

 **Hogeschool van Amsterdam**  
Amsterdam University of Applied Sciences


## AN ACCIDENT REPORTS EVALUATION FRAMEWORK EMBEDDING STATE-OF- THE-ART VIEWS ON SAFETY

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## OVERALL APPROACH

Scope: Introduction of a unified framework for:

- Evaluating safety views;
- Assessing barriers' effectiveness/quality.

Assumption: Accident investigation reports data are indicative of organizational safety advancements.

Pilot study: 16 accident reports of a nuclear power plant studied in terms of:

- Indicating state-of-art-views on safety during exploration and discussion of causal factors ;
- Evaluating preventive measures recommended;
- Evaluating successful barriers addressed in the reports.

2

## STATE-OF-THE-ART VIEWS ON SAFETY - HUMAN ERROR

### Theoretical background

"Human error is a symptom of trouble deeper inside a system [not a cause of incidents]." (Dekker, 2006)

### Framework focus

Apart from the human error that is almost always visible, there must be explanations for the factors that influenced human performance.



3

## STATE-OF-THE-ART VIEWS ON SAFETY – HINDSIGHT BIAS

### Theoretical background

"Hindsight means being able to look back, from the outside, on a sequence of events that led to an outcome you already know about." (Dekker, 2006).

"Avoiding hindsight bias requires changing our emphasis in analysing the role of humans in accidents from what they did wrong to why it made sense for them to act the way they did." (Leveson, 2011).

### Framework focus

Accident investigation must:

- Emphasize on the sequence of decisions made along time and try to discover how humans evaluated the options and choices available at the specific points of time and space.
- Avoid confirmation bias that leads to focus on evidence that proves what has already been perceived as cause.

4

## STATE-OF-THE-ART VIEWS ON SAFETY – SHARED RESPONSIBILITY

### Theoretical background

‘The efforts to find the blame are as a result directed to people in the front line, and the result of the approach is the attribution of the blame. If the guilty person is found, he or she can be held responsible for the accident. In practice this may mean that the ‘bad apple’ will be removed or prosecuted.’

(Catino, 2008).

### Framework focus

Accident investigation must not employ linear thinking and look for “root-cause”. All conditions and organizational functions / levels must be considered.



5

## STATE-OF-THE-ART VIEWS ON SAFETY – SAFETY II / FOCUS ON SUCCESS

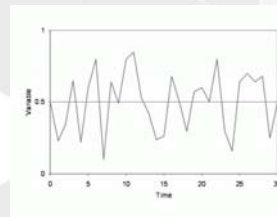
### Theoretical background

- ‘The purpose of an investigation is to understand how things usually go right as a basis for explaining how things occasionally go wrong.’
- ‘Humans are seen as a resource necessary for system flexibility and resilience.’
- ‘ [Performance variability is] inevitable but also useful. Should be monitored and managed.’

(Hollnagel, 2014)

### Framework focus

Accident investigation must explain how similar tasks were successful in the past, how required flexibility was managed and how inevitable performance variability was controlled.



6

## STATE-OF-THE-ART VIEWS ON SAFETY – CONTROL LOOP CONSIDERATION

### Theoretical background

'Control processes operate between levels to control the processes at lower level in the hierarchy. These control processes enforce the safety constraints for which the control process is responsible. Accidents occur when these processes provide inadequate control and the safety constraints are violated in the behaviour of lower-level components.'

(Leveson, 2011).

### Framework focus

Accident investigation must consider how each process was planned and performed in order to ensure a close loop setting.



7

## STATE-OF-THE-ART VIEWS ON SAFETY – AVOIDANCE OF FOLK MODELS

### Theoretical background

'Folk models are easily made because the concept of these terms are ill-defined. Often folk models offer a popular, but not necessarily helpful, characterization of difficult phenomena.'

(Dekker, 2006).

