POLICY ISSUE
INFORMATION

November 1, 2001 SECY-01-0196

FOR: The Commissioners

FROM: William D. Travers
Executive Director for Operations

SUBJECT: STATUS OF THE NRC PROGRAM ON HUMAN PERFORMANCE IN NUCLEAR POWER PLANT SAFETY

PURPOSE:

The purpose of this paper is to inform the Commission that "The NRC Program on Human Performance in Nuclear Power Plant Safety," described in SECY-00-0053, February 29, 2000, will be sunset as an independent document. In the future, descriptions of human performance research activities will be included in the "NRC Human Reliability Analysis Research Plan: Fiscal Years 2001–2005," May 2001 (HRA Plan), or the "NRC Research Plan for Digital Instrumentation and Control," SECY-01-0155, August 15, 2001 (Digital I&C Plan), as appropriate. This paper also is an update for the Commissioners on the status of the activities described in SECY-00-0053.

BACKGROUND:

In SECY-00-0053, the staff submitted an integrated program planning document that described the status of the Agency human performance activities related to nuclear power plant safety. The goals of the program are to ensure that NRC human performance activities are directed at a better understanding of the risk significance of human performance, to improve our ability to model human performance, and to use risk insights to inform regulatory activities. The planning process for the human performance program included: (1) a detailed review and analysis of important human actions contained in Accident Sequence Precursor program risk models and results, associated licensee event reports, and related inspection or investigation reports; (2) review of individual plant examination reports focusing on important human performance actions; and (3) review of other reports where critical human performance actions are identified.

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In addition, the staff reviewed other information to determine its applicability to the planning process. This information included human performance activities in the domestic and international nuclear industry, human performance programs at other agencies, and changes to the regulatory activities of the NRC.

DISCUSSION:

The bases for integrating the activities described in SECY-00-0053 with the HRA Plan or the Digital I&C Plan and the status of those activities are discussed below.

Integration of Human Performance Activities with the HRA Plan and the Digital I&C Plan

Since publication of SECY-00-0053, the HRA Plan and the Digital I&C Plan were developed. Because of the close linkages among the activities included in these plans and the cross-cutting nature of human performance, the staff has decided to integrate the human performance activities described in SECY-00-0053 into the HRA Plan and the Digital I&C Plan. In addition to the activities in SECY-00-0053, any new activities identified by program office needs, emerging issues or technology, or other sources, such as subject matter expert (SME) workshops will be integrated into these plans, as appropriate. Hence, human performance activities will continue, however there will not be a separate planning document for human performance.

The integration of human performance activities with the HRA Plan activities will improve the synergy among projects that are intended to enhance the data and data sources for establishing human error probabilities (HEP). Human factors experiments will be planned so that data collected will be amenable to conversion to HEPs. Methods for converting data and information from published human factors and behavioral science literature into HEPs for particular issues (e.g., the effects of fatigue on personnel performance) can be developed. Further, human factors reviews of operational experience reports may identify needed improvements to HRA techniques. On the other hand, HRA analyses could be used to identify and prioritize issues and topics for which human factors regulatory guidance may be needed.

The integration of digital I&C and human factors activities will improve the synergy among projects in these areas as well. Information and control functions are provided to plant personnel, while human factors technology addresses interfaces between the humans and the systems they control. With the increased use of automation, it is important to consider the allocation of functions between people and engineered systems for questions related to staffing, work processes, communications, and control station design for advanced reactors.

RES staff responsible for the human performance, human reliability, and digital I&C research programs will work together to determine how best to integrate the human performance activities into the HRA Plan and the Digital I&C Plan. As new human performance research activities are identified, whether or not associated with one of the plans, they will be prioritized as part of the RES budget planning and prioritization process.

Status of Human Performance Activities

There are four key areas that are supported by human performance activities: the Reactor Oversight Program (ROP), Plant Licensing and Monitoring, Risk-Informed Regulation, and

Emerging Technology/Emerging Issues/Advanced Reactors. The accomplishments since the issuance of SECY-00-0053 and proposed future activities are discussed below and summarized in Table 1 in the attachment.

Reactor Oversight Program

Human performance activities related to the ROP include development of an inspection module, a significance determination process (SDP) module, a process to support human performance reviews, and an evaluation of human performance as a cross-cutting issue. Two human performance activities completed by the Office of Nuclear Reactor Regulation (NRR) were publication of supplemental inspection IP 71841, "Human Performance," and "Operator Requalification Human Performance Significance Determination Process." The Office of Nuclear Regulatory Research (RES) developed the Human Performance Evaluation Process (NUREG/CR-6751) as a possible resource for inspectors for more detailed investigations of a licensee's corrective action program when human performance is involved. RES is also completing work to evaluate whether the ROP appropriately captures the human performance element. This is being accomplished by applying ROP inspection modules, performance indicators, and the SDP to past events with significant human performance contributions, to determine if the human performance problem would be identified by the ROP.

