Human Factors in Incident Investigations
Learning within a Just and Fair Culture context

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Director & Chartered Occupational Psychologist
The Keil Centre Limited
About The Keil Centre...

- Based in the UK & Australia
- 20 staff & associates
- International client base

Applying psychology to promote organisational success since 1983
Human Factors...what is it?

HSE Definition

“Environmental, organisational and job factors, and human and individual characteristics which influence behavior at work in a way which can influence health and safety. This includes the jobs people do, the individuals doing the jobs, and how they are organised and managed.”

(Health and Safety Executive, 1999)

80% of incidents have a human factors contribution
Key challenges

Technical aspects

- Produce “hard facts”
- Produce useful data that can be included in the report; graphs, diagrams, images
- Fit the core competence of the investigation team
- Fit the expectations of the organisation

Human Factors aspects

- May be viewed as subjective or speculative
- May be judged with caution
- Can be challenging to adequately describe in simple terms
- May require a new vocabulary and new concepts that are unfamiliar to the organisation

Note: all aspects are competing for the same resources
The progression of Human Factors involvement in investigations

- Mainly technical content
- Human Factors added-in (post hoc)
- (Socio-technical) system perspective: Human Factors embedded in investigation process
Typical Incident Analysis Process

Gather Evidence → Assemble Timeline → Identify Critical Factors & Causes

Specify behavior(s) to be understood

Unintentional
- Sensory
- Memory
- Decision
- Action

Intentional

Error Analysis → ABC Analysis

Change analysis if dictated by evidence
# Behavior Definition

<table>
<thead>
<tr>
<th>The person</th>
<th>Mr Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>The task</td>
<td>Whilst checking the valve line-ups</td>
</tr>
<tr>
<td>What they did/ did not do</td>
<td>Opened the boom 5 jetty-head ballast valve instead of the oil valve</td>
</tr>
<tr>
<td>The result</td>
<td>Allowing fuel oil to enter the ballast system for approximately one hour forty minutes</td>
</tr>
</tbody>
</table>
### Intentional or unintentional behavior?

<table>
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<tr>
<th>Intentional (violation)</th>
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</thead>
<tbody>
<tr>
<td>▶ Person announced their intention to behave in that way, prior to behavior</td>
</tr>
<tr>
<td>▶ It can be demonstrated that the person knew what should be done</td>
</tr>
<tr>
<td>▶ Their behavior led to some positive consequences for them</td>
</tr>
</tbody>
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<th>Unintentional (error)</th>
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<tr>
<td>▶ The person can explain how the error occurred, but not why - they are puzzled by their own actions.</td>
</tr>
<tr>
<td>▶ Colleagues have done similar things unintentionally</td>
</tr>
</tbody>
</table>
ABC analysis - Understanding Intentional Behavior

- First step in changing behavior is to understand why people are currently behaving as they are.
- ABC analysis helps you to understand behavior from the other person’s perspective.
- Antecedents get us going, consequences keep us going.

**Antecedent**
Something that comes before a behavior, and sets the stage for the behavior to occur.

- suitable tools & equipment
- information, signs
- skills and knowledge
- training
- other’s expectations & example
- rules
- procedures

**Behavior**
What the person does.

**Consequence**
What happens to the person as a result of the behavior.

Certain types of consequence strongly influence behavior.
Different types of consequences

- Positive (P) or Negative (N), from perspective of the other person
- Immediate (I) or Future (F)
- Certain (C) or Uncertain (U), that consequence will occur
- PICs most strongly influence behavior
**Behaviour:** Operators, while cleaning up broken whisky bottles that have fallen from forklift trucks fail to put on their gloves resulting in cut hands.
Behaviour:
Operators, while cleaning up broken whisky bottles that have fallen from forklift trucks put on their gloves resulting in protection from cuts.

Don’t get to take home unbroken whisky bottle NIC

Takes more time - NIC

Avoid Punishment – send a consistent message PIC

Avoid Injury – educate on the numbers of injuries PIC

Consequences supporting the safe behaviour

Consequences supporting the unsafe behaviour
Human Error Analysis
Understanding unintentional behavior

1. Sense information from outside world
2. Memory of training, procedures, recent events, etc.
3. Make decision based on senses and information from memory
4. Take action based on decision
Behavior: Car driver while refuelling their diesel car put petrol in the diesel tank resulting in damage to the car

<table>
<thead>
<tr>
<th>Error Type</th>
<th>Possible Scenarios</th>
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<tr>
<td>Sensory Error</td>
<td>If the driver looked at the two similar nozzles and mistook the petrol nozzle for the diesel nozzle</td>
</tr>
<tr>
<td></td>
<td>Clearly label and distinguish between the two nozzles by color</td>
</tr>
<tr>
<td>Memory Error</td>
<td>If the driver forgot that they were driving a diesel car</td>
</tr>
<tr>
<td></td>
<td>Put a clear label on the fuel cap or dashboard marked ‘diesel’</td>
</tr>
<tr>
<td>Decision Error</td>
<td>If the driver made the decision that it is okay to put petrol in the diesel tank</td>
</tr>
<tr>
<td></td>
<td>Education at petrol stations/news/motorways</td>
</tr>
<tr>
<td>Action Error</td>
<td>If the driver had meant to pick up the diesel nozzle but picked up the petrol one instead</td>
</tr>
<tr>
<td></td>
<td>Change the nozzle so that petrol nozzle does not fit diesel cars</td>
</tr>
</tbody>
</table>
Human Error Classification Scheme

- **Error Type**
  - Sensory
  - Memory
  - Decision
  - Action

- **Error Mechanism**
  - Two buttons looked similar and were in close proximity
    - Confusion
    - Distraction Preoccupation
  - Human variability
  - Intrusive thoughts / habits
  - Other slip

- **Performance Shaping Factors**
  - Clarity of information, equipment ergonomics, workload

Unintentionally pressed the wrong button on a control panel
HF-related capabilities for Incident Investigators

Basic
- Working knowledge of key HF issues and why they are important
- Avoids making assumptions
- Interviewing skills
- Uses systematic methods, checklists and prompts

Additional
- Keen interest in understanding human behavior
- Seeks to develop investigation-related skills and experience
- Willing to suspend judgement until analysis is complete
- Always seeks corroboration of evidence
Information gathering for Human Factors

Interviews:

- With eyewitnesses and people in the immediate context
- With people in the wider context
- Use of technology
Formulating recommendations

- The recommendations are the sum product of the work - relevance for HF integration and analysis quality
- Fewer, specific and relevant recommendations are judged more favourably
  - Stand-alone or incorporated into a wider scope?
  - Can behavior be eliminated?
- Identify the target group for each recommendations
- Hierarchy of controls is also highly relevant for any HF-related recommendations:
  - Improved design to ensure robustness to error or aid recovery
  - Improved supervision and checking to capture errors
  - Improved knowledge through training
Report preparation

- Generally, shorter reports are more graciously received!
- A dilