HUMAN & ORGANISATIONAL FACTORS IN OIL AND GAS

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Martin Anderson: Manager Human Factors
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All references to dollars, cents or $ in this presentation are to US currency, unless otherwise stated.

References to “Woodside” may be references to Woodside Petroleum Ltd. or its applicable subsidiaries.
Overview

+ Where it all started (for me)
+ Six key concepts
+ Our approach
Where it all started (for me)

“different organisations doing similar work are known to have different safety records and certain specific factors in the organisation are related to safety”,

“Third Report: Organising for Safety”, ACSNI*
Human Factors Study Group, 1993

* Advisory Committee on the Safety of Nuclear Installations

Real data showing variation in safety performance across different facilities in an international organisation (not Woodside)
My UK HSE experience: Where do companies focus?

1. Engineering and hardware issues

- ESD system failure
- Fire and gas detection
- Instrumentation failure
- Human errors

2. Personal safety

- Personal safety
- Process safety

3. Front-line staff

- To err is human
- To blame it on someone else is even more human!

“Be careful out there”
SIX KEY CONCEPTS
Key concept 1: “Human error” is inevitable

“It is generally understood that virtually all major accidents include Human Factors among the root causes and that prevention of major accidents depends upon human reliability”

IOGP, Report 460, 2010

(IOGP - International Association of Oil and Gas Producers)

The challenge is to create human reliability
Key concept 2: Don’t just focus on the last person to touch the equipment

“...The critical common element is an unwavering commitment to safety at the top of an organization: the CEO and board of directors must create the culture and establish the conditions under which everyone in a company shares responsibility for maintaining a relentless focus on preventing accidents.”

Deep Water: Report to the President, 2011
“Rather than being the main instigators of an accident, operators tend to be the inheritors of system defects created by poor design, incorrect installation, faulty maintenance and bad management decisions. Their part is usually that of adding the final garnish to a lethal brew whose ingredients have already been long in the cooking”

(James Reason, Human Error, 1990)
Key concept 3: Human reliability can be influenced...

...by **Performance Shaping Factors**, such as fatigue, workload, distractions

- **Human failures are not random!**

  "People’s actions are influenced by the organizations in which they work, shaping their choices in directions that even they may not realize"

  NASA – Shuttle Columbia Accident Investigation Board

  "Although actions or errors by operations personnel at the BP Texas City site were immediate causes of the accident, numerous latent conditions and safety system deficiencies influenced their actions and contributed to the accident"

  CSB, BP Texas City Investigation Report
What might influence Homer's behaviour?
Key concept 4: Whose behaviours and decisions?

+ Front line staff often have little control over a range of influences:
  - Shift patterns
  - Competing demands
  - Staffing levels
  - Quality of contractors
  - Competence programme
  - Permit system
  - Layout of plant
  - Procedures
  - Distractions
  - Design of controls and displays
  - Handover arrangements
  - Clarity of roles and responsibilities
  - Quality of supervision

+ “Behavioural safety” does not equal “human factors”
+ “Behavioural safety and major accident hazards: Magic bullet or shot in the dark?”, (Anderson, 2004)
Key concept 5: Human factors can be applied proactively

When something goes wrong

+ Applying human factors to investigations is part of the picture. . .

Before something goes wrong

Understand the human component

“Pre-incident” investigations?

+ . . . but what about applying human factors to incidents that haven’t occurred yet?

flickr.com/photos/pasukaru78/3998273279
Key concept 6: Defining human factors as a set of key topics

<table>
<thead>
<tr>
<th>Optimising human performance</th>
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</thead>
<tbody>
<tr>
<td>Design of equipment, processes, tasks &amp; environment</td>
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<tr>
<td>Organisational change</td>
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<tr>
<td>Supervision</td>
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<tr>
<td>Staffing levels and workload</td>
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<tr>
<td>Training &amp; competence</td>
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<tr>
<td>Procedures</td>
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<tr>
<td>Safety critical communications (including handovers, permits &amp; alarms)</td>
</tr>
<tr>
<td>Fatigue &amp; shiftwork</td>
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<tr>
<td>Organisational &amp; safety culture</td>
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</tbody>
</table>

Top 11 Human factors for WA mine sites, DMP, 2017
## Key human factors topics in practice

