Human Factors in Learning from Adverse Events:

The importance of Situation and Context

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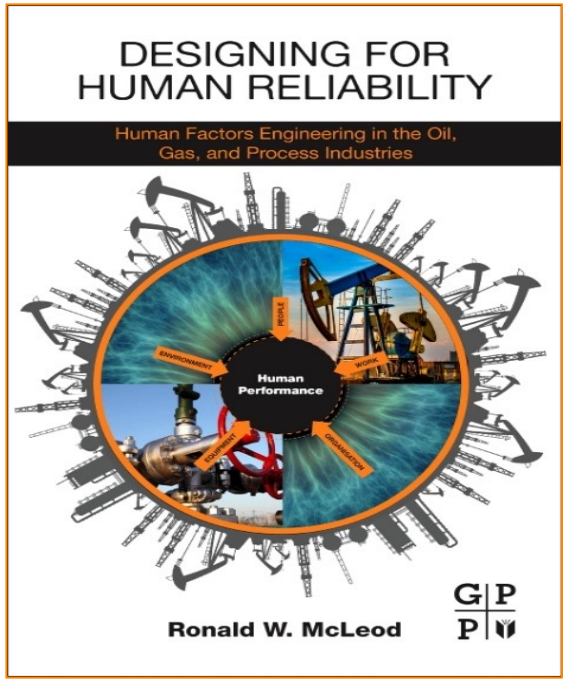
Ron McLeod

- BSc Psychology - 1980
- MSc Ergonomics - 1981
- PhD Engineering and Applied Science - 1986
- 40 years experience as Human Factors Specialist

- Human Factors Global Discipline Lead - Royal Dutch Shell (to 2014)
- Independent Human Factors Consultant

- Honorary Professor of Engineering Psychology, Heriot-Watt University,
- Visiting Professor of Human Factors, Loughborough University

- CIEHF 2020 Lifetime Achievement Award
- Former CIEHF Trustee
- SPE Distinguished Lecturer
- US National Academy of Sciences Committee Member
- Board Member SPE Human Factors Technical Section



About the CIEHF

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  - Fellow
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  - Technical
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- White Paper team
  - Ron McLeod (Chair)
  - Jon Berman
  - Claire Dickinson
  - Donna Forsyth
  - + Numerous member contributors
  - + 5 independent reviewers

