

April 10, 2000

MEMORANDUM TO: ACRS Members

FROM: **/RA/**  
Noel Dudley, Senior Staff Engineer

SUBJECT: CERTIFICATION OF THE SUMMARY/MINUTES OF THE ACRS  
SUBCOMMITTEE MEETINGS ON HUMAN FACTORS MARCH 15,  
2000, ROCKVILLE, MARYLAND

The minutes of the subject meeting, issued on March 22, 2000, have been certified as the official record of the proceedings of that meeting. A copy of the certified minutes is attached.

Attachment: As stated

cc: Technical Support Branch  
Operations Support Branch (3 copies)

cc via e-mail:  
J. Larkins  
H. Larson  
S. Duraiswamy  
ACRS Fellows and Technical Staff  
Operations Support Branch

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
MINUTES OF ACRS SUBCOMMITTEE MEETINGS ON  
HUMAN FACTORS  
MARCH 15, 2000  
ROCKVILLE, MARYLAND

The ACRS Subcommittee on Human Factors met on March 15, 2000, to hold discussions with representatives of the NRC on the latest revision of the NRC Program on Human Performance and related staff activities. The meeting included presentations concerning SECY-00-0053, "NRC Program on Human Performance in Nuclear Power Plant Safety," results of reports prepared for and by the Office of Nuclear Regulatory Research (RES), and Office of Nuclear Reactor Regulation (NRR) activities. The entire meeting was open to public attendance. Mr. Noel Dudley was the cognizant ACRS staff engineer for this meeting. The meeting was convened at 1:05 p.m. and was adjourned at 5:35 p.m.

**ATTENDEES**

**ACRS**

G. Apostolakis, Chairman  
J. Barton, Member  
M. Bonaca, Member

D. Powers, Member  
J. Sieber, Member  
N. Dudley, ACRS Staff

**NRC REPRESENTATIVES**

J. Rosenthal, RES  
M. Cunningham, RES  
J. Persensky, RES  
I. Schoenfeld, RES  
D. Trimble, NRR

B. Hallbert, INEEL  
D. Gertman, INEEL  
J. O'Hara, BNL  
V. Bier, University of Wisconsin

There was one written comment and no requests for time to make oral statements received from members of the public. One member of the public attended the meeting. A list of meeting attendees is available in the ACRS office files.

**INTRODUCTION**

Dr. Apostolakis, Chairman of the Human Factors Subcommittee, explained that the purpose of the Subcommittee meeting was to review the NRC Program on Human Performance in Nuclear Power Plants, the status of international activities, a quantitative analysis of risk associated with human performance, a safety issues report on economic deregulation, the status of control station review guidance, and planned activities by RES and NRR.

Dr. Apostolakis read a statement prepared by Mr. Barry Quigley, who is a senior reactor operator licensed by the NRC. Mr. Quigley's statement requested that the ACRS consider operator fatigue when discussing the causes of human error.

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Dr. Apostolakis noted that the ACRS last reviewed and commented on the Human Performance Plan in a letter dated February 19, 1999. He stated that the staff would update the Subcommittee members on its latest revision to the plan and asked Mr. Jack Rosenthal, RES, to begin the presentations.

### **STAFF INTRODUCTION** - Mr. Jack Rosenthal, RES

Mr. Jack Rosenthal, RES, outlined the presentations the staff planned to make and provided background concerning the evolution of the Human Performance Plan. He outlined the program described in SECY-00-0053 and provided the basis for the program. Mr. Rosenthal presented the important events, as identified by the Accident Sequence Programs, that occurred between 1992 and 1997. He then summarized the preliminary results of an Idaho Engineering and Environmental Laboratory (INEEL) analysis of these events. Mr. Rosenthal concluded by explaining the integration of the human performance programs with other NRC program activities.

The Subcommittee members and the staff discussed the following issues:

- percentage of human factors research that is in response to user needs requests,
- inconsistencies between probabilistic risk assessments and operating experience,
- use of ATHEANA in conjunction with other human reliability analyses,
- aspects of safety that are not included in equipment reliability determinations, and
- human performance data that could be provided by licensees.

### **QUANTITATIVE ANALYSIS OF RISK ASSOCIATED WITH HUMAN PERFORMANCE** - Messrs. Bruce Hallbert and David Gertman, INEEL

Mr. Bruce Hallbert, INEEL, presented the objective of the analysis. Mr. David Gertman, INEEL, explained the method and approach used in the analysis, and summarized the findings. He stated that most identified human errors were latent errors, which had no immediate observable impact. He presented examples of these latent errors and noted that latent errors are not explicitly modeled in probabilistic risk assessments (PRAs). Mr. Hallbert concluded the presentation by summarizing the following findings:

- the average contribution of human performance to event importance was above 90%,
- most incorrect operator actions occurred during normal and abnormal conditions,
- latent errors figured prominently in significant operating events, and
- the need to understand how less significant errors combine to create significant effects.

