Develop Improved Methods for Calculating Risk in Support of Risk-Informed Regulatory Decision-Making

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, RES is developing, with the support of the Idaho National Laboratory, the Human Event Repository and Analysis (HERA) system was developed 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). 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 it is been pursued through collaboration with NRC, national, and international experts.

The objective of HERA is to make available empirical and experimental human performance data, from commercial nuclear power plants (NPPs), in a content and format suitable to HRA. The development of HERA has three aspects: (a) develop a data taxonomy for collecting information on human performance during abnormal conditions suitable for HRA, (b) populate HERA with information from real and simulated events, and (c) develop mathematical structures and tools enabling the use of HERA to inform HRA. The staff published NUREG/CR-6903, Vol. 1, "Human Event Repository and Analysis (HERA) System, Overview," July 2006 (ML062700593). This Volume discusses the need for a systematic collection of human performance data on the basis of current regulatory HRA and human factors needs, describes the taxonomy and structure of the data in HERA, and presents examples of information extraction and coding from NPP operational and simulator experience. The staff also developed Volume 2, "Human Event Repository and Analysis (HERA): The HERA Coding Manual and Quality Assurance," November 2007 (ML073130034). Volume 2 describes an effective process for event coding and quality control as well as an updated/refined data taxonomy. In parallel, HERA is being populated with human events from selected operational occurrences and from simulator experiments. Furthermore, a piece of software is being developed aiming at improving the HERA coding process, providing a user friendly capability, and communicating safety insights regarding human performance in NPPs.

Human events from operational experience coded into HERA on the basis of considerations such as the risk significance of the event, the richness of information available, and its relevancy to PRA. Simulated events currently loaded into HERA are those generated through the simulator experiments of Halden Reactor Project. A MOU between NRC and a utilities group (i.e., the STARS utilities alliance) has been established for collecting human performance information from the utilities' corrective action events.

The HERA related activities can be classified into four areas: data taxonomy, data collection, use of data, and tool. The data taxonomy is to specify the data need to be collected in order to inform HRA with balance of data needs and data availability. The data collection is expand the event sources to expand the HERA database. The use of data refers to using different data

analysis technologies to obtain human performance insights to inform HRA. The tool is the HERA database software to perform above three types of activities.

The efforts on data taxonomy currently are improving the taxonomy to ensure data quality and usability. The efforts on use of data are exploring suitability of various data analysis technologies in use of HERA data to inform HRA. The efforts on tool are to streamline the process and be user friendly. The data collection efforts interface with domestic and international organizations. Beside the MOU with the STARS utilities alliance, another MOU is developing to work with the South Texas Project Nuclear Operation Company (STPNOC) to use its crew and simulator to collect data into HERA. 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.

Project Considerations: The development of a data repository suitable for HRA is a step towards addressing some important unresolved issues in HRA. Beyond its primary objective of providing quality data to inform HRA, HERA also aims to provide a means of obtaining an objective measure on human error probabilities (HEPs). Currently the many HRA quantification methods generate different HEP estimates for the same human actions. A primary reason for the differences is that different methods consider different aspects of human performance and require significant amount of subjective judgment on HEP estimations. Developing a data repository system that loaded with empirical data of human performance will allow benchmarking the results of HRA methods, and the next step, a less subjective judgment approach to produce consistent and credible HEP estimates can be achieved.

Selected Major Milestones and Schedules				
Major Milestones	**Original Target Date**	**Revised Date**	**Completion Date**	**NRC Responsibility**
Established a memorandum of agreement with the Strategic Teaming And Resource Sharing (STARS) utilities group on collecting human performance information		August 2008	August 2008	RES/DRA
Workshop on commenting HERA software (All)		September 2008		RES/DRA
HERA User's group training		August 2008		RES/DRA
Publish NUREG/CR-6903, Vol.3 HERA user's manual		November 2009		RES/DRA
Publish NUREG/CR-6903, Vol. 4 HERA programmer's manual		November 2009		RES/DRA
Publish NUREG/CR-6903, Vol. 5 human performance insights gained through HERA		November 2009		RES/DRA
Submit a journal paper on HERA		January 2010		RES/DRA
MOU with the South Texas Project Nuclear operation company on simulator data collection		November 2010		RES/DRA