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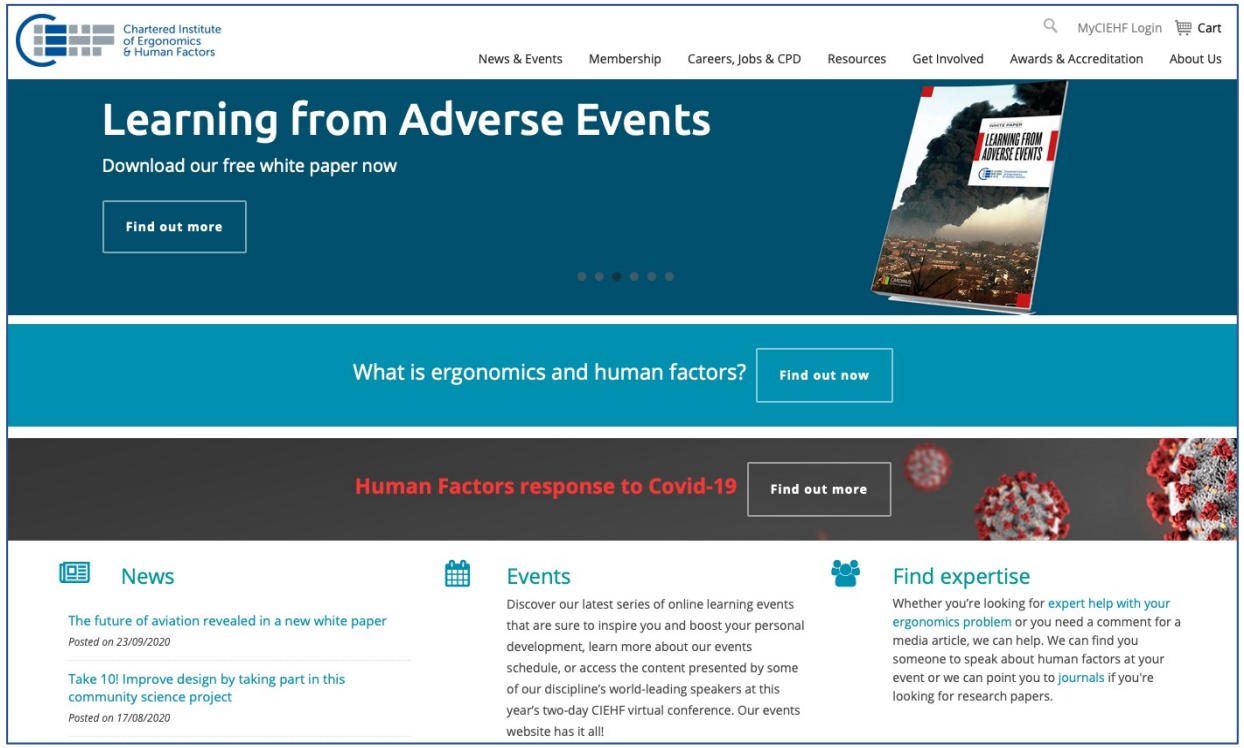
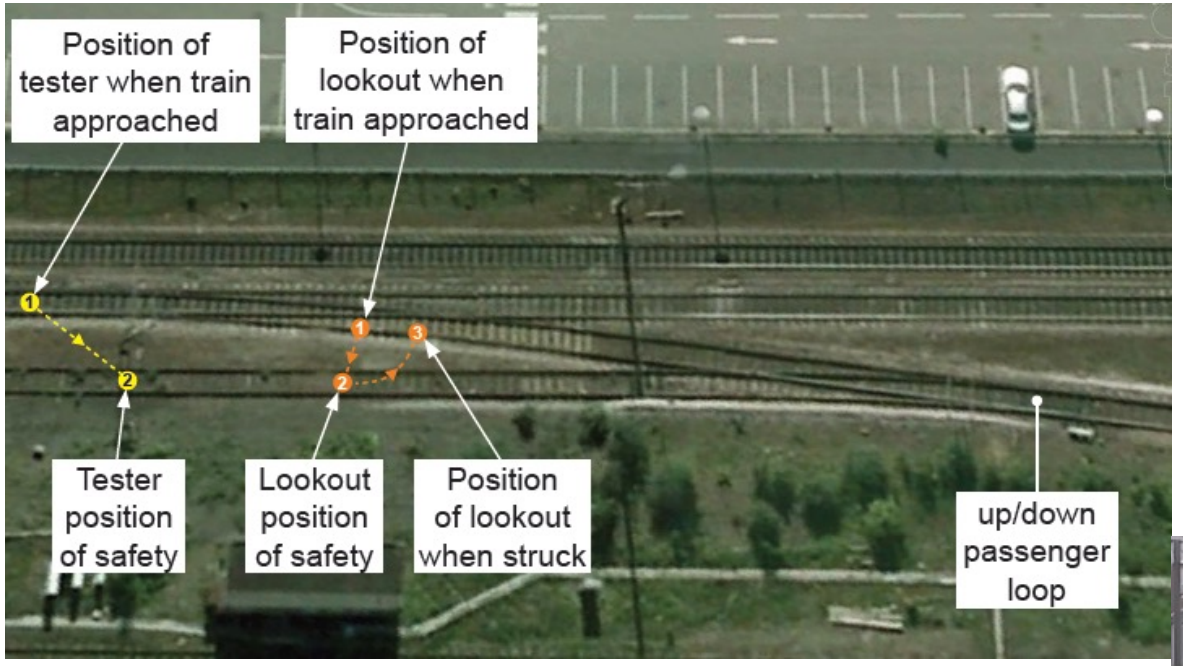
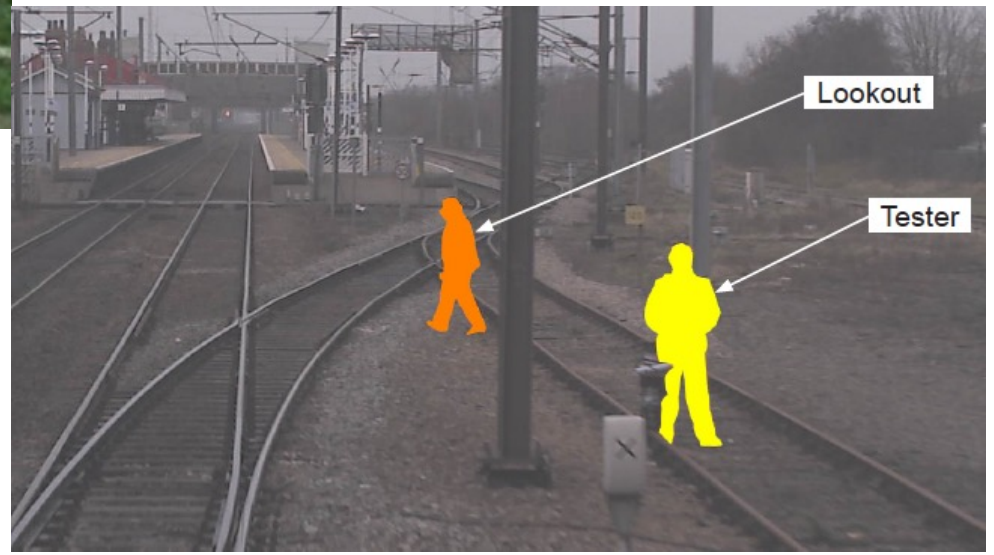


A railway fatality

Rail Accident Investigation Board:
Rail Accident Report 01/2015



What was he thinking?