The Subcommittee members and the staff discussed the lack of peer review received by the models used in the analysis, the definition of terms used in the equation for human error percent contribution, random occurrences, and variability of crew performance. They also discussed the effects of organizational and safety culture, organizational learning, and leadership on human performance. Dr. Powers, ACRS, stated that there were ramifications to the inspection process, since it does not attempt to identify programmatic failures. Mr. Sieber,

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ACRS, noted that the analysis did not include an assessment of the contribution of fatigue to human performance.

**CONTROL STATION REVIEW GUIDANCE** - Dr. John O'Hara, Brookhaven National Laboratory (BNL)

Dr. John O'Hara, BNL, explained that the objective of his work was to define the technology trends in human-system interfaces, evaluate implications for plant safety, develop human factors evaluation guidance, and propose revisions to NUREG-0700. He described the general findings resulting from his work and a guidance development methodology. Dr. O'Hara presented the results of his analyses of alarm systems, hybrid human-system interfaces, and interface management. He concluded by summarizing the current status of his work and his future plans.

The Subcommittee members, Mr. O'Hara, and the staff discussed the effect of emergent control room display technologies to plant safety and the validity of research data developed at the Halden Project to the operation of U.S. nuclear plants.

**EFFECTS OF DEREGULATION ON SAFETY** - Dr. Vicki Bier, University of Wisconsin-Madison

Dr. Vicki Bier, University of Wisconsin-Madison, evaluated the delegation of the U.S. aviation industry, the U.S. rail industry, and the U.K. electrical industry. She explained that the purpose of the evaluation was to develop a complete list of changes relevant to safety and to emphasize changes with possible negative effects on safety. Dr. Bier described her findings concerning the time scale, overall safety performance, reprioritization of expenditures, safety culture, financial pressures, and downsizing associated with deregulation. She presented the experiences of the associated regulatory organizations and the conditions favorable to safety. Dr. Bier concluded that deregulation is not incompatible with maintaining safety and that the changes associated with deregulation create major challenges to the management of safety.

The Subcommittee members and Dr. Bier discussed the effect of overtime and fatigue on safety, the excessive use of contractors, and equipment availability. The Subcommittee members discussed aspects of the deregulation of the U.S. nuclear industry, such as, stranded costs, the ability to understanding problems with safety culture by trending equipment performance, and recommendations for the NRC.

**UPDATE OF INTERNATIONAL SAFETY CULTURE ACTIVITIES** - Ms. Isabelle Schoenfeld, RES

Ms. Isabelle Schoenfeld, RES, presented the activities of the following international organizations with regard to safety culture:

- OECD Nuclear Energy Agency (NEA),
- NEA Committee on the Safety of Nuclear Installations,
- NEA Committee on Nuclear Regulatory Activities, and the
- International Atomic Energy Agency.

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She explained how each of these organizations are actively involved in monitoring safety culture and developing safety culture guidelines. Ms. Schoenfeld described ongoing safety culture activities in Belgium, Canada, Finland, France, Japan, Spain, Sweden, Switzerland, and the United Kingdoms.

**PLANNED NRR ACTIVITIES IN HUMAN PERFORMANCE** - Messrs. David Trimble and Richard Eckenrode, NRR

Mr. David Trimble, NRR, provided an overview of NRR human factors activities and background on the worker fatigue issue, which is under review by the NRC. Mr. Richard Eckenrode, NRR, presented the NRR staff position concerning how the reactor oversight process will monitor human performance. He stated that the effects of human performance on plant safety will be reflected in the plant performance indicators and baseline inspection findings. Mr. Eckenrode described the supplemental inspection procedure for human performance and the human performance significance determination process.

The Subcommittee members and the staff discussed proposed changes to 10 CFR Part 26, "Fitness for Duty Programs," and the lack of an analysis to support the premise that anything less than complete failure to perform an action may not be as risk-important as complete failure.

**STAFF CONCLUDING REMARKS** - Mr. Jack Rosenthal, RES

Mr. Rosenthal noted that the staff planned to hold a workshop to assimilate the data contained in the reports that were presented to the Subcommittee and to discuss what actions to take with regards to latent human errors. He stated that the staff was not supporting any activities associated with safety culture. Mr. Rosenthal requested a letter from the ACRS concerning the staff's efforts.

