How Do You Define a Human Reliability Analysis Expert?

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Background

- Historically, human reliability analysis (HRA) is understood to be an important contributor to safety assessments
- The importance of quality HRA/PRA has been recognized, especially, in recent years, in order to support risk-informed regulation, new applications of HRA/PRA, etc.
- Along with the HRA methods and guidance being used, the analyst who applies these tools also is important:
  - HRA expert?
  - HRA analyst/practitioner?
  - HRA developer?
- The history of HRA/PRA and current needs can help define an “HRA expert”

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Historical Perspectives

- The Reactor Safety Study, or WASH-1400 is the 1st NPP PRA—THERP was developed for this study
- TMI resulted in an increased focus to address human performance in NPPs
- The late 80s and the 90s are characterized by tremendous PRA/HRA activities:
  - Development of methods to address PRA issues, computer codes, equipment failure data
  - Performance of industry-initiated PRAs and studies in response to NRC's IPE Program

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Historical Perspectives (cont.)

- Development activities included many new HRA methods, e.g., SLIM, FLIM, ASEP, HCR, HCR/ORE
- Development continued into 2000s (e.g., ATHEANA, CBDT, SPAR-H, EPRI's HRA Calculator), but seemed to driven in two different directions
  1. Develop methods that incorporate improved understanding of human performance in accidents
  2. Develop simplified methods to reduce the efforts needed to perform an HRA
- The first type of methods identified the interdisciplinary nature of HRA
  - Competency in the understanding of human performance
  - Competency in understanding in scenario impact on human failure
- Simplified methods seems to have created a "wrong expectation"
  - HRA can be performed by just following the steps of a method
  - HRA can be done by using available THERP tables

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Historical Perspectives

- The NRC's PRA Policy Statement, 1995 created a new era for the use of PRA, i.e., risk-informed regulation
- How to use PRA and how to incorporate its results in decision making, given the quality of a PRA became a focus and gave rise to many initiatives NRC and industry, e.g.,
  - RG 1.174
  - NEI PRA review guidance
  - ASME/ANS Standards
  - RG 1.200

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NRC Efforts to Improve HRA

- Development of guidance:
  - NUREG-1792, *HRA Good Practices*
  - NUREG-1842, *Evaluation of HRA Methods Against the Practices*
- Support to the International HRA Empirical Study—a multinational and multi-team effort to "benchmark" HRA methods on the basis of simulator experiments performed at the OECD Halden Reactor Project
- Address SRM-M06020 to address HRA model differences:
  - Should NRC adopt a single model for all HRA applications?
  - Or, should NRC adopt more than one— *and to provide explicit guidance on the applicability and implementation of each model?*

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NRC Efforts to Improve HRA (cont.)

- However, results and feedback from the IPE program, the International Benchmarking effort, and other work has shown that:
  - Improved guidance alone cannot assure that a quality HRA will be performed.
  - Two additional, important ingredients are:
    - The need for HRA to be performed by interdisciplinary teams.
    - The need for HRA experience in performing the analysis

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Who is an HRA Expert?

- We believe that an "HRA expert" is a person that has developed an in-depth understanding of the equipment performance and human performance aspects as well as the modeling needs in these areas.
- An HRA analyst or practitioner, however, is a person who can perform HRA using one or more methods.
- This distinction can help focus the discussion on what it takes to be an HRA practitioner, rather than expert.
- Of course, we need both:
  - experts who can lead the field in addressing existing and emerging needs,
  - practitioners who have the capability to appropriately perform an HRA or gather the right experts to perform it.
- HRA expert also is a practitioner—
  - However, correct characterization of people's roles may help addressing some of the confusion that exists when it comes to the HRA field.

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Who is an HRA Expert?

- An HRA expert, may not need to have a degree in the behavioral sciences, if he/she has an engineering degree as well as competence in PRA.
  - An HRA expert should have developed an understanding of human performance issues related to accident conditions.
- HRA expert may not need to be an engineer, if
  - He/she has developed an understanding of how important is to carefully take into consideration the particular plant conditions and equipment performance aspects pertaining to the human failure event being analyzed.
- Bottom line: The HRA expert should be able to identify and integrate the expertise and capabilities of other experts (e.g., engineering, plant operations, and thermal hydraulics) into the analysis.

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The Challenge for the Future

- In the coming years, there are many potential applications of HRA/PRA,
  - HRA/PRA capability is such areas as fire, low power and shutdown, seismic events, and accident management.
  - support for upgrades to the existing fleet of NPPs
  - new and advanced reactors
- These anticipated HRA/PRA applications have elevated the need for the NRC and industry to develop HRA capability and help to advance the discipline of HRA
- While continuing NRC research (alone and in collaboration with industry or international partners) provides support to both of these needs, further steps appear necessary

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The Challenge for the Future (cont.) – Further Steps?

- As recommended by the "Good Practices" and as evident by the International HRA Empirical Study,
  - it should be recognized that HRA should be performed by "experts."
  - the discipline of HRA should be explicitly recognized as a important element of any risk-informed organization
- Up-to-date HRA/PRA curricula, including material related to all aspects of HRA
- Serious thought should be given to development of a professional society for HRA