Formosa Chemicals

CSB Investigation report:
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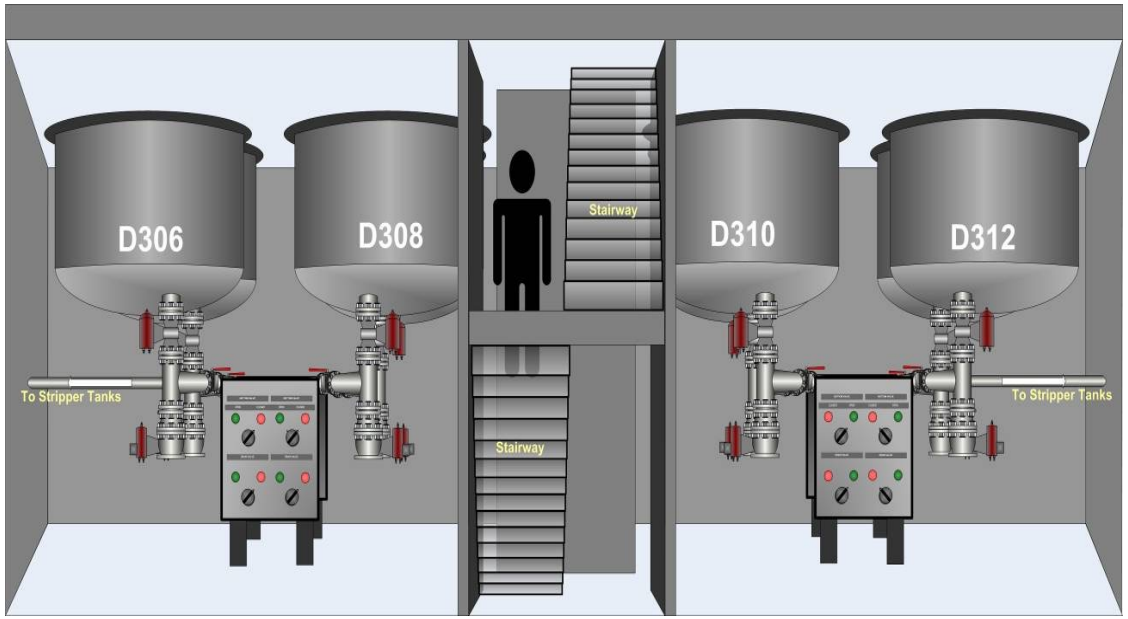


What was he thinking?

Content

- Summary of the 9 Principles
- The importance of Situation and Context
  - What do they mean?
  - An Example
  - Understanding Context
- Some Questions

THE CASE FOR A WHITE PAPER

1. The reflex to “find someone to blame” at the expense of properly investigating systemic issues.
2. Over-reliance on hindsight at the expense of understanding context and situation.
3. Lack of appreciation of psychological factors and motivations.
4. Failure of investigation findings to lead to genuine learning and improvement.

TARGET AUDIENCE

Any industry or service that needs to manage significant risk:

- Major Accident Hazard sites
- Health and social care
- Finance, environment, emergency services, housing.

Not Human Factors professionals or regulators

Learning investigations

- Focus is on Learning, *not* assigning blame or legal liability.

- Motivations behind decisions and behaviour can leave little trace.

- Standards of “evidence” for learning need to be more flexible;
  - Judgement
  - Reasonable doubt
  - Balance of probabilities

9 Principles

Principle 1
Be prepared to accept a broad range of types and standards of evidence

Principle 2
Seek opportunities for learning beyond actual loss events

Principle 3
Avoid searching for blame

Principle 4
Adopt a systems approach

Principle 5
Identify and understand the *situation* and the *context*

Principle 6
Recognise the difference between "work-as-imagined" and "work-as-done"

Principle 7
Accept that learning means changing

Principle 8
Change must be embedded in a culture of learning and continuous improvement

Principle 9
Do not confuse recommendations with solutions

Local Rationality

…In the end, what they are doing makes sense to them at the time. It has to make sense, otherwise they would not be doing it.

Sydney Dekker, 2006

Principle 5
Identify and understand the *situation* and the *context*

What *Situation* were they in at the time?

What was the *Context* of the decisions or behaviour?

Situation

What is the “Situation” in “Situation Awareness”?

- “..the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status into the future”. p.13
- “..the status, attributes and dynamics of relevant elements in the environment”. p.14.

Endsley, Bolte & Jones (2003) Designing for Situation Awareness: An approach to User-Centered Design. Taylor & Francis.

What *Situation* were they in at the time?

From a learning perspective, understanding the situation people were in at the time ***is not the same*** as understanding the situation they were facing. It is more;

- The actual situation they were facing (i.e. SA)
- The circumstances around their being there.
- The reasons for being there.

SITUATION & CONTEXT

SITUATION

- Circumstances specific to the time and place
- Factual
- Discoverable
- No speculation

CONTEXT

- The meaning ascribed by the individuals involved
- Perceptions, beliefs, motivations, values, expectations
- Little traceable evidence
- Can require speculation

CASE STUDY

GRENFELL TOWER

London, 14 June 2017
72 dead
74 hospitalised

Why did the Incident Commanders not rescind the “Stay Put” instruction earlier?

Grenfell inquiry chair demands end to 'stay put' advice for all high-rises

Sir Martin Moore-Bick's call for new fire guidelines would mark shift away from advice given in tower disaster

News

London fire chief admits 'stay put' advice was not suitable for Grenfell as she calls for urgent research on 'buildings that fail'

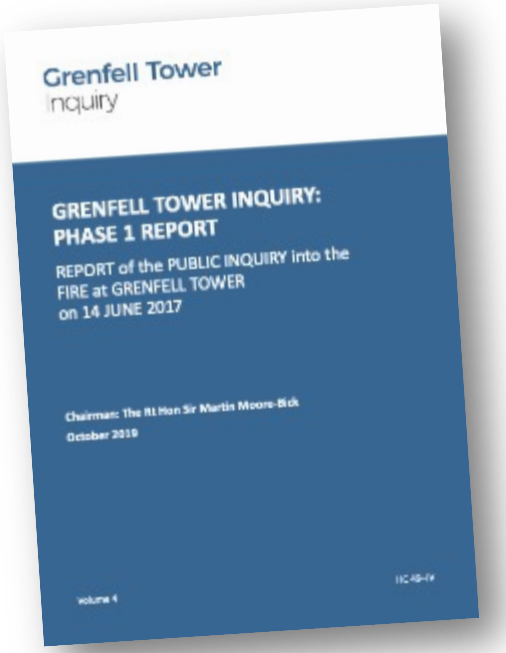
Grenfell Tower report: Fire service's 'stay put' advice cost lives, long awaited public inquiry concludes

Investigation points to 'compelling evidence' regulations were flouted during refurbishment of ill-fated tower

CASE STUDY

GRENFELL TOWER

Situational factors



PREPARATION AND PLANNING

- No training in how to conduct a fire inspection of a high-rise building.
- The information available to the IC was insufficient, particularly in relation to the tactical plan and floor plans of the tower.

