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## Human Factors in High Hazard Industries

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## Major accidents...



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## 'Minor' accidents...



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## Route Map

- What is the focus for HF?
- The conundrum for PSA
- Some issues:
  - Drift
  - Compliance
  - Dependency
- Moving forward

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## Consider...

- Columbia
- Davis Besse
- Deepwater Horizon
- Costa Concordia
- Nimrod
- Fukushima
- RBS NatWest
- Aircraft incidents:
  - US Airways 1549 (Hudson River) 2009
  - BA 'Short landing' Heathrow 2008

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## Columbia

"So ingrained was the agency's belief that foam debris was not a threat to flight safety that in press briefings after the accident, [the Program Manager] still discounted the foam as a probable cause"

"In contrast, foam debris and eroding O-rings were defined as nagging issues of seemingly little consequence"

"Each time an incident occurred, the Flight Readiness process declared it safe to continue flying. Taken one at a time, each decision seemed correct"

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### Costa Concordia

- More than one person on the bridge of the vessel
- Not the first time on that route
- Not the first time deviated close to island
- Design-basis accident?
- Elements of response poor
- Some innovative decisions good

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### Current HF Focus

HF is a broad discipline...

- Methods, eg TA, HRA, etc
- Design guidance
- 'Soft' HF:
  - Human performance
  - Safety culture
  - Behavioural safety
  - Learning organisations
  - High reliability organisations
  - Safety management
- 'Macro' HF:
  - Human Factors Integration
  - etc.

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### Challenge for PSA

- PSA deals in actions and events
- SAPs and TAGs push to minimise claims on operators
- Some claims are unavoidable
- Need to quantify
- Operate at task level
- But...
  - People are dynamic, creative, innovative, pattern-matching, etc
  - People add value – sometimes...
  - People are sensitive to PSFs, non-compliance, dependency...

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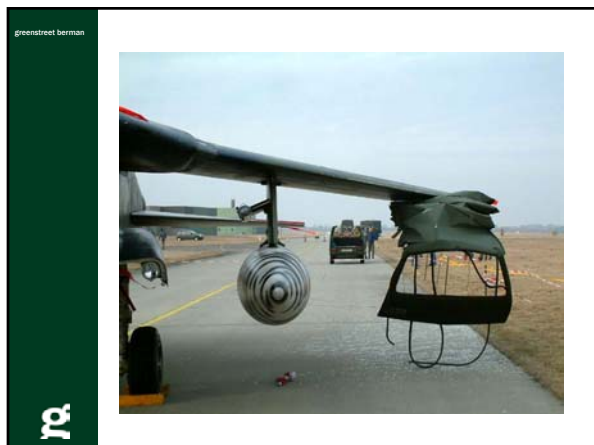
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These pictures are apparently of an Express Airlines plane in Memphis. The mechanics had poked the plane out of the hangar after working on it all night. What they failed to do was have someone using chocks at the plane, failed to bring chocks, failed to set the aircraft parking brake and failed to set the tug parking brake. They then left the aircraft unattended. When they returned to the aircraft.

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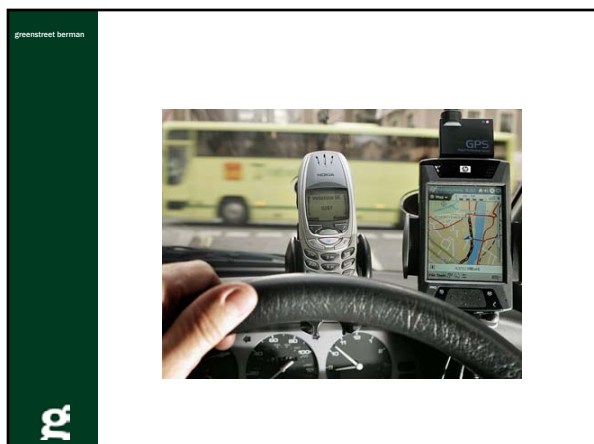


Predictable Performance

- HRA is about assessing the predictability of performance
- But unreliability is predictable:
  - Organisational Drift
  - Compliance/Violations
  - Human Error Dependency
- Other issues:
  - Recovery opportunities (including extended time)
  - Experience (+ve, -ve)
  - Organisational issues
  - etc.

