Data Collection for Human Reliability Analysis

RES/DRA

Consistent with the Commission's policy statements on the use of probabilistic risk assessment (PRA) and for achieving an appropriate PRA quality for NRC risk-informed regulatory decision-making, the NRC has ongoing activities to improve the quality of human reliability analysis (HRA). The adequacy of data available for HRA is a concern on the credibility and consistency of human error probability estimates. To address this need, NRC's Office of Research (RES) is developing, with the support of the Idaho National Laboratory, the Human Event Repository and Analysis (HERA) system which was developed aiming to provide empirical evidence in support of qualitative and quantitative implications of HRA. The development and use of the HERA is a key component of the NRC's efforts to improve HRA and has been recommended by the ACRS in its response to the commission's SRM on HRA models (M061020 and M090204B). The ACRS, in its letter to the Commission (ML071140297), states: "Additional evidence should be collected from operating experience, especially the Augmented Inspection Team reports on past incidents. The staff is already evaluating the operating experience in the Human Event Repository and Analysis System (NUREG/CR-6903). These sources of information should be used to enhance the insights gained from the Empirical Study." This activity is included as an item in the "Action Plan—Stabilizing the PRA Quality Expectation and Requirements," Appendix to SECY-04-0118 and SECY-07-0042, and is been pursued through collaboration with NRC, national, and international experts.

The data base of the NRC widely used SPAR-H method relies on the THERP method whose data base were mostly collected in the 70s and early 80s. The industry widely used HRA methods such as HCR/ORE and CBDT whose database were collected in early 80s. In the past three decades, changes to the plant operation (e.g., procedures, training, regulation, and others) may have significantly affected human performance and altered the contributors to human reliability. Without using more recent human performance data, the quality of risk-informed decision may be affected. The HRA data project is to collect and analyze the up-to-date human performance information for the quality of HRA which is an important element of risk-informed decision making.

Current HRA data efforts focus on two objectives: improving knowledge in operators' behavior responding to plant malfunctions and informing the estimations of human error probabilities (HEPs). To effectively achieve these two objectives, the approach is to understand the HRA applications (e.g., HRA in the significance determination process (SDP)) and explore the available data sources then to develop a method (or methods) to bridge the gap between HRA applications and data sources.

The HERA project manager did a 3.5 months rotation to the PRA Support Branch of the Office of Nuclear Reactor Regulation (NRR) to have hands on experience on HRA in the SDP. The SDP is a focused HRA application. The exploration of potentially available data sources are focusing on operating experience, licensed operator requalification exams, licensed operators simulator training, and data used for developing HRA methods.

To improve knowledge in operator behavior in responding to plant malfunctions, the operating experience documented in the augmented inspection reports has been the focus. Current efforts are to improve the format of event timeline with the vision that the event timeline would be used by NRC event inspectors (e.g., in special inspections, augmented inspections, and incident inspections) to guide the inspectors in the collection and documentation of the human performance information. From the user perspective, the new event timeline provides a format that human performance issues and insights can be easily grasped by the readers.

To inform HEP estimates, the short term (in five years) objective is to provide HEPs for a number of human failure events with empirical data support and sufficient contextual information as reference HEPs for tuning HRA methods. The long term objective is to have all HEP estimates having strong empirical data supports. All four data sources mentioned above are potential data sources. The operating experience used for developing the NUREG/CR-6890 "reevaluation of station blackout risk at nuclear power plants" could provide some HEP indications. This requires analysis of the raw data to separate human performance from hardware performance in these events. There may be similar information in other programs (e.g., in the accident sequence precursor (ASP) program) that can be used for the same purpose. Regarding the operator requalification exam data, the Office of Regulatory Research (RES) plans to work with NRR and Region Offices to obtain and analyze the exam results. Regarding the licensed operator simulator training data, RES is negotiating with a NRC licensee to sign an MOU to collect the licensee's simulator training data. Regarding the data used in developing HRA method, current exploration is on the CORE-DATA database which was used to develop the NARA (Nuclear Action Reliability Assessment) HRA method. A method is planned to be developed to integrate human performance data of various formats to provide empirical indications for HEP values.

The international efforts are particularly working with those led by the Organization for Economic Co-Operation and Development (OECD) through the Nuclear Energy Agency (NEA)/Committee on the Safety of Nuclear Installations (CSNI)/Working Group Risk (WGRisk) and the Halden Reactor Project. The WGRisk promotes exchange of simulator data among its member organizations. RES supports the efforts.

Selected Major Milestones and Schedules				
Major Milestones	**Original Target Date**	**Revised Date**	**Completion Date**	**NRC Responsibility**
Established a memorandum of understanding with a NRC licensee to collect the licensee's licensed operators simulator training data	February 2011			RES/DRA
Developed and implemented a data collection tool for simulator training data collection	August 2011			RES/DRA
Analyzed operator requalification exam results	August 2011			RES/DRA
Complete NRC inspectors review on the event timeline	January 2011			RES/DRA
Develop a method that can aggregate data of various data sources to inform HEP estimates	June 2012			RES/DRA
Letter report on the use of operating experience to inform HEP estimates	January 2012			RES/DRA
A NUREG report on empirical data for HEP estimates	December 2012			RES/DRA