<table>
<thead>
<tr>
<th>Key human factors topics</th>
<th>Examples: CSB investigation of BP Texas City</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimising human performance</td>
<td>No proactive analysis of DCS issues. Issues in previous start-ups not investigated.</td>
</tr>
<tr>
<td>Design of equipment, processes, tasks and environment</td>
<td>Control system did not support operations personnel</td>
</tr>
<tr>
<td>Organisational change</td>
<td>Various changes not evaluated for their impact on the control of major hazards</td>
</tr>
<tr>
<td>Supervision</td>
<td>Ineffective supervisory oversight and technical assistance during unit start-up</td>
</tr>
<tr>
<td>Staffing levels and workload</td>
<td>Insufficient staffing to handle board operator workload during the high-risk time of unit start-up</td>
</tr>
<tr>
<td>Training and competence</td>
<td>Inadequate operator training for abnormal and start-up conditions</td>
</tr>
<tr>
<td>Procedures</td>
<td>Not up-to-date or accurate. Start-up procedure lacked sufficient instructions</td>
</tr>
<tr>
<td>Safety critical communications</td>
<td>No policy for effective shift communication</td>
</tr>
<tr>
<td>Fatigue and shiftwork</td>
<td>Unit operators were likely fatigued (e.g. 12-hour shifts, 29 days in a row)</td>
</tr>
<tr>
<td>Organisational and safety culture</td>
<td>A work environment that encouraged operations personnel to deviate from procedure</td>
</tr>
</tbody>
</table>
What if we don’t address human factors?

+ Things take longer than they should . . .
+ Things have to be re-done . . .
+ People don’t do what we expected (or hoped for) …

+ . . . stuff gets out of the pipes, and we hurt:
  + people
  + the system
  + the environment
  + the organisation

+ When other organisations have hurt people, the system and the environment all in one go, it has cost $$$ billions.
OUR APPROACH TO HUMAN FACTORS
Our human factors capability and resources

- Central HF Team
- Operations HF Adviser
- Developments HF Adviser
- Incident investigators
- HFAT® trained staff
- HF focal points

Approach based around the 10 Key HF topics
Internal resources based around the key topics
## Gap analysis against the key topics

<table>
<thead>
<tr>
<th>UK HSE top 10 HF Topics</th>
<th>Brief description of topic</th>
<th>Company 1</th>
<th>Company 2</th>
<th>Company 3</th>
<th>Company 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Human Factors in Risk Assessment</td>
<td>As above for incident investigation</td>
<td>Amber</td>
<td>Amber</td>
<td>Green</td>
<td>Red</td>
</tr>
<tr>
<td>2. Procedures</td>
<td>Providing operator training and procedures which support efficient performance</td>
<td>Amber</td>
<td>Amber</td>
<td>Amber</td>
<td>Amber</td>
</tr>
<tr>
<td>3. Training &amp; Competence</td>
<td>Ability to undertake responsibilities and perform activities in a recognised standard in a regular basis. It is a combination of skills, experience and knowledge</td>
<td>Amber</td>
<td>Amber</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>4. Staffing</td>
<td>4.1 Staffing levels</td>
<td>Right level of staff available for task</td>
<td>Amber</td>
<td>Amber</td>
<td>Green</td>
</tr>
<tr>
<td>4.2 Workload</td>
<td>Manageable workload, especially during upset and emergency situations</td>
<td>Red</td>
<td>Amber</td>
<td>Red</td>
<td>Amber</td>
</tr>
<tr>
<td>4.3 Supervision</td>
<td>Experienced supervisors regularly present at work site</td>
<td>Amber</td>
<td>Amber</td>
<td>Green</td>
<td>Amber</td>
</tr>
<tr>
<td>4.4 Contractors</td>
<td>Competent contractors, properly trained and accredited</td>
<td>Amber</td>
<td>Amber</td>
<td>Green</td>
<td>Amber</td>
</tr>
<tr>
<td>5. Organisational Change</td>
<td>Human aspects of organisational design re-assessed and controlled</td>
<td>Amber</td>
<td>Red</td>
<td>Red</td>
<td>Amber</td>
</tr>
<tr>
<td>6. Safety-Critical Communications</td>
<td>6.1 Shift Handover</td>
<td>Structured process for shift and task handover in place and working as intended</td>
<td>Red</td>
<td>Green</td>
<td>Red</td>
</tr>
<tr>
<td>6.2 Permit-to-Work</td>
<td>As above for permit-to-work</td>
<td>Red</td>
<td>Green</td>
<td>Red</td>
<td>Green</td>
</tr>
<tr>
<td>7. Human Factors in Design</td>
<td>7.1 Central Roles</td>
<td>Ergonomic design principles used</td>
<td>Amber</td>
<td>Amber</td>
<td>Amber</td>
</tr>
<tr>
<td>7.2 Human-Computer Interface</td>
<td>As above</td>
<td>Amber</td>
<td>Amber</td>
<td>Amber</td>
<td>Amber</td>
</tr>
<tr>
<td>7.3 Alarm Management</td>
<td>As above, to prevent alarm floods</td>
<td>Amber</td>
<td>Amber</td>
<td>Amber</td>
<td>Amber</td>
</tr>
<tr>
<td>7.4 Lighting, Thermal Comfort, Noise &amp; Vibration</td>
<td>As above</td>
<td>Amber</td>
<td>Amber</td>
<td>Amber</td>
<td>Amber</td>
</tr>
<tr>
<td>8. Fatigue &amp; Shiftwork</td>
<td>8.1 Behavioural Safety</td>
<td>Programmes that identify and mitigate stressors and exhaustors</td>
<td>Red</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>8.2 Learning Organisations</td>
<td>Chronic stress evident, always striving for higher levels of performance and opportunities to learn from experience</td>
<td>Green</td>
<td>Amber</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>9.2 Intelligent Customers</td>
<td>The capability of the organization to have a clear understanding and knowledge of the product or service being supplied. Relevant to use of contractors</td>
<td>Red</td>
<td>Amber</td>
<td>Green</td>
<td>Amber</td>
</tr>
</tbody>
</table>

