The views expressed herein are those of the author(s) and do not represent official positions of the U.S. Nuclear Regulatory Commission.

Uses of FLEX Equipment

- Beyond Design Basis Accidents
- Plant Flexibility
Challenge Using Current Methods for FLEX

- Limitations of current methods
  - Mostly designed for and based on data for control room actions
- HRA is needed for various scenarios and environments
  - Actions performed outside the control room
  - Low Power/Shutdown Actions
  - Level 2/3 Probabilistic Risk Analysis (PRA) actions

NRC’s HRA Needs for Crediting FLEX

- Support risk assessments
  - Significance Determination Process, Notices of Enforcement
  - Discretion, licensing, incident investigation
- Update SPAR models
  - Using FLEX to support Level 1/2/3 PRAs
- User-friendly
  - In order to support quick-turnaround assessments

Plan to Address Challenges in Crediting FLEX

- Ultimate goal - Develop a user-friendly Human Reliability Analysis (HRA) approach for FLEX actions
1) Data Evaluation
  - Use current plant field work data to generate surrogates for similar FLEX decisions/actions
  - Need volunteer plants to provide data
2) Expert Elicitation
  - Expert elicitation to look at common FLEX decisions/actions
3) Develop Advanced SPAR-H Capability
  - Use IDHEAS-ECA as basis for developing a user-friendly HRA method
Data Sources

- Surrogate industry data – i.e. firefighting, military, etc.
- Nuclear industry FLEX actions
- Nuclear industry field work data
- NRC’s Scenario Authoring Characterization and Debriefing Application (SACADA) database – expanding to capture Job Performance Measures

Expert Elicitation

Used to
- Identify important FLEX actions
- Identify unique performance shaping factors
- Evaluate the contribution of the performance shaping factors on the total Human Error Probability (HEP)
- Quantify HEPs of FLEX
  - Plant flexibility
  - Beyond design basis scenarios

IDHEAS - ECA

- Supports HRA in Event and Condition Assessment
- Qualitative Analysis
  - Identify boundary conditions under the specific event and condition.
  - Major tools are Crew Response Trees and Human Fault Trees
- Quantitative Analysis
  - HEP includes Cognition Error Probability (HEPc) and Time Uncertainty Error Probability (HEPu).
  - HEPc includes Information Detection, Diagnosis, Decision, and Execution Errors.
  - HEPu is the probability of the human action failed due to the Uncertainty of the Time Required to perform the specific action.
SPAR Model Updates

- HRA improvements are used in conjunction with NRC SPAR models
- PWR Pilot Model
  - Created
  - Modeling process and challenges - documented.
- BWR pilot model
  - In process
- Additional models are expected to be created as resources allow.

Path Forward

- Develop and document NRC approach
  - Supported by the Office of Nuclear Regulatory Research
  - To be used in NRC’s risk-informed decision making processes
- Engage industry on their approach
  - Communicate any concerns
  - Continue to hold public meetings to discuss concerns (as necessary)

Schedule

- Data Analysis - Ongoing
- Expert Elicitation – Summer 2018
- IDHEAS-ECA – Summer 2018
- SPAR Updates - Ongoing
Questions?

If you have further questions, please email:
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