IAEA Fukushima Report

A Systemic Analysis of Human and Organizational Factors and Safety Culture at Fukushima

The Methodology

Birgitte Skarbø, IAEA 2014
HOF Project Objective

Address how human and organizational factors and safety culture contributed to the event to address the "whys" of the event.

- Perform a systemic analysis of the accident, capturing the relationships and synergies between the actors involved
- Develop lessons learned
Human Organizational Factors Writing Team

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Biases in the Analysis of Complex Accidents

- **The Hindsight Bias**

**Figure 5:** The indeterminacy of looking ahead.

**Figure 6:** The orderness of looking back.

Source: Hollnagel, 1998
Biases in the Analysis of Complex Accidents (cont.)

- **Oversimplification**
  - Reports written in a linear manner
  - Creates a false sense of orderliness

- **Distancing through Differencing**
  - A main barrier for learning
  - Accidents open for “learning windows” that quickly close
  - Shift from focusing on the specifics...
  - ...to study more general mechanisms such as the functioning of socio-technical systems and cultures
Methodology* - overview

Final product (Lessons learned and areas for further research identified (Phase 2) )

Text produced and reviewed internally and externally

Analysis; information is thematically grouped, systemic interactions are mapped and overarching themes are identified.

- Human and organizational factors and safety culture mini themes
- Human and organizational factors and safety culture facts
- Collection of data on human and organizational factors and safety culture other sources

- Human and organizational factors and safety culture mini themes
- Human and organizational factors and safety culture facts
- Collection of data on human and organizational factors and safety culture from other WG experts

- Human and organizational factors and safety culture mini themes
- Human and organizational factors and safety culture facts
- Collection of data on human and organizational factors and safety culture from Fukushima Reports

* Methodology is based on the IAEA safety culture assessment methodology.
Methodology – data collection

Collection of data on human and organizational factors and safety culture from other sources:
- Consultancy Meetings
- Peer reviewed publications on social and historical factors

Collection of data on human and organizational factors and safety culture from other WG experts:
- Questionnaire
- Liaising during Working Group meetings

Collection of data on human and organizational factors and safety culture from Fukushima reports:
- 30 reports identified and reviewed by HOF team
- 10 main reports for extracting facts relevant to HOF and SC

→ Created HOF Cumulative Fact Database
■ **Extracted facts** on HOF and SC from 10 selected accident reports

■ **All facts assigned to a category** and several attributes
  - The HOF team jointly developed a list of categories and attributes

■ **All facts were inserted to the Cumulative Fact Database allowing sorting for category and attribute**
The department responsible for safety design believed that rational explanations could not be given for facility measures requiring huge expenditure unless reliable PRA methods were perfected and it would be difficult to obtain consent within the company.

TEPCO March 2013 report, Pg. 13

Category: Decision-Making
Attributes: Hard Facts, Design, Business Impact, Methodology, Safety Culture
The department responsible for safety design believed that rational explanations could not be given for facility measures requiring huge expenditure unless reliable PRA methods were perfected and it would be difficult to obtain consent within the company.

TEPCO March 2013 report, Pg. 13

Category: Decision-Making
Attributes: Hard Facts, Design, Business Impact, Methodology, Safety Culture
### Analysis: Application of Cumulative Database (1)

**Sorted facts by category or attribute for the team to review them together**

<table>
<thead>
<tr>
<th>Reading List Number</th>
<th>Fact Code</th>
<th>Fact</th>
<th>Category</th>
<th>Attribute/Qualifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Ad15</td>
<td>Particularly in March, it was confirmed that six people exceeded 250 mSv, which is the dose limit for an emergency worker. All of these were TEPCO employees who were operators and engineers in electricity and instrumentation engaged in monitoring of instruments in the main control rooms immediately after the occurrence of the accident. TEPCO has made it a rule not to allow workers who have exceeded 200 mSv to work at the Fukushima Dai-ichi NPS. p. 15 summary</td>
<td>Decision-Making</td>
<td>Provided Margin</td>
</tr>
<tr>
<td>7</td>
<td>Ad7</td>
<td>Although cooling by isolation condenser (IC) (two lines) was begun after the automatic shutdown of the nuclear rector, it was manually stopped by following the operation procedure documents because of a rapid decrease in the temperature of the RPV. p. 5 Summary</td>
<td>Decision-Making</td>
<td>Adhered to Procedures or Requirements</td>
</tr>
<tr>
<td>3</td>
<td>D102</td>
<td>The secretariat of the NERHQ, which should have played an active role in the decision-making on evacuation zones, was not able to make a proposal of any kind to the fifth floor of the Kantei. They accepted the evacuation orders that had been unilaterally decided upon at the fifth floor of the Kantei, with no understanding of the grounds for such orders. (C3 pg 63)</td>
<td>Decision-Making</td>
<td>Communications</td>
</tr>
<tr>
<td>3</td>
<td>D103</td>
<td>Questions also remain over whether or not they possessed the required know-how for allocating human resources to the emergency response. (C1 pg68)</td>
<td>Decision-Making</td>
<td>Accident management</td>
</tr>
<tr>
<td>3</td>
<td>D140</td>
<td>At the time of the accident, however, TEPCO had not completed the seismic backchecks, and the final report was scheduled for submission in January 2016. This is approximately one decade after the 2006 seismic backcheck instructions and 21 years after the Great Hanshin-Awaji Earthquake that became the catalyst for revising the Guideline. (Ch .5 p.2)</td>
<td>Decision-Making</td>
<td>Failed to take actions</td>
</tr>
</tbody>
</table>
Performing a **two-fold mapping exercise** identifying relationships, concepts and trends resulting in **mini-themes and overarching themes**.
- **Text on mini themes & overarching themes produced throughout analysis process**

- **Final deliverable**
  - Connecting the systemic mapping exercises; and
  - Application of theory (social constructionism/constructivism)
  - Lessons learned
Feedback so far

- Challenge to communicate “soft aspects” to a technical audience
- Report currently under internal and external review
- Draft presented to co-chairs of WG 2 (covering Safety Assessment) of the Fukushima Report:

“Results are aligned with the results from the rest of chapter 2 and also provide further explanations to the current understanding. The methodology you are using is sound and it will allow for a validation of the rest of the working groups’ conclusions.”
Further work: Phase 2

- Team sees a need to **continue the work** after the Fukushima Report is finalized

- Phase 2 of project aims to
  - Collect data identified as missing
  - Expand analysis to take a full systemic approach based on an integration of the data collected and analysis performed in phase 1 with contribution from technical factors
...Thank you for your attention