### Framework focus

Accident investigation must not refer to abstract and non decomposed statements (e.g. "lack of situational awareness", "complacency", "boredom")



8

## STATE-OF-THE-ART VIEWS ON SAFETY – NON COUNTERFACTUAL

### Theoretical background

‘They lay out in detail what these people could or should have done to prevent the mishap.’

(Dekker, 2006).



### Framework focus

The persistent focus on the end-user, with the use of expressions such as “could” and “should” without thorough discussion about latent factors that affected performance, indicate a counterfactual approach.

9

## STATE-OF-THE-ART VIEWS ON SAFETY – NON JUDGMENTAL

### Theoretical background

‘Judge people (e.g. not taking enough time, not paying enough attention, not being sufficiently motivated) for supposed personal shortcomings.’

(Dekker, 2006).

### Framework focus

The persistent judgment of the end-user for actions and choices that are considered as merely personal responsibility.



10

## STATE-OF-THE-ART VIEWS ON SAFETY – NON PROXIMAL

### Theoretical background

'At the sharp end (for example the train cab, the cockpit, the surgical operating table), people are in direct contact with the safety-critical process'

'The blunt end is the organization or set of organizations that supports and drives and shapes activities at the sharp end (for example the airline or hospital; equipment vendors and regulators).'

(Dekker, 2006).

### Framework focus

Sharp-end and blunt-end contributions to accidents must be discussed in the same detail and extent.



11

## RECOMMENDATIONS' DESIGN FRAMEWORK – S.M.A.R.T. CRITERIA

<b>Specific</b>	<ul style="list-style-type: none"> <li>• What: What do I want to accomplish?</li> <li>• Why: Specific reasons, purpose or benefits of accomplishing the goal.</li> <li>• Who: Who is involved?</li> <li>• Where: Identify a location.</li> <li>• Which: Identify requirements and constraints</li> </ul>
<b>Measurable</b>	<ul style="list-style-type: none"> <li>• Measuring progress toward accomplishment of goals (how will I know when a goal is accomplished?)</li> <li>• Quantifiable indicators</li> </ul>
<b>Agreed</b>	<ul style="list-style-type: none"> <li>• Have key personnel and stakeholders agreed on what has been decided?</li> </ul>
<b>Realistic</b>	<ul style="list-style-type: none"> <li>• Are the goals durable and realistic in terms of available resources etc.?</li> </ul>
<b>Time-bound</b>	<ul style="list-style-type: none"> <li>• Target date for goals completion (time-frame)</li> </ul>

12

## RECOMMENDATIONS' QUALITY FRAMEWORK (1/2)

Quality	Short definition	Physical (P)	Functional (F)	Symbolic (S)	Incorporeal (I)
Efficiency	How well the barrier meets its intended purpose	3	3	2	1
Resource needs (cost)	What is needed to design, develop and maintain a barrier	2,5	1,5	1,5	1
Robustness (reliability)	How well a barrier can withstand the variability of the environment	2,5	2,5	1,5	1
Implementation delay	The time from conception to implementation of a barrier	1	1,5	2	3
Applicable to safety critical tasks	Self-explanatory	1	2	1	1

(based on Hollnagel, 2008)

13

## RECOMMENDATIONS' QUALITY FRAMEWORK (2/2)

Quality	Short definition	Physical (P)	Functional (F)	Symbolic (S)	Incorporeal (I)
Availability	Whether a barrier can fulfil its purpose when needed. This is critical for barriers designed for rare conditions.	3	2	3	2
Evaluation	How easy it is to determine whether a barrier works as expected, both during design and actual use	3	1	1	1
Independence on humans (during operation)	The extent to which a barrier does not depend on humans do achieve its purpose	3	3	1	1
Median quality score		2,75	2	1,5	1
Total quality score		1,75			

(based on Hollnagel, 2008)

14

## FURTHER RESEARCH

Framework's application on large sample of accident reports in order to:

- Test further its validity and reliability
- Compare results:
  - Along time
  - Among companies
  - Among industry sectors
  - Among states - authorities

15

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Thank you!

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