**SUBCOMMITTEE COMMENTS, CONCERNS, AND RECOMMENDATIONS**

Dr. Powers identified two concerns. His first concern was related to plant assessments and cross-cutting issues and whether the performance indicators would reveal human performance deficiencies before significant events occurred. He stated that the related NRR staff assumption needed to be validated. Dr. Powers' second concern was related to the treatment of human performance in PRAs. He stated that research was needed to better define human reliability analyses (HRA) and to determine how to incorporate the HRA results in PRAs so that more accurate predictions could be made. Dr. Powers suggested preparing a letter that would be supportive of the RES efforts.

Dr. Mario Bonaca supported writing a letter. He stated that the NRC Program on Human Performance should address the right human factors elements and identify correct applications. He noted that the results of the INEEL report should be presented at the April 2000 ACRS meeting. He suggested that the ACRS letter include a discussion of human reliability without referring to safety culture. Dr. Bonaca suggested that a database of human performance problems be created from the finding of licensees' root-cause analyses.

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Mr. Sieber recommended that the presentation made by Mr. Rosenthal be summarized at the April 2000 ACRS meeting. He noted that the NRC has responsibility for protecting the public health and safety but has done little to evaluate and regulate human performance, which is a major contributor to significant events. Mr. Sieber stated that the NRC should develop a database of human performance that could be used to quantify human performance in PRAs. He noted that research tools are needed to make progress in quantifying human performance. Mr. Sieber supported the staff in continuing its human factors activities.

Mr. John Barton stated that the staff's oversight and significance determination processes should include planned activities to assess human performance. He recommended preparing a letter that stressed the need for research to evaluate safety culture issues.

Dr. Apostolakis provided the staff detailed comments on its Program on Human Performance and summarized the Subcommittee's discussion. He stated that neglecting safety culture in the oversight program was a major lapse but that safety culture would not be addressed in the proposed ACRS letter. He suggested the letter be supportive of the staff's activities, focus on the quality of the staff's Program on Human Performance, and provide recommendations for improvement.

#### **STAFF AND INDUSTRY COMMITMENTS**

The staff agreed to provide the ACRS with a copy of a case study done by Dr. Heshlinger.  
[Provided , 2000]

#### **SUBCOMMITTEE DECISIONS**

The Subcommittee requested that the staff make a presentation at the April 5-7, 2000 ACRS meeting concerning the NRC Program on Human Performance and the use of human performance inspections in the plant oversight process. The Subcommittee recommended that the Committee prepare a letter on this matter.

#### **FOLLOW-UP ACTIONS**

No follow-up actions were identified.

#### **PRESENTATION SLIDES AND HANDOUTS PROVIDED DURING THE MEETING**

The presentation slides and handouts used during the meeting are available in the ACRS office files or as attachments to the transcript.

**BACKGROUND MATERIAL PROVIDED TO THE SUBCOMMITTEE:**

1. Letter dated February 19, 1999, from Dana A. Powers, Chairman, ACRS, to William D. Travers, Executive Director for Operations, NRC, Subject: SECY-98-244, "NRC Human Performance Plan."
2. U.S. Nuclear Regulatory Commission SECY-00-0053, "NRC Program on Human Performance in Nuclear Power Plant Safety," dated February 29, 2000.
3. Memorandum dated March 6, 2000, from Jack E. Rosenthal, Office of Nuclear Regulatory Research, to John T. Larkins, Executive Director, ACRS, Subject: Meeting with the ACRS Human Factors Subcommittee, March 15, 2000, on SECY-00-0053, "NRC Program on Human Performance in Nuclear Power Plant Safety."
4. U.S. Nuclear Regulatory Commission Report, "Accident Sequence Precursor (ASP) Qualitative Analyses," received March 6, 2000.
5. U.S. Nuclear Regulatory Commission Report, "Human Performance Programs at Other Agencies," received March 6, 2000.
6. O'Hara, John M., and Higgins, James C., "Risk Importance of Human Performance to Plant Safety," Brookhaven National Laboratory Report W6546-T1-2-10/99, transmitted by letter, February 28, 2000.
7. Hallbert, Bruce, et. al., "Summary of INEEL Findings on Human Performance During Operating Events," Idaho National Engineering and Environmental Laboratory Report No. CCN 00-005421, transmitted by letter, February 29, 2000.

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NOTE: Additional details of this meeting can be obtained from a transcript of this meeting available in the NRC Public Document Room, 2120 L Street, N.W., Washington, D.C. 20006, (202) 634-3274, or can be purchased from Ann Riley & Associates, LTD., 1025 Connecticut Ave., NW, Suite 1041, Washington, D.C. 20036, (202) 842-0034.

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