TRAINING AND RISK AWARENESS

- Very few (if any) of the Incident Commanders were aware of the risks posed by exterior cladding.
- None had received any training in recognising or assessing the risks or the steps that should be taken in response to a fire in the envelope of a high-rise building.

SITUATION AWARENESS

- IC 1 had no information on the number, rate or location of Fire Survival Guidance (FSG) calls being received.

CASE STUDY

GRENFELL TOWER

Contextual factors

The importance of context is illustrated by the fact that WM Dowden was called out to an ordinary domestic kitchen fire of….a fire which appeared to have been successfully extinguished.

A belief that the building complied with all relevant fire safety standards – that all active and passive fire protection measures were in place and effective.

"It is doubtful whether..[IC1]..ever had in mind the possibility of a full evacuation, since from his perspective such a course was contrary to all the established wisdom about fighting fires in high-rise buildings."

Local Rationality at Grenfell Towers

Why did the Incident Commanders not rescind the “Stay Put” instruction earlier?

What *Situation* were they in at the time?

- Unprepared
- Untrained
- Unaware
- …

What was the *Context* of the decision?

- Believed it was a “normal” fire
- Believed complied with building standards
- Established wisdom
- …

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A railway fatality

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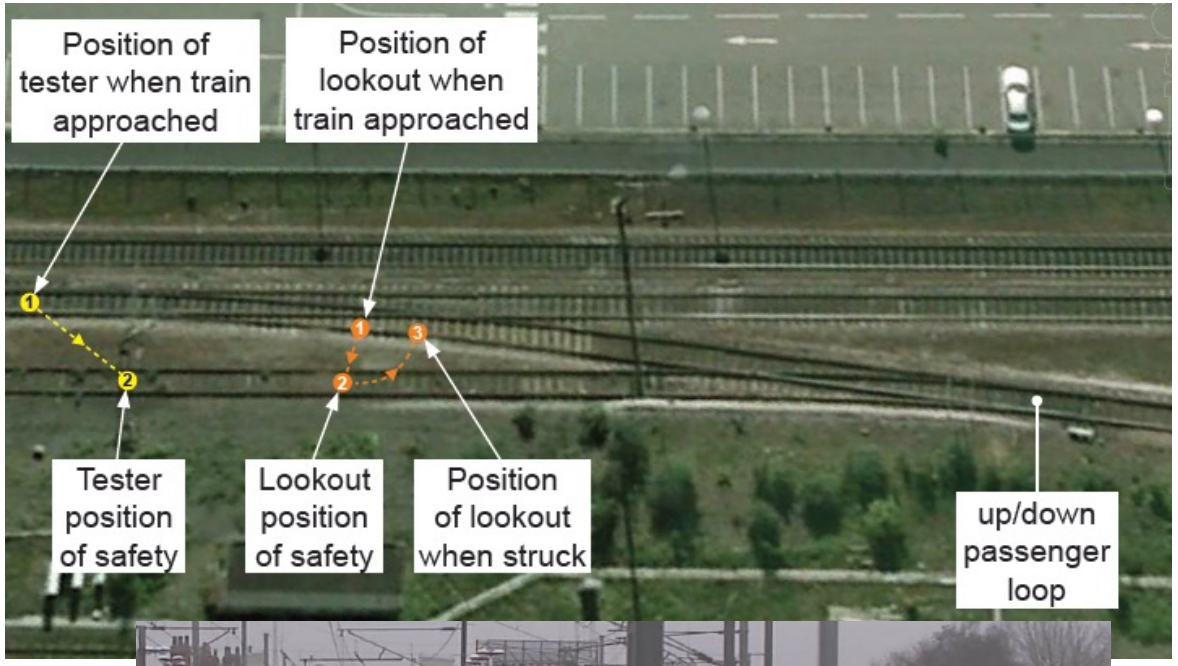

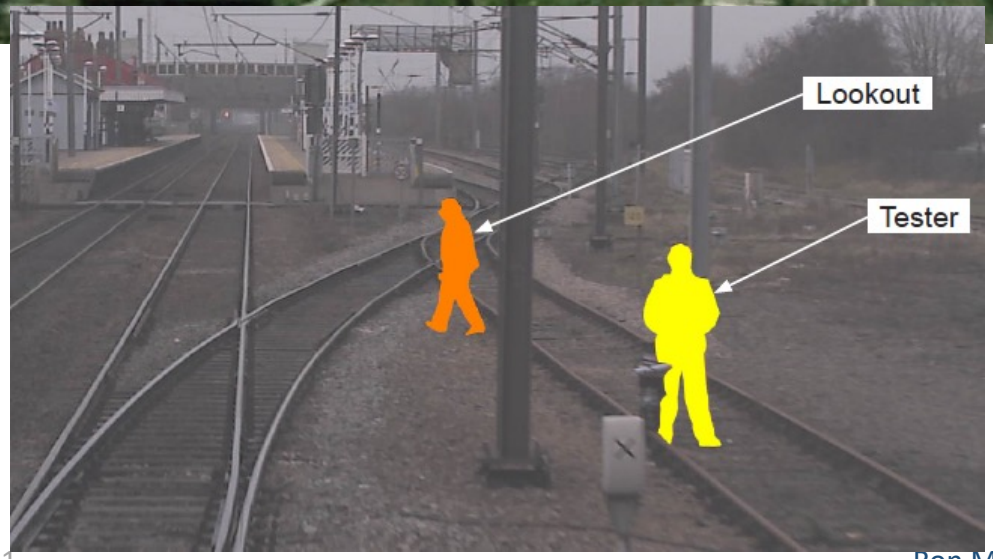

Situation

- *11:34. 4 hours into 7hr shift*
- *Routine, familiar task (Ultrasound inspection)*
- *Three lines.*
- *Good visibility.*
- *Train arrived 2 minutes after starting work.*
- *Audible warnings given and acknowledged.*
- *COSS not present to give permission to leave position of safety*

