

October 14, 2003

MEMORANDUM TO: John H. Flack, Chief  
Regulatory Effectiveness Assessment and Human Factors Branch  
Division of Systems Analysis and Regulatory Effectiveness  
Office of Nuclear Regulatory Research

FROM: Shana R. Browde, Reactor Systems Engineer */RA/*  
Regulatory Effectiveness Assessment and Human Factors Branch  
Division of Systems Analysis and Regulatory Effectiveness  
Office of Nuclear Regulatory Research

SUBJECT: TRIP REPORT FOR PARTICIPATION IN OECD-HRP SUMMER  
SCHOOL ON DESIGN AND EVALUATION OF HUMAN SYSTEM  
INTERFACES (HSIs) AND THE WORKSHOP ON INNOVATIVE HUMAN  
SYSTEM INTERFACES AND THEIR EVALUATION,  
HALDEN, NORWAY

Attached is a summary trip report for my travel to Norway from August 25, 2003, to September 2, 2003, to participate in the OECD-HRP Summer School on Design and Evaluation of Human-System Interfaces (HSIs) and the Workshop Meeting on "Innovative Human-System Interfaces and their Evaluation." I also had the opportunity to meet with Halden staff to plan future activities for an extended visit to observe and analyze experiments in early 2004.

No Actions by the Commission are recommended as a result of this trip.

Attachments: As stated

cc w/att:

W. Dean, AO

J. Dunn Lee, OIP

T. Rothschild, OGC

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## **NRC INTERNATIONAL TRIP REPORT**

**Subject:** TRIP REPORT FOR PARTICIPATION IN OECD-HRP SUMMER SCHOOL ON DESIGN AND EVALUATION OF HUMAN SYSTEM INTERFACES (HSIs) AND THE WORKSHOP ON INNOVATIVE HUMAN SYSTEM INTERFACES AND THEIR EVALUATION

**Dates of Travel, Country and Organizations Visited:** August 25 - September 2, 2003, Norway, OECD Halden Reactor Project at the Institute for Energy Technology

**Author, Title, and Agency Affiliation:** Shana R. Browde, Reactor Systems Engineer, REAHFB, Office of Nuclear Regulatory Research

**Sensitivity:** Not applicable.

**Background/Purpose:** The OECD Halden Reactor Project (HRP) conducts an annual Summer School that provides an opportunity to educate participants from any of the 18 HRP member countries on specific areas of HRP research. The August 25 - 29, 2003 Summer School was intended for scientists, engineers and technicians working in process industries (such as nuclear), engineering companies, research institutes and universities, with problems related to Human-System Interfaces design and evaluation. The Summer School provided an overview of and insight into the different steps in design, development and evaluation of HSIs, and in the human factors principles, standards and guidelines which should be followed in this process. Additionally, the Summer School aimed to transfer knowledge to the "young generation". The Summer School was attended by individuals from 13 HRP member countries, including the U. S.A.

A Workshop Meeting on Innovative Human-System Interfaces and their Evaluation, held September 1-2, 2003, gave HRP member countries an opportunity to provide direction to the HRP staff on current research activities. The Workshop consisted of expert presentations followed by group discussions on the work presented. Individuals from 7 countries participated in the workshop, including the U.S.A.

**Abstract: Summary of Pertinent Points/Issues:** The Summer School was a beneficial learning experience, one that served not only to provide an overview of the basic concepts involved with design and evaluation of Human-System Interfaces (HSIs), but also provided a deeper look at the research being performed at the HRP facilities.

The Workshop, while it had rather low attendance from HRP member countries, was an excellent knowledge-sharing opportunity. More importantly, it is a conduit for member input into HRP research as it progresses through the current program period. A concerted effort should be made in the future to take advantage of opportunities such as this workshop, so that the NRC can ensure that the HRP products better suit agency needs.

In addition to the Summer School and Workshop, I had discussions with HRP staff planning my activities during an upcoming extended visit to the HRP facilities.