**Gap analysis findings: Fictitious data**
Human factors focus areas

1. **Set people up to succeed through good design**
   - Design things so it’s easy to do the right thing and hard to do the wrong thing (and make ‘wrong’ things noticeable)
   - Ensure our ‘end-users’ are involved in design
   - Consider capabilities, limitations & needs of users

2. **Ensure human reliability on critical tasks**
   - Identify critical tasks in your business area
   - Understand the potential for human failure in these tasks and the conditions or influences that make them more likely
   - Implement control measures (using the hierarchy of control)

3. **Understand and learn from events (good and bad)**
   - Seek to understand how and why something went wrong
   - Report and discuss errors, and understand the conditions that make errors more likely
   - Understand why we were successful, so we can replicate success

4. **Continue to maintain “Our Safety Culture”**
   - Engage people using the Discussion Cards
   - Understand key behaviours in investigations
   - Incorporate the framework into everything we do
   - Create the environment that underpins the above key areas
Human factors in design

Set people up to succeed through good design
✓ Design things so it’s easy to do the right thing and hard to do the wrong thing (and make ‘wrong’ things noticeable)
✓ Ensure our ‘end-users’ are involved in design
✓ Consider capabilities, limitations & needs of users

Also known as Human Factors Engineering:
“Designing plant, processes and systems in a way that optimises the human contribution”
+ Misfuelling costs Australian motorists $10 million each year
+ Average repair costs $7000
+ The solution:
  + tell people not to do it?
  + standardise the pump colour coding?
  + segregation of fuel pumps?
  + warning sticker on fuel cap?
+ Engineering solutions are more robust:
  + Assume people will pick the wrong pump
  + Make it physically impossible to misfuel
Human reliability on critical tasks

Ensure human reliability on critical tasks

✓ Identify critical tasks in your business area
✓ Understand the potential for human failure in these tasks and the conditions or influences that make them more likely
✓ Implement control measures (using the hierarchy of control)

+ Traditionally, we consider how the system can harm the person
+ We need to also consider the opposite:
  ▪ What can the person do (or not do) that could harm the system?
+ This involves proactively identifying and managing potential human performance issues on critical tasks

“Identification of critical human tasks should be the first step for organisations seeking to improve their control of error risk” (NOPSEMA, 2015, N-06300-IP1509)

“Members should work towards adopting practices to identify and understand safety-critical human tasks. They should also work on the operational and management practices that need to be in place to ensure operators are able to perform these tasks reliably”, (IOGP, Report 460, July 2012)
Critical Task Analysis: Human factors risk assessment

- Focus on tasks that can result in serious consequences and are vulnerable to human performance issues.
- Aim for 20% of tasks to be rated as High.
- Walk-through and Talk-through in the workplace. What and who do people interact with? What information do they need? What documents are used?
- Consider unintentional and deliberate failures. Identify the relevant Performance Shaping Factors (the context in which behaviour occurs).
- What makes the task or system ‘error resistant’ and ‘error tolerant’? Identify measures that will prevent human performance issues; as well as measures that will increase recovery.
Human factors in investigations

3

Understand and learn from events (good and bad)
- Seek to understand how and why something went wrong
- Report and discuss errors, and understand the conditions that make errors more likely
- Understand why we were successful, so we can replicate success

+ Investigator non-technical skills
+ Learning lessons
+ Links to non-HSE events
+ Incorporating the HFAT® approach
+ Investigating successes

When a flower doesn’t bloom you fix the environment in which it grows, not the flower

Alexander Den Heijer

Photo credit: Martin Anderson
Investigation approach

Specify behaviour(s) to be understood

Determine behaviour type(s), based on evidence available

HFAT®
Human Factors Analysis Tools

Gather Evidence → Assemble Timeline → Identify Critical Factors & Causes

CF 1  CF 2  CF 3

Root Cause Analysis tools

Sensory Error  Memory Error  Decision Error  Action Error  Intentional Behaviour

Do Human Error Analysis

Do ABC Analysis
4 Continue to maintain “Our Safety Culture”

- Engage people using the Discussion Cards
- Understand key behaviours in investigations
- Incorporate the framework into everything we do
- Create the environment that underpins the above key areas

“Our Safety Culture” Framework

Our Safety Culture Discussion Cards
Assessing Our Safety Culture

Comparing safety culture across facilities - Fictitious data

- People at my facility
- My direct supervisor
- Managers at my facility