Context

1. *He knew the danger.*
2. *He knew the train was approaching the station.*
3. *He had no doubt the train would continue on the Up main line.*
4. *He wanted to get into position to continue work.*

Formosa Chemicals

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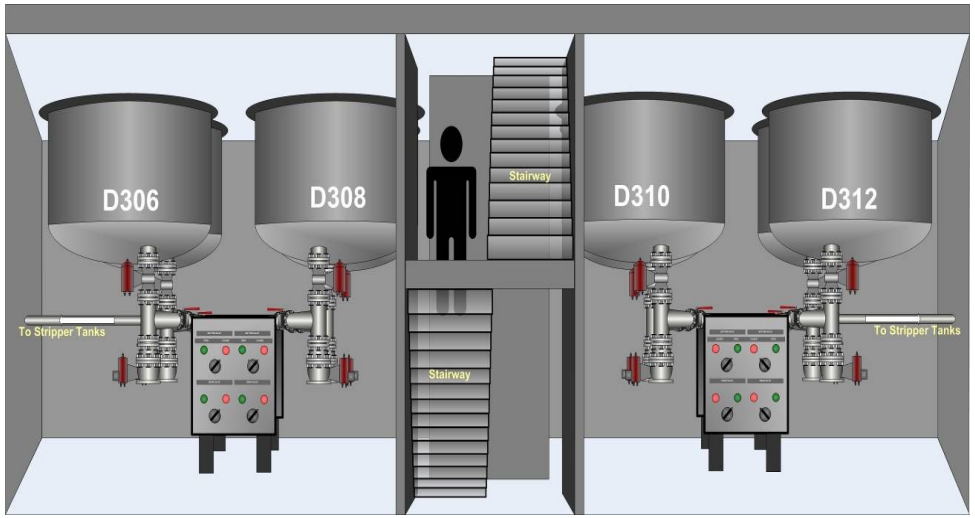


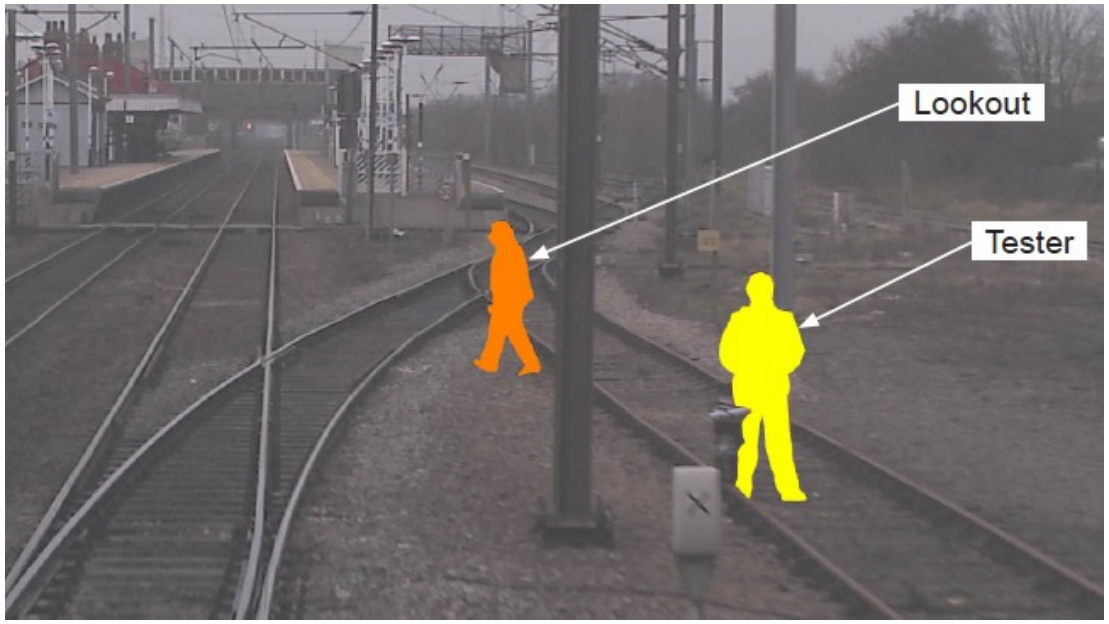
Situation:

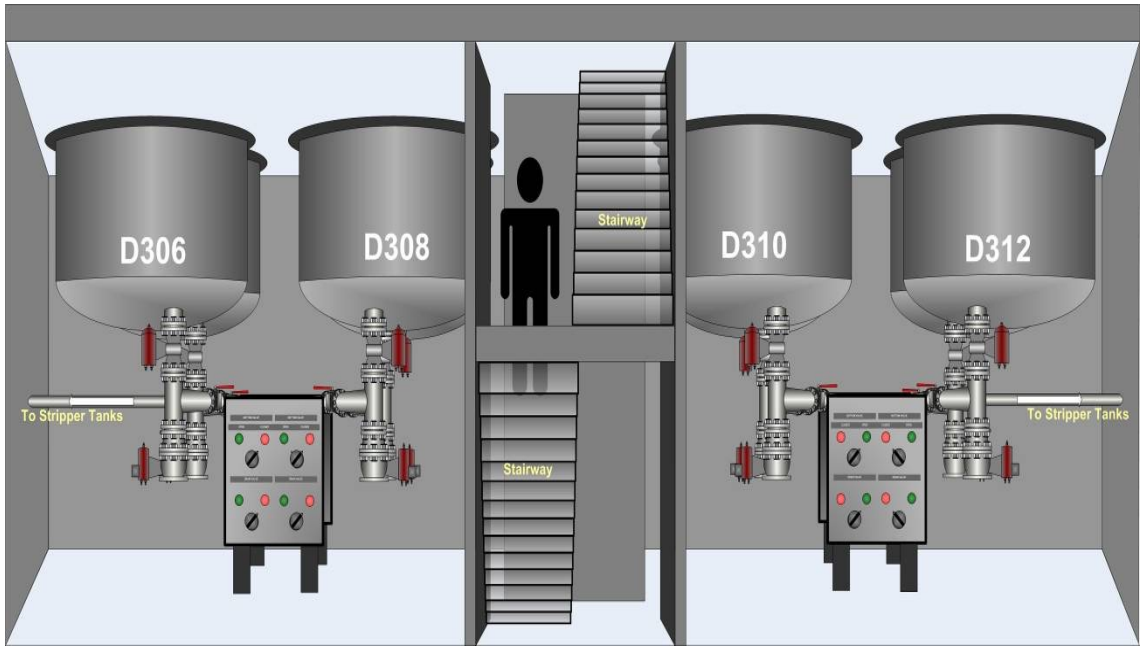
- 1030 pm. Operations normal.
- All 17 other reactors making PVC except D310.
- Reactors in identical groups of 4.
- Control panels on upper level; drain valves on lower.
- D306 and D310 in same relative position.
- Reactor status only available on upper level.
- Site Supervisor required to authorize bypass. Not easily accessible.
- No physical security on interlock
- Emergency air easily accessible for emergency override.

Context:

- He knew the danger
- He had no doubt he was in front of vessel D306
- He had no doubt that the reactor contained water.
- Assumed the drain valve not working.
- "Inconvenience" having to climb to upper level to check status
- Believed override would not be detected.

www.csb.gov





Learning issue: How is it that they could have no doubt in such hazardous activities?

What were they thinking?

How were they thinking?

Styles of Thinking

System 1

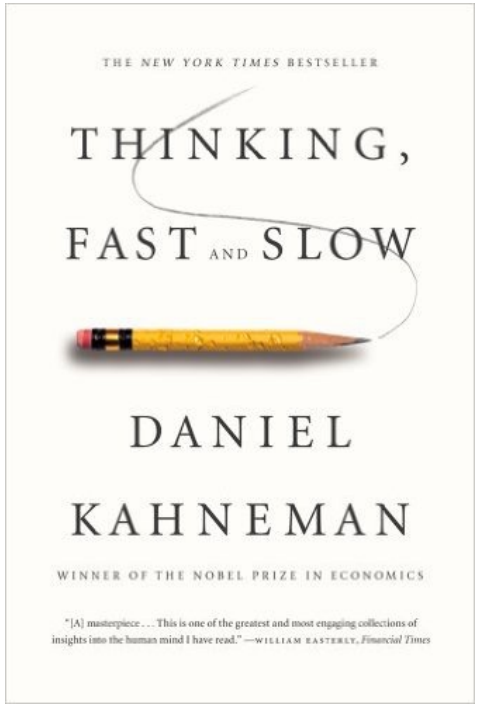
- Near instantaneous
- Works by association of ideas
- Always ‘On’
- Effortless

- Inclined to accept 1st solution
- Does not question
- Does not see doubt
- Associated with many biases

System 2

- Slow
- Evidence-based reasoning
- ‘Off’ unless turned ‘on’
- Takes effort

“..a system for jumping to conclusions”



Heathrow Airport, 23 May 2013

Air Accident Investigation Branch: Air Accident Report 1/2015.

- Door opening procedure not followed
- Oil needed topping up on both engines
- Doors left open during task interruption

- Returned to the wrong aircraft
  - Engine doors were closed
  - Oil did not need topping up

- They can have had no doubt they were at the right aircraft.

- Cross-checking did not challenge.
- Colleagues did not intervene.