Plant Licensing and Monitoring

Human performance activities that support Plant Licensing and Monitoring include development and implementation of regulatory review guidance. Revision 3 to Regulatory Guide 1.8, "Qualification and Training of Personnel for Nuclear Power Plants," was issued. The technical basis for the review of plant changes that credit operator action in place of automatic actions was developed to serve as a basis for a future revision to the Standard Review Plan (SRP), NUREG-0800, Chapters 18 and 19. RES assisted NRR in reassessing the Commission's policy on fatigue (SECY-01-0113, "Fatigue of Workers at Nuclear Power Plants," June 22, 2001). Future work in the area of fatigue will be conducted in accordance with the staff requirements memorandum.

In addition to regulatory review guidance for nuclear reactor regulation, RES developed a SRP (NUREG-1718) chapter on human factors for the Office of Nuclear Materials Safety and Safeguards (NMSS) for use in the review of a mixed oxide (MOX) fuel facility. RES is also performing the licensing review of the MOX facility in the area of human factors for NMSS and will prepare the Safety Evaluation Report. Further, RES participated in the Mallinckrodt Lessons Learned Task Group that recommended enhancements to NMSS licensing and inspection in the areas of training, work place design, procedures, staffing, overtime, and corrective action programs.

Risk-Informed Regulation

Support to risk-informed regulation involves the generation, collection, analysis, and evaluation of data on human performance that can be used in human reliability analysis (HRA) models. HRA model development work is included in the HRA Plan and provides the structure for defining the needed data and information on the context in which humans work. Human performance data will be collected and evaluated from operational experience, plant specific

nuclear power plant simulators, or research simulators. The data will be evaluated to provide insights to support risk-informed regulation, including risk-informing 10 CFR Part 50, and to assess industry PRA/HRA models.

Emerging Technology/Emerging Issues/Advanced Reactors

The Emerging Technology/Emerging Issues/Advanced Reactors area is intended to prepare the Agency for potential future activities and includes: control station design review guidance, deregulation, advanced reactors, and the aging workforce. As nuclear power plants' analog controls and displays age, they are being replaced with digital components. These new digital components can provide the operator with more and better configured information. However, poorly designed human-system interfaces could have a negative impact on the performance of operations and maintenance staff. Revision 2 to NUREG-0700 is planned for 2002 and will incorporate the results of recently completed studies of advanced alarm systems, display navigation, computerized procedures, and issues specific to hybrid control stations. Research on automation, function allocation, large screen displays, computerized procedures, hybrid control rooms, navigation, and human error recently completed at the Halden Reactor Project will also be included in NUREG-0700. Future development of NUREG-0700 will be sunset after publication of Revision 2.

An SME Workshop was held on April 2 - 6, 2001, to identify human performance activities that the agency should consider pursuing over the next 5 years. Workshop participants included: NRC human performance and risk staff; representatives from NRC contractors, national laboratories, industry, and other Government agencies; and human performance experts who apply human performance technology in settings other than nuclear. This workshop identified emerging issues from other applications that may be applied to nuclear.

A study to identify safety issues that might result from economic deregulation of the nuclear power industry was published as NUREG/CR-6735, "Effects of Deregulation on Safety: Implications Drawn from Aviation, Rail, and United Kingdom Nuclear Power Industries." Issues important to safety that could result from economic deregulation identified in this report will be considered at an SME workshop in November 2001. Any new safety issues that are identified will be assessed for risk significance; a White Paper on these issues will be prepared, and activities will be identified.

Currently, the nuclear industry is considering the licensing of new reactors, especially new designs such as the pebble bed modular reactor. The new designs are highly automated and purported to be inherently safe. Operational incidents in other applications, (e.g., transportation systems), demonstrate that automated systems can impact human performance and safety. Therefore, research on topics such as staffing, procedures, training, operator licensing, and information technology will be considered for future research. Any new safety issues that are identified will be assessed for risk significance; a White Paper on these issues will be prepared, and activities will be identified.

Another issue that the nuclear industry and the NRC are facing is the aging workforce. The Electric Power Research Institute (EPRI) is pursuing research on methods for enhancing knowledge management as a tool for capturing and accessing the knowledge of experts who are leaving the industry. NRC staff will track EPRI's research to determine its applicability to the NRC as a tool to capture the knowledge of its own workforce. Staff will consider developing

a Human Factors Tool Box to provide efficient access to NRC regulations, regulatory guides, NUREGs, and inspection modules that contribute to the elements of a human factors review. This will be done to capture the history and knowledge of the human factors discipline at the NRC. Further, the development of a training program to familiarize NRC staff with human factors and human performance issues in the nuclear arena will be considered. The training program would also instruct staff on the elements of the tool box and their use.

