Ringhals FRAM Case Study on Risk Assessment - Challenges in a pro-active application

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Background

- Ringhals Nuclear Power Plant can be viewed as a complex socio-technical and safety-critical system, balancing production and safety goals.

- The study aims to gain experience in FRAM as a pro-active methodology on risk assessment in safety-critical and socio-technical systems.

- Two re-active FRAM analyzes has been performed, and a third re-active analysis is scheduled, at Ringhals.

Team profile

- Christer Axelsson, Lead Analyst

- Caroline Karlsson, Sociology behavioural science

- Johanna Larsson, Cognitive behavioural science

- Natalia Gonzalez, Cognitive behavioural science

The case study – basic steps

1. Identification of Functions
   - The actual process description
2. Interviews with operators in the system
   - With reference to the process
3. Instantiation
   - By the process description and modified by interview data
4. Defining performance variability
   - Based upon interview data
5. Identication of Background and Dummy Functions
   - E.g. Qualification and Regulation
6. Resonance analysis (TBD)
   - Selection and assumptions on potential's
7. Evaluation of FRAM as an advanced risk assessment methodology

Step 1 – Identification of Functions

- Identification of Functions
  - The actual process description was used as the reference

Problem?

- Although handy to start with a reference point, it certainly gives a bias to the data sampling – how can such biases be managed?

- At the end, in a proactive FRAM we do see a need to evaluate towards some performance reference, baseline or standard – don't we?

- Can a desired process outcome serve as the general reference?
  - e.g. safety goal, production goal, business goal including the balance – which in turn raises the question on the balance point itself!

Step 2 - Interviews

- Interviews with operators in the system
  - With reference to the defined process by Functions

Problem?

- Can the resulting bias be managed?

- Is this a non-sound approach?

- Should the reference rather be more of a desired process outcome?

Step 3 - Instantiation

- Instantiation
  - By the process description and modified by interview data

Problem?

- The process is iterative by ”nature”, thus resulting in output’s looping back to previous executed Functions.
  – does that cause a problem for how Performance Variability migrates and thus the Resonance Analysis?

Step 4 – Performance Variability

- Defining performance variability
  - Based upon interview data
  - Using FRAM-tables of Human, Technology and Organization variability, defining dampening or

Problem?

- A pre-dominance of problem orientation and risk focus were present in the interviews during our data collection, both by the organizational memory (history), and by the FRAM-team performing the risk-analysis.
  – how can identification of dampening variability be effectively supported?

- The current approach results in kind of a ”worst-case” scenario.
  e.g. the varibility ”Competence” is more often adequate than inadequate, but in the Resonance Analysis it becomes a negative ”status”.
  – is there means to reach a more balanced view?

Step 5 – Background and Dummy Functions

- Identication of Background and Dummy Functions
  - E.g. Qualification and Regulation

Problem?

- No, not really. This steps makes up to some degree the initial bias towards the process as designed.

Step 6 – Resonance Analysis

- Resonance analysis (TBD)
  - Selection and assumptions on potential's

Problem?

- How to evaluate e.g. the impact of *n* upstream negative performance variabilities, a dampening variability within Function X, on the Output Y?

$$n \times \uparrow\sim F_{x_{in}} + \downarrow\sim F_{x} = F_{x_{out}} \text{ (subjectively?)}$$

- Failure modes?