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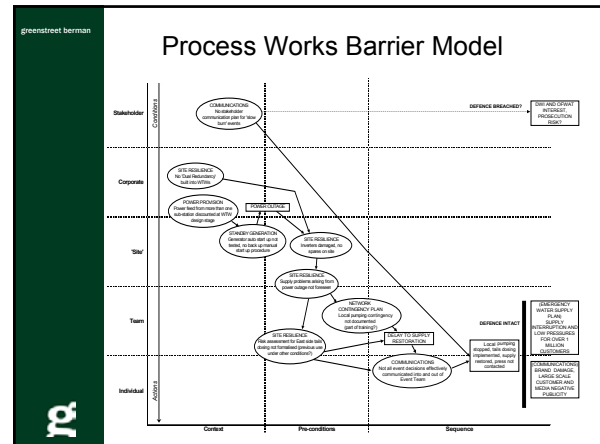
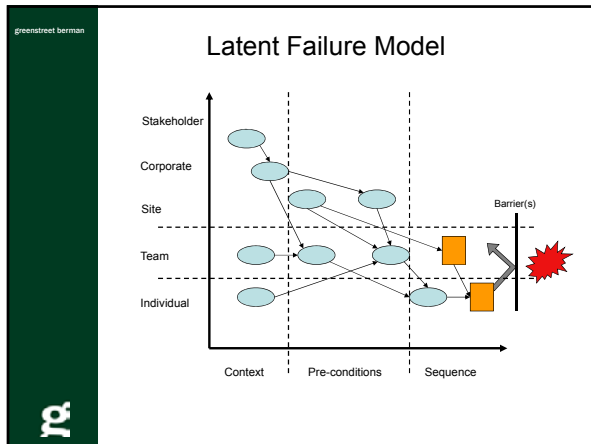


Error Types

- Within PSA typically consider error Types:
  - Type A: Pre-initiator Failures
  - Type B: Initiating Errors
  - Type C: Post Fault Errors
- But organisationally they are interlinked

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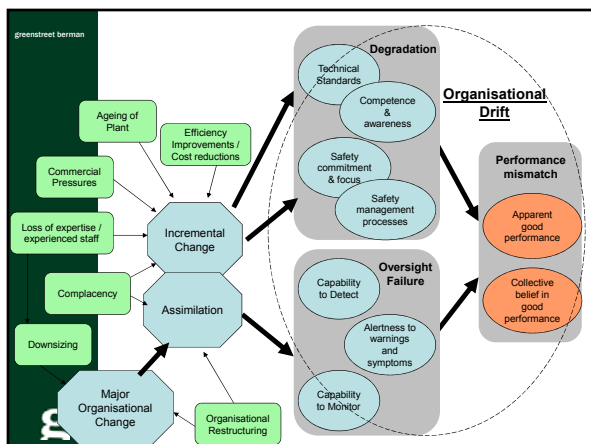
### Attributes of Organisational Drift

Typically:

- It occurs in high-performing organisations
- It is a gradual process
- It comprises shortcomings that are detectable
- There is a failure to detect those shortcomings
- The organisation becomes 'comfortable' with a level of performance that is less than adequate.

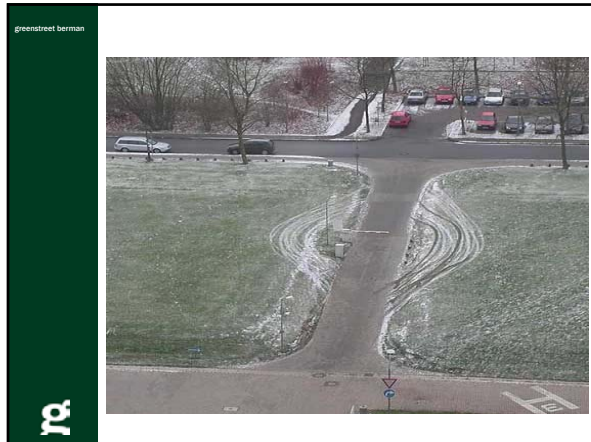
### Why does it matter?

- Nuclear industry study/Regulatory concern
  - Is it inevitable?
  - Can you detect and prevent Drift?
- Resilience is essential – how do we create it?
- 2 necessary conditions for Drift:
  - Degradation of key aspects of operational processes
  - Failure of oversight processes
- Its about whether you're doing what you think you're doing...



