HRA Data Workshop Summary

- The Ongoing and Planned Activities

At the U.S. Nuclear Regulatory Commission, Rockville Maryland

March 14 – 15, 2019

Data Collection

- EPRI - To address dependency
- KAERI – Meeting with UJV in July 2019 on simulator data collaboration
- Halden simulator experiments in 2019 to study the differences between missing and misleading information using SBO scenario with two crews
- Halden conduction of operation – this fall – two crews
- KAERI- APER1400 data collection finish in 2019 – summarize HEPs, analyzing PIFs effects in 2019
- NRC – continue SACADA data collection in STP and Vogtle 3&4. Work with Halden to collect SBO data.
- INL – conduct microworld studies, use students for the studies
- UMD – Develop the common terminology
- UMD/HRASociety - Survey data collection activities – UMD & HRAS
- CRIEPI – exploring data collection tools with interaction with Japanese nuclear industry

Data Analysis

- NRC - IDHEA-G (multiple data sources, see slide 5 for details)
- NRC - IDHEAS-ECA use SACADA data to tune numbers
- KAERI – 2019 basic HEPs, PSF effect, and error recovery
- UMD –hybrid model – methodology developed 2019 – looking for data and potential users' interest
- UMD – developing methodology on HFE and PSF dependency, start with definitions
- EPRI - form a WG on digital I&C – safety, maybe include security

Data Applications/Sharing

- NRC - SACADA – plans to make context and performance statistics available to the HRA community
- KAERI – time of operator action, HEP, PSF effects (proprietary) – KHNP
- NRC – FLEX expert elicitation results comparison with IDHEAS-ECA, plan to perform by May 2019
- Halden performance repository – make Halden research results more easier to find and available to support HRA – first test version available in 2019

IDHEAS-G (Dr. Jing Xing, NRC)

The NRC developed IDHEAS General Methodology (IDHEAS-G) and the report (NUREG-2198) is expected to be published in 2019. NRC staff also plans to publish two Research Information Letter (RIL) reports to document the cognitive basis we used for two assumptions in IDHEAS-G HEP Quantification Model as described in the following

Assumption 1: Base PIFs and base HEPs

Some performance influencing factors may affect human error probabilities significantly more than other factors do. Through our extensive literature study, we found that three PIFs, *Information reliability*, *Cognitive complexity*, and *Scenario familiarity*, can result in a human error probability that varies from a minimal value to 1. We refer these PIFs as to base PIFs. The HEPs at various states of these base PIFs are referred to as base HEPs, which can vary from a minimum value to 1. Moreover, our literature study suggests that the effect of the base PIFs on human error rates generally follows a logarithmic function. The rest of IDHEAS-G PIFs are referred to as Modification PIFs. The data in the literature shows that they typically modify base HEP values with a weight factor.

Assumption 2: Linear combination of PIF effects

At present, there is no adequate data allowing calculation of the HEPs of all CFMs for any given combination of PIF states, nor has cognitive research clearly elucidated the mathematic relation between PIFs and HEPs. We performed a limited meta-data analysis on experimental studies in which human error rates (i.e., the percent of human errors) were measured with several PIFs varying independently and jointly. We found that the human error data fitted better to the simplest additive linear combination than to multiplicative combination of individual PIF effects, e.g., $P_{combined}$ = BP x (w1 + W2 + W3 …), where ***BP*** is the base HEP for a failure mode, ***Wi*** is the percent of increment in error rates when a PIF varies from its base state to a poor state.