Integrating human factors within MAE control measures: Error and ALARP in offshore petroleum activities

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Humans interact with control measures
Error can be a barrier-defeating factor
Error risk can be addressed through adapted traditional risk management approaches
Reducing error risk

Error Prevention

Organisation

Individual

Job

Error Management

Human Reliability

Desired Performance

Human Error

Event

Near Miss
Typical approach

Hazard
Hazard
Error
Hazard

EVENT

Mitigation Controls

Elimination Prevention Reduction Mitigation

Hazard
Hazard

Consequence
Consequence
Consequence
Consequence

Training & competency

Controls
Controls

Error

Consequence
Consequence
Consequence
Consequence
A more accurate approach
A deeper exploration

Performance shaping factor

Prevention Controls

ERROR

Mitigation Controls

Control measure failure

Elimination Prevention Reduction Mitigation
March 23, 2005
– Isomerization unit start-up
– Operators overfilled the raffinate splitter tower
– Pressure relief devices activated
– Flammable liquid spurted from a blowdown stack
– No flare installed
– Ignition, explosion and fire
– 15 deaths, 180 injuries
Error analysis

Knowledge-based mistake

- Incorrect knowledge
- Fatigue
- Misleading HMI
- Poor handover
- Insufficient personnel

Overfilling tower
Knowledge-based mistake

- Incorrect knowledge
  - Training
  - Simulation
  - FRMS

- Fatigue
  - Drills

- Misleading HMI
  - HF in design
  - Maintenance
  - Comms conventions

- Poor handover
  - Procedure
  - Risk indicators

- Insufficient personnel
  - Planning rules

Possible controls
Benefits of error analysis

• Classify potential high-risk errors
• Identify critical PSFs
• Develop targeted control measures
• Focus on prevention and mitigation
• Facilitate risk reduction to ALARP
• “Critical human tasks”
• Activities people are expected to perform:
  – as barriers against an incident
  – to prevent incident escalation
  – to support or maintain barriers during an incident

A suggested process

1. Identify critical human tasks
2. Identify error potential
3. Identify PSFs
4. Evaluate existing controls
5. Develop additional controls
Identify critical human tasks

- Tasks where:
  - a procedure is a single point failure
  - people interact with control measures
  - error can lead to barrier failure
  - barrier failure can lead to MAE
Task analysis can help

- What errors are possible?
- Classify errors by a taxonomy
- What are the potential consequences?
- What are the high-risk potential errors?
• People-level
  – Knowledge, skills, experiences
  – Health
• Job-level
  – Procedures
  – Equipment
  – Supervision
• Organisation-level
  – Culture & climate
  – Corporate strategy
• Prevention controls?
• Mitigation controls?
• Is error risk ALARP?
Layered defences targeting error:
- **Eliminate** the opportunity
- **Prevent** the error
- **Reduce** the impact – error identification and recovery
- **Mitigate** the consequences

- Develop additional controls
- Identify critical human tasks
- Identify error potential
- Identify PSFs
- Evaluate existing controls
Where to start?

- Evidence of uncontrolled error:
  - Events and dangerous occurrences
  - Existing controls have failed to mitigate error risk

- Performance-shaping factors:
  - Latent conditions
  - Broader implications
• Human error can facilitate barrier failure
• Error is most significant within critical human tasks
• Layered defences can reduce error risk
• Effective risk reduction includes:
  – error prevention
  – error mitigation
Online resources

www.nopsema.gov.au
Questions