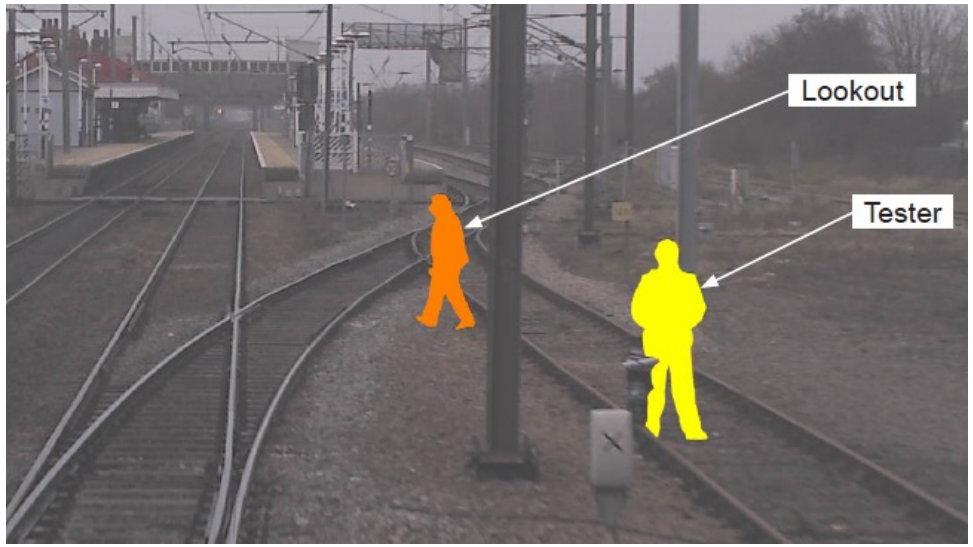
Fatigue and System 1 thinking

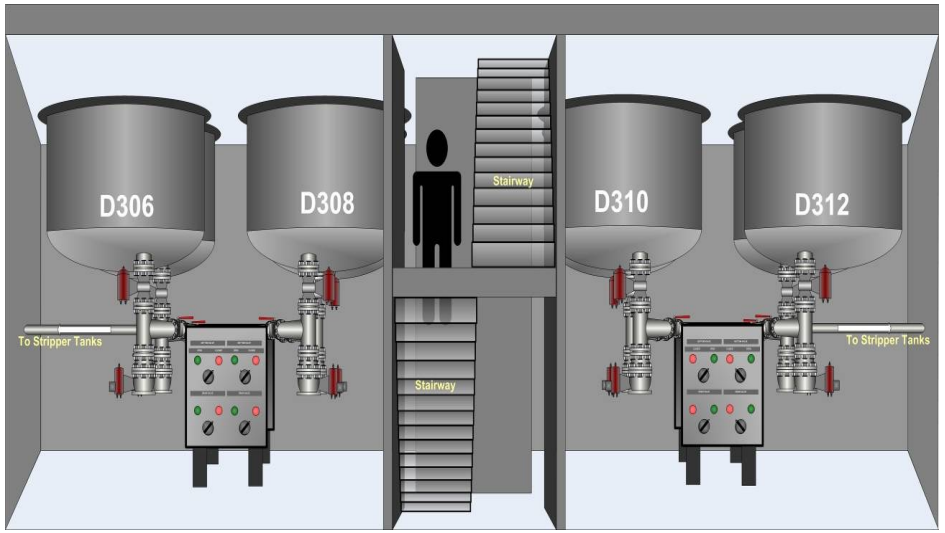
- Fatigue Index at Heathrow = 38 / 39.4

Safety Recommendation 2015-001: …requirements for the implementation of an effective fatigue risk management system within approved maintenance organisations.

- One of the main effects of fatigue is reduced motivation and energy: reduced willingness to apply effort
- It takes effort to engage and apply System 2 thinking
- Are fatigued people more susceptible to System 1 reasoning errors?

System 1 reasoning errors?





Context:

- They knew the danger.
- They *had no doubts* about what they were doing
- Were they captured by System 1 thinking?
  - Accepts 1st solution
  - Does not question
  - Does not doubt

Learning issue:

- How could operators in a hazardous activity, who know the hazards and risk, be in no doubt before doing the wrong thing?

A pigging fatality

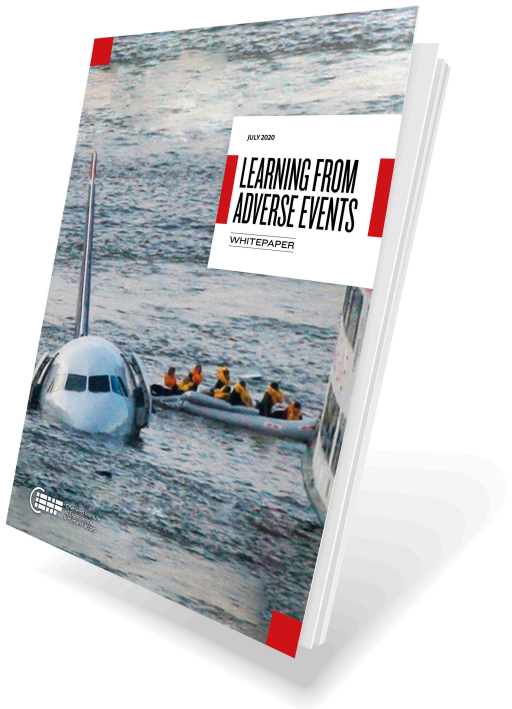
- Preparing for pigging
- Job Risk Assessment completed
- Believed valves were open – actually closed
- One dead, two hospitalized.

System 1 Thinking in Job Risk Assessment

If System 1 is faced with a difficult question, it will substitute, and answer an easier one

- Job Risk Assessment
  - Do we know the Hazards associated with this job?
  - Do we understand the risks: are they under control?
- These are difficult questions
- System 1 will substitute easier questions
  - Are we familiar with the equipment ?
  - Do we know what we have to do?
  - Can we remember an incident doing this job?
  - Can we see anything unexpected or that might be a problem?

