

International HRA Developments & Applications

May 29, 2014

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Overview of presentation

- Applied HRA in the UK nuclear industry
 - My experience from working for British Energy/EDF Energy
- Applied HRA method research in Norway
- HRA developments at Halden

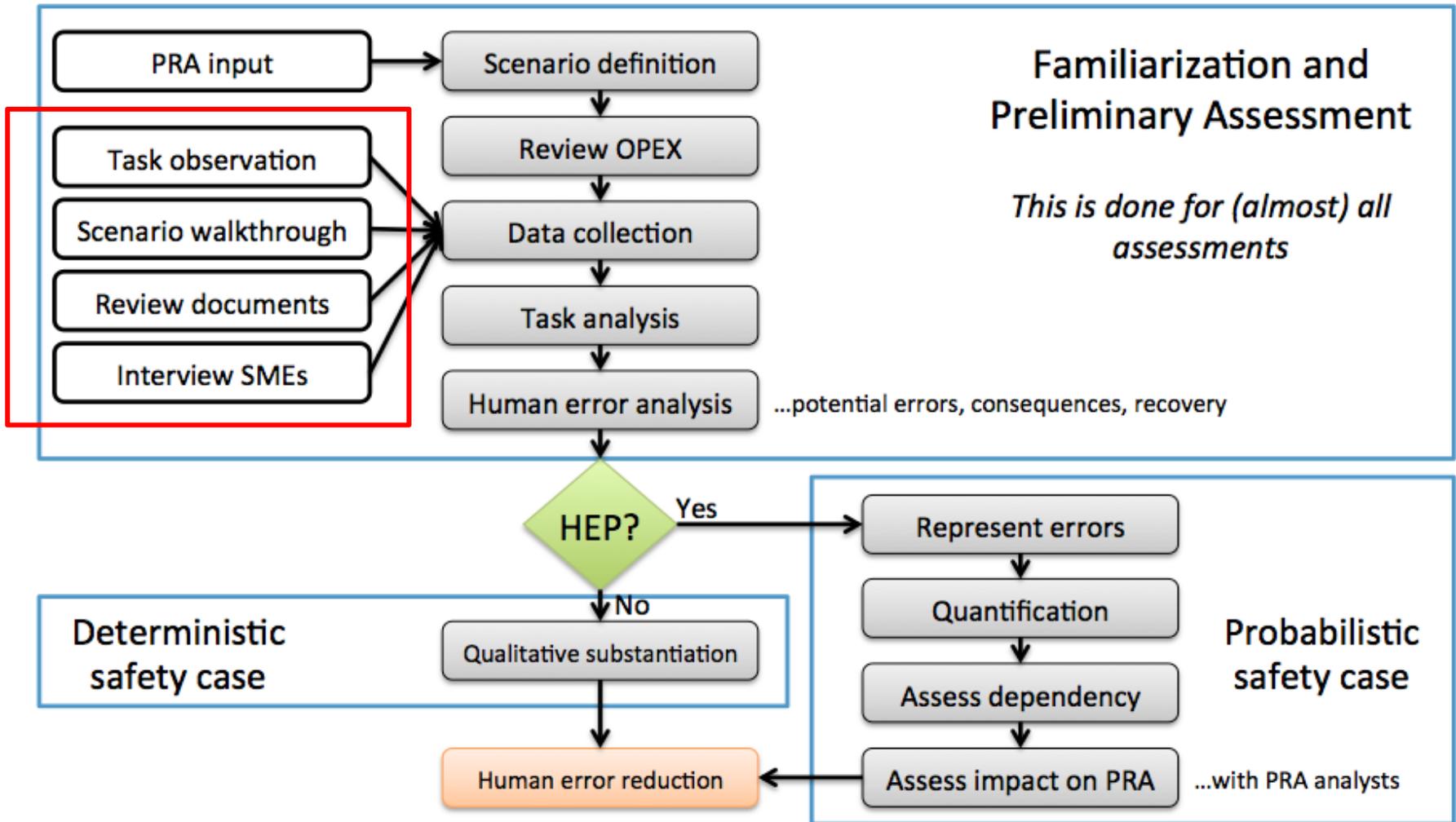
HRA in the UK Nuclear Industry - 1

- HRA is often performed as an input to the safety case:
 - Via the Probabilistic Risk Assessment (PRA)
 - Or as a direct input if a deterministic safety case
- The safety case:
 - Provides substantiation that a new plant, modification, operation or activity can be operated within safety limits
 - Documents how the risks have been reduced to As Low As Reasonably Practicable (ALARP)
 - Uses the Claim, Argument, Evidence (CAE) structure and Defence in Depth principles of prevention, protection, mitigation

HRA in the UK Nuclear Industry - 2

- HRA usually required as evidence to substantiate claim(s) on operator action(s)
- HRA is tailored to the needs of the safety case; depth & formality depends on:
 - The level of risk associated with operator actions
 - The degree of novelty of the tasks & assessment – may only require review of previous HRA
 - The perceived complexity of the task (PRA/HRA/plant)
 - The familiarity of the HRA analyst with the plant and the task(s) being assessed
 - HRA & Human Factors good practice

Approach to HRA



Importance of Operator Input

- HRA should not be a desktop exercise!
- Plant/simulator visits and operator input are essential
 - To provide accurate information about how tasks are really performed at the plant
 - To provide information about the presence and effects of Performance Shaping Factors
 - To check assumptions and uncertainties in the HRA
- Operators can also provide invaluable input at the end of the analysis
 - To check whether the final HEP seems reasonable
 - When developing recommendations for improvements

Benefits of this approach

- Detailed qualitative familiarization and preliminary assessment allows for better human error reduction:
 - Analyst can identify opportunities for improvements to the task, equipment, operating procedures, training, etc. & develop recommendations for these
- HRA can assist with decision making and prioritization of improvements:
 - Where fault trees are dominated by human error, analyst can estimate the impact of the improvement on the HEP to help target effort

HRA Methods Used in UK Nuclear

- Two main methods used to quantify Human Error Probabilities (HEPs):
 - HEART – human error assessment and reduction technique
 - THERP – technique for human error rate prediction
 - Also used “HEART Sheets” to guide collection & presentation of qualitative data
- Now using NARA, which is an extension of HEART:
 - NARA – nuclear action reliability analysis
 - Revised definitions of Generic Task Types and Error Producing Conditions
 - Revised nominal values for HEPs
 - Covers issues such as extended time factors, human performance limiting values (HPLV), potential for double-counting, consideration of dependency

Applied HRA Research in Norway

- Petro-HRA project (2013 – 2016):
 - Funded by Research Council of Norway and Statoil
 - The primary objective of the project is to test, evaluate and adjust HRA methods for application in the petroleum industry
 - Focus on SPAR-H method as this has been used previously by Statoil
 - Aim is to develop practical guidance for use by HRA analysts working in petroleum

HRA Developments at Halden - 1

- Ongoing HAMMLAB simulator experiments:
 - Using operating crews primarily from the USA and Sweden
 - Running PRA scenarios to test the effect of plant conditions, Performance Shaping Factors, Human Machine Interfaces, operating procedure use, etc.
 - Results are used to support HRA development and to provide empirical data on human performance
- International Empirical Study (now complete):
 - The study identified strengths & weaknesses of different HRA methods by comparing HRA analyses to empirical data from HAMMLAB
 - This study was replicated in the US to compare HRA analyses to data from a training simulator at a US plant

HRA Developments at Halden - 2

- Development of a HRA information base / database, populated with empirical and qualitative data from the HAMMLAB simulations
- Qualitative scenario analysis study to follow up on findings from the International empirical HRA study, with the aim to develop practical guidance for analysts on conducting scenario analysis
- International collaboration study on HRA data use (upcoming) to investigate how analysts could use data to support their analyses; scenario analysis study inputs to this
- Review of the IDHEAS method

Thank you