**Discussion:**

*OECD - HRP Summer School on Design and Evaluation of Human-System Interfaces (HSIs)  
(August 25 - 29, 2003)*

The Summer School was intended for scientists, engineers, and technicians working in process industries such as nuclear, engineering companies, research institutes, and universities, with problems related to HSI design and evaluation. The Summer School provided insight into the different steps in design, development and evaluation of HSIs, and in the human factors principles, standards, and guidelines to be followed in this process. The Summer School focused on the following topics:

- Safety Issues and Research Needs in the Human Factors Area/ The OECD Nuclear Energy Agency Programs and Priorities.
- Overview of the OECD HRP Project Programs in the Safety-MTO Area
- Overview of Different Types of Control Rooms and their Human System Interface (HSI) Solutions
- Overview of Standards and Guidelines
- Design and Evaluation
- Evaluation Methods and Tools
- Workstation and Display, Lay-out and Contents
- User Interaction
- Technical Tour of the Halden Project Experimental Facilities
- Alarm Systems
- Human-System Interfaces, Types and Principles
- Integrated, Unified HSI Solutions

*Planning discussion with Halden staff (August 29, 2003)*

I had discussions with Halden staff planning my activities during an upcoming extended visit to the Halden facilities. It was decided that I spend 2 to 3 weeks observing the Task Complexity experiments and assisting with data collection, and then 3 to 4 weeks assisting with experimental data analysis. Objectives for the trip were defined to be: (1) to learn more about

how data is collected at the HRP facilities, (2) facilitate better NRC use of HRP products, (3) Improve the NRC's database of Human Reliability Analysis data, (4) contribute to the HRP Work Report discussing the experiments and their results. Plans were made for future phone conferences regarding planning specific tasks during the trip.

#### *Workshop Meeting on Innovative Human-System Interfaces and their Evaluation*

A Workshop Meeting on Innovative Human-System Interfaces and their Evaluation, held September 1-2, 2003, gave HRP member countries an opportunity to provide direction to the HRP staff on current research activities. The Workshop consisted of expert presentations followed by group discussions on the work presented. 7 countries participated in the workshop, including the U.S.A. The workshop topics included:

- The Function-Oriented Concept
- Integration of Ecological Approach into a NPP Control Room and Its Empirical Evaluation
- Design and First Evaluation of a Prototype of Function-based NPP Display Dedicated to Shift Supervisors
- HRP Work on Ecological Displays
- HRP Work on Function-Oriented Displays
- HRP Work on Task-Based Displays
- Innovative HSIs for Petroleum
- Key Features of Dukovany NPP Modernization
- Demonstrations in HAMMLAB
- Innovation vs. Guidelines
- Human-Centered Validation
- Criteria-based Integrated System Validation
- Control Room V&V - The Oskarshamn Case

**Pending Actions/Planned Next Steps for NRC:** Phone conferences between RES/DSARE/REAHFB and HRP staff will be necessary to plan specific tasks during my anticipated rotation to the HRP facilities.

**Points for Commission Consideration or Items of Interest:** No action is required by the Commission.

**Attachments:** None.

**“On the Margins”:** The Halden Boiling Water Reactor (HBWR) is the main research facility for the HRP. The reactor is a 25 MW heavy water cooled and moderated research reactor which is operated for testing nuclear fuel and materials to study safety related matters and operational performance. The reactor is owned and operated by Institute for Energy Technology (IFE). Every third year the authorities (The Directorate for Fire and Explosion Prevention) and Det Norske Veritas (DNV) inspect the reactor vessel and the primary system to ensure the reactor meets governmental requirements.

The most recent inspection revealed a crack in the primary circuit of the reactor that exceeds the American nuclear standard ASME XI acceptance criterion. The crack, located in the subcooler line from the bottom of the reactor vessel to the first isolation valve, is not penetrating and would still take many thousands of hours under operating conditions to reach the outer surface. DNV also emphasized that such a development would only lead to drops of leakage and not a break. Similar cracks, known as Stress Corrosion Cracking, occur in BWRs and proven repair methods are available. IFE is working with the Norwegian directorate for fire and electrical safety and the Norwegian radiation protection authority prior to restarting the reactor, and is working with Westinghouse to repair the crack. HRP expects that the reactor will be fully functional after the repair and restart, and will resume its research activities.

Please contact Shana Browde, (301) 415-7652, for any additional information regarding this trip.