9 Principles



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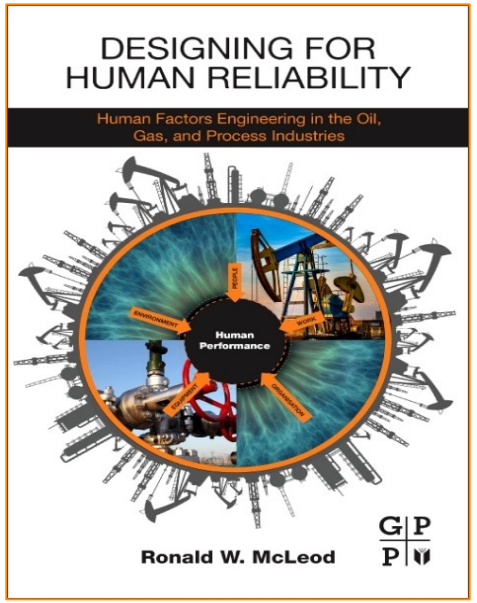
Questions…

- Does the distinction between “Situation” and “Context” as described, seem useful in Learning?
- Can contextual factors be generic across operational situations and demands?
  - Can they be systematically included in learning investigations?
  - Or are they inherently system – or Situation – specific?

- What strategies are effective in kicking people out of System 1 thinking and engaging System 2 in critical situations?
  - Selection? Design? Training? Peer support?
- Does Fatigue make people more susceptible to System 1 reasoning errors?

Some of my related publications

- McLeod. R. W. (2020) *The awareness of risk, complacency and the normalisation of deviance.* Chapter 4 in: Process Safety Management and Human Factors. Ghanem, W.S. (Ed) I.Chem.E.
- McLeod, R. W., De Araujo, D.T., Meireles, A.E.S., Thompson, T.F. (2019) *Developing and implementing a Human reliability program for a multinational petrochemicals company'* Chemical Engineering Transactions, Volume 75.
- McLeod, R. W., Novia, M., Nonno, L. (2018) *'Proactive monitoring as a safety barrier for a global service company'.* SPE International HSSE Conference, Abu Dhabi, April 2018. Paper SPE-190690-MS.
- McLeod, R. W. (2018) *'From Reason and Rasmussen to Kahneman and Thaler: Styles of thinking and human reliability in high hazard industries. 'Advances in human error, reliability, resilience and performance'* Ed: Boring, R., Springer books
- McLeod, R. W. (2017) *'Human Factors in Barrier Management: Hard truths and challenges*. Process Safety and Environmental Protection. *www.psep.ichemejournals.com/article/SO957-582(17)30012-5/pdf*
- McLeod, R. W. (2016) *'The impact of Styles of thinking and cognitive bias on how people assess risk and make real-world decisions in oil and gas operations.* Oil and Gas Facilities, October.
- McLeod, R. W., (2015) *Designing for human reliability: Human Factors Engineering for the Oil, Gas and Process Industries*. Gulf Professional Publishing
- Fruhen, L.S., Flin, R.H & McLeod, R.W. (2013*) Chronic unease for safety in managers: a conceptualisation*, Journal of Risk Research: http://dx.doi.org/10.1080/13669877.2013.822924



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Publication expected by mid-2022

Thank you for your attention.

Any questions?

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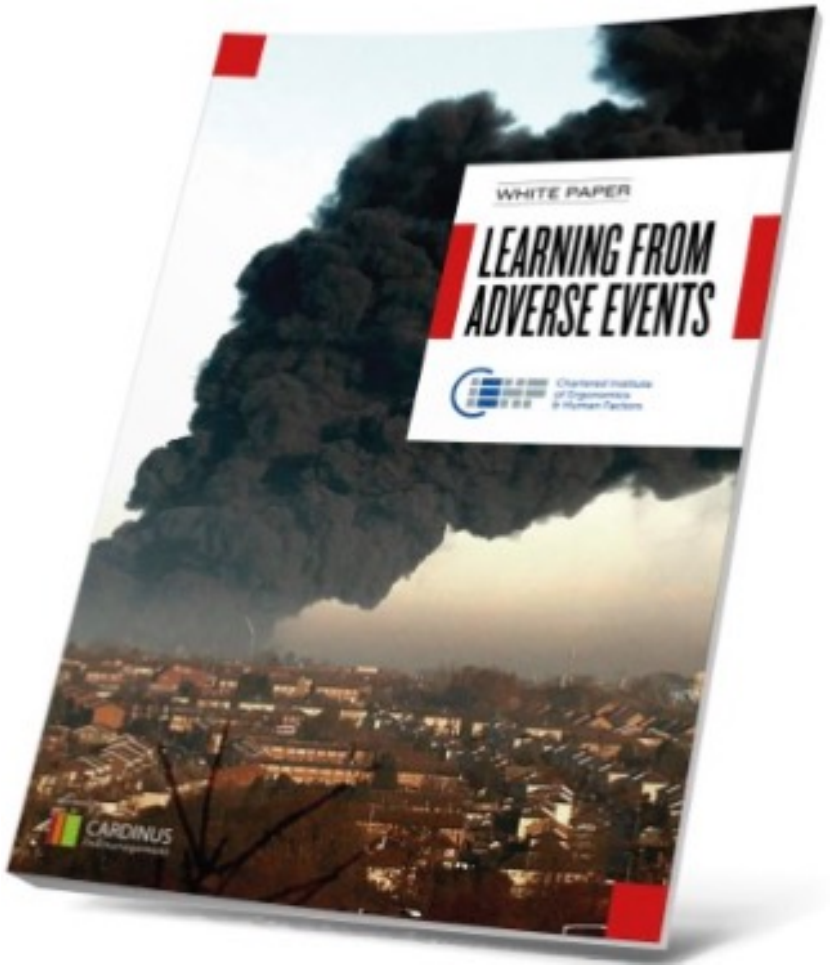

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