models, methods and available data sets are directly applicable. Furthermore, for most of NMSS applications, an elaborate risk assessment, such as the ones done for reactors, may not be warranted because of the simplicity of the system, economics, level of precision needed and other factors. Consequently, a different approach to HRA for NMSS applications may be warranted. Finally, NMSS recognizes that the quantification of HRA requires cooperation between human factors and reliability technologies.

HRA Needs for NMSS Risk-Informed Applications

NMSS requests RES assistance in the following activities:

Feasibility/Scoping Phase

1. Perform a comprehensive review of available risk studies in the materials and waste arenas where human performance would play a non-trivial role (e.g., see references [3] through [11]).

2. Work with NMSS and Region staff, e.g., license reviewers, inspectors, event assessment staff, etc., in identifying the level of detail needed to address the needs of the various NMSS applications and determine the desired product format. For example, a simplistic HRA approach in the form of look-up tables may be adequate for some applications while a more detailed approach may only be needed for a few applications under specific circumstances.

3. Based on results of the first two activities, group similar applications (e.g., spent fuel handling for dry cask storage and spent fuel handling for repository) for method, model, data, tool and guidance development.

4. Identify HRA capability needs for NMSS applications. For each of the groups identified in the third activity: (1) review existing methods, models, data and tools available; (2) determine whether any existing methods, models and data developed for other areas can be readily used; (3) identify any model and data gap; (4) conclude whether it is feasible (e.g., cost effective) to commence the development; (5) for those groups that are determined to be feasible, develop a plan for obtaining the necessary information and developing the capability; and (6) document the results of this activity.

In summary, the feasibility phase should factor in previous risk-informed work, such as the screening considerations developed in Phase I of NMSS risk-inform initiatives, and ongoing work such as the development of the safety goals for materials and waste applications.

Implementation Phase

Based on the results of the feasibility phase, develop HRA methods, data, tools and guidance as necessary. NMSS will interact with RES to prioritize and schedule the development work.

I believe frequent interactions of our respective staff will ensure the success of this project. We would expect the feasibility/scoping phase be completed by the end of FY 2003. The findings can then be factored into priority setting and resource allocation for FY 2004 to start the implementation phase. Please contact Christiana Lui in the NMSS Risk Task Group (RTG) after you and your staff have had the opportunity to review this request. The RTG staff will be happy to meet with your staff to discuss details of this user need.

References

1. US NRC, "Staff Requirements Memorandum – SECY-99-100 Framework for Risk-Informed Regulation in the Office of Nuclear Material Safety and Safeguards," June 28, 1999.

2. US NRC, SECY-99-100, "Framework for Risk-Informed Regulation in the Office of Nuclear Material Safety and Safeguards," March 11, 1999.

3. NMSS Risk Task Group and Brookhaven National Laboratory, "Risk Informing the Materials and Waste Areas: Integration of Case Studies and Related Risk Assessments," Volume 1 and 2, December 2001. (ADAMS Access No: ML022130067)

4. "Request for Probabilistic Risk Assessment Analysis Branch Review of NNPP Likelihood of Criticality," White Paper," Memorandum from Scott Newberry, RES, to John Greeves, NMSS, July 5, 2002. (ADAMS Access No: ML021930429)

5. NUREG/CR-6642, "Risk Analysis and Evaluation of Regulatory Options for Nuclear Byproduct Material Systems", Volumes 1 - 3, February 2000.

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7. NUREG-1669, "A Risk Analysis of Fixed Nuclear Gauges, " April 2000.

8. NUREG/CR-6672, SAND2000-0234, "Reexamination of Spent Fuel Shipment Risk Estimates," Volumes 1& 2, March 2000.

9. NUREG/CR-4829, UCID-20733, "Shipping Container Response to Severe Highway and Railway Accident Conditions," Volumes 1& 2, February, 1987

10. NUREG-1717, "Systematic Radiological Assessment of Exemptions for Source and Byproduct Materials," June 2001.

11. "A Pilot Probabilistic Risk Assessment of a Dry Cask Storage," Draft, June 2002.

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