RES Human Performance staff continues to derive insights from operational experience reviews and capitalizes on international activities related to human performance through participation in the Halden Reactor Project and the Committee on the Safety of Nuclear Installations (CSNI) working groups on risk, operating experience and the Special Experts Group on Human and Organizational Factors. Staff also continues to participate in consensus standards committees (e.g., ANS and IEEE) and professional activities and cooperates with industry and other agencies (e.g., DOE/EPRI Nuclear Energy Plant Optimization (NEPO) projects) to keep abreast of new developments. These activities allow staff to derive insights on human performance issues from various external sources.

RESOURCES:

If additional resources are needed to support integration of the human performance activities into the HRA and digital I&C plans in FY 2003, the needs will be considered as part of the RES budget planning and prioritization process. New human performance research activities will also be prioritized as part of the RES budget planning and prioritization process.

COORDINATION:

The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objections. The Office of the General Counsel has no legal objection to this paper.

/RA by Carl J. Paperiello Acting For/

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Attachment: As stated

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Table 1. Human Performance Program Activities

ACTIVITY	MILESTONE	DATE	STATUS	User Need
Reactor Oversight Process				
Human Performance Supplemental Inspection Procedure	Issue Final	12/00	Complete	NRR Activity
Operator Requalification Significance Determination Process	Issue Final	12/00	Complete	NRR Activity
Human Performance Evaluation Protocol	Publish Final	12/01	Completed as NUREG/CR-6751	RES
Characterize the Effects of Human Performance in Reactor Oversight Process	Develop Plan Publish Report	03/00 12/01	Completed Draft NUREG/CR in review	NRR
Plant Licensing and Monitoring				
Reg. Guide 1.8 Draft Guidance for Credit for Operator Action Modify SRP Chapter 18 and 19 Support Fatigue Rulemaking	Published Publish Draft Final Rulemaking plan Final Rule	05/00 09/00 07/02 06/01 TBD	Completed Completed as NUREG/CR-6689 Work Initiated Awaiting Commission SRM	NRR RES NRR NRR SRM
Support to MOX Facility Licensing	Construction SER License SER	09/02 08/04	In Review Process	NMSS NMSS

Attachment

Table 1. Human Performance Program Activities (Cont.)

ACTIVITY	MILESTONE	DATE	STATUS	User Need
Risk-Informed Regulation Implementation Plan				
Operational Experience Reviews ASP/SPAR Analysis	Final Report	09/01	Draft NUREG/CR in review	RES
Results of Simulator Experiments	As Available		Continuing	
HRA Data Collection and Analysis	Evaluation of Data Needs	12/01	Task 1 of HRA Plan	RIRIP RSEER1-3
HRA for Advanced Control Rooms	Identify Key HRA Issues	09/03	Task 10 of HRA Plan	RIRIP RSEER1-1
Latent Errors in HRA	Identify Key HRA issues	09/03	Task 11 of HRA Plan	RIRIP RSEER1-3
Emerging Technology/Issues/Advanced Reactors				
Control Station Review Guidance	Revision 2, NUREG-0700 Final	12/01	Final in Review	NRR
Hybrid Control Stations	Interim Guidance	03/00	Completed as NUREG/CRs-6633-6637	NRR
Alarm Systems	Interim Guidance	11/00	Completed as NUREG/CR-6684	NRR

Table 1. Human Performance Program Activities (Cont.)

ACTIVITY	MILESTONE	DATE	STATUS	User Need
Interface Management	Technical Basis	12/01	Incorporated in Draft NUREG-0700	NRR
Human Factors Engineering Program Review Model	Revision 1, NUREG-0711 Final	12/01	Final in Review	NRR
Staffing for Advanced Reactors	Tech. Basis Report Proposed Guidance	11/00 TBD	Completed as NUREG/IA-0137 New	NRR
Economic Deregulation	Safety Issues Report SME Workshop White Paper Identifying Issues	08/01 11/01 TBD	Completed as NUREG/CR-6735 Scheduled 10/31–11/2/01	RES RES RES
Human Factors for Advanced Reactors	Complete White Paper	TBD	New	RES
Knowledge Management	Track EPRI work Develop Work Plan	Continuing TBD	New	RES
Develop Human Factors Tool Kit	Develop Work Plan	TBD	New	RES
Develop Human Factors Familiarization Training	Develop Syllabus	TBD	New	RES

Table 1. Human Performance Program Activities (Cont.)

ACTIVITY	MILESTONE	DATE	STATUS	User Need
Continuing Activities				
Identify Human Factors Issues from Operational Experience Reviews	Ongoing			RES
Cooperation with Other Agencies and Industry	Ongoing		DOE/EPRI NEPO	RES
International Cooperation	Ongoing		Halden Reactor Project CSNI	RES
Consensus Standards Support	Ongoing		IEEE ANS	RES