PAUL SCHERRER INSTITUT

Quantifying the Human Factor – Time for a change

Vinh N. Dang

Risk and Human Reliability

Laboratory for Energy Systems Analysis

Paul Scherrer Institut, Switzerland

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Quantifying the human factor

Quantifying the human element

Human Reliability Analysis

Quantifying the human factor

Quantifying the human element

Human Reliability Analysis (HRA)

identification of human-related failure events

estimation of their failure probabilities

The human factor in accidents

The human contribution to risk

The human contribution to system safety

1.

"There is too much expert judgment involved"

"There are too many methods"

Once upon a time...

Change #1

The expectations and desire for a simple, cheap, and fast way to get a solution need to change.

So, what does the solution look like?

It does not look like： one method...

It could look like:

for each need, one method

and one method to rule them all

The method to rule them all ...
is an overall HRA methodology

Like PRA,

- it typically starts with scoping / screening,
- it prioritizes on the basis of risk significance, and
- the significant human failure events are analyzed in detail

A method for each need, but needs are not arbitrary. There is a hierarchy of needs.

If safety is being managed, there is an evolution of the safety level.

The safety level and the PSA application determine the needs.

Unrealistic needs: There are some human-system issues for which a probabilistic approach, meaning the application of HRA, is not the first choice.

- Ergonomic shortcomings
- Reliable normal operation, which allows you to focus on potential accidents
- Necessary (minimum) conditions for responding to upset events are met
- Management of decision-related errors and alternative responses – *errors of commission*

Change #2

- Realize that the HRA in a PRA has to evolve in tandem with the safety level

- Methods appropriate for one level of safety will probably not satisfy the needs of the next higher level.

Changes #1 and #2

relate to the boundary conditions for the HRA community with regard to **expectations, schedule, and resources.** These are set by:

- regulators
- utilities
- international PSA community, PSA managers, teams and reviewers

Change #3

is about the developments and progress in HRA.

A time of changes for HRA

3.1 A renewed emphasis on data

- Systematic incorporation of data from the literature
  - CORE-DATA and the NARA and CARA methods
- Analysis of operating experience data + for HRA
  - NRC's HERA data collection
  - GRS
- Measurement of performance of safety culture interventions (A. Hale)
- HRA Empirical Study

3.2 Joint international activity

- **Int. HRA Empirical Study**
  - OECD Halden Joint programme
  - NRC, PSI, EDF, Scientech/EPRI
  - Sandia, INL, NRI, EDF, Vattenfall & Ringhals, IRNS, VTT, KAERI
  - 14 licensed crews from one utility, four scenarios, simulator study
  - assessment of methods by comparing HRA results with simulator data

- Nuclear Energy Agency **(NEA) initiative on HRA data collection in simulators**
  - driven by CSNI Working Groups on Risk Assessment (WGRisk) and on Human and Organizational Factors (WGHOF)
  - planning for **2009 workshop**

3.3 Newer methods coming into HRA Practice

- EDF has updated 3 PSAs with MERMOS HRA method.
- NARA, with its data pedigree, coming soon into practice
- other, more limited efforts

3.4 Simulation models of operator-system dynamic interactions (dynamic event tree)

- UMD/PSI's ADS-IDAC, K. Coyne diss.
- Peschke and Kloos, GRS
- Sandia-OSU ADAPT

Summary

Change #1

There are no shortcuts to solving the complex problem we call the human factor in risk.

Change #2

There is a hierarchy of needs, for which different methods are appropriate.

Change #3

Substantial progress on HRA has been made. Data enables better assessments of existing methods as well as essential improvements and developments.