### Defences?

- Focus on operational standards – and criteria
  - What are you doing?
  - How are you actually doing it?
- Early, effective detection of change
- Proactive identification/review of 'threatening' changes
- Effective oversight:
  - Can detect deterioration in 'technical' standards
  - Can identify deterioration in commitment and focus
  - Is independent of/resists degradation influences
  - Is compelling
  - Is externally anchored
- Indicators include 'compensating behaviours'



### A definition of compliance

- Rule compliance: the extent to which people choose to follow a rule or procedure or, knowingly or unintentionally, choose not to do so.
- Non-compliance: the failure to follow a rule – may occur deliberately (but with good intent), or unintentionally (eg through ignorance, misunderstanding, task difficulty, etc).

### Why focus on compliance?

- Organisational Drift is partly defined by a gradual deviation from 'accepted' performance
- It tends to be associated with increasing levels of undetected non-compliance
- Incentives for non-compliance can be indicators
- Compliance can be influenced directly
- Improvement in compliance leads to greater resilience – it allows the organisation to recognise and address the factors that degrade performance

### PSA challenge?

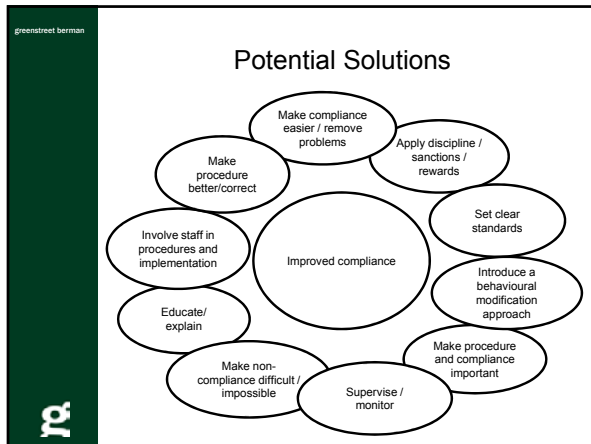
- Do we know the extent of non-compliance?
- Is non-compliance condoned?
- Is non-compliance easy – can we make it more difficult?
- Has non-compliance become 'normal'?
- Are we clear what constitutes non-compliance?
- What claims are we making on people and are they reasonable and clear?
- Do operators perceive the same goals as the designers/safety assessors?

### How is it manifest?

- Indication of problem or cause?
  - Culture: inadvertent reward?
  - Goals: communication?
  - Interfaces: looking for shortfalls?
  - Procedures: compensating behaviours?
  - Training: training needs update?
  - Job Aids: ad-hoc aids to compensate?
- Do people perceive that they are non-compliant?
- Do people consider that what they are doing has management approval?
- Can PSA help focus attention on compliance?

### Factors affecting compliance

- Procedures – are they clear, available, relevant?
- Objectives – do people understand what they are being asked to achieve and why?
- Competence – are people suitably trained and experienced?
- Task design – is it easy to comply and are necessary tools/systems/equipment/PPE available?
- What do we reward?
- Do we adequately manage the process?



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### Drift and resilience

- Accidents and failures appear to arise from a gradual drift in performance
- Complexity contributes to it
- High-performing organisations need to be resilient – responding to abnormal events
- Response may comprise compensating behaviour and ‘small experiments’
  - Who controls this?
  - What does it look like to the front-line staff?
  - What does it look like to the Supervisor?

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### Dependency


- PSA starts from assumption of independence
- Need qualitative analysis of human error dependency
- More than same(different) person/time/task/ location
- Coupling mechanisms:
  - expectations; experience; group think; etc.
- Impacts:
  - Diagnosis
  - Action
  - Recovery

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### Positives...

- Opportunities: human can be beneficial, particularly for BDB/severe accidents
- Not a ‘necessary evil’ but part of the system
- Find opportunities to optimise the capability of the person
- Understand the factors that affect optimisation
- Control flexibility/autonomy



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### Conclusions

- HF supports successful PSA
- PSA should demonstrate:
  - human (un)reliability is properly controlled
  - Claims are reasonable and realistic
  - the role of the person has been properly considered
- HF spans individual actions and organisational behaviours
- PSA needs to demonstrate that it has considered both aspects, but tends to focus on the actions
- PSA needs to make assumptions (about HF) explicit and drive these back into Operations
- Accept that high-reliability organisations are about flexibility, accommodation, learning, etc.

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“Only two things are infinite, the universe, and human stupidity – and I’m not sure about the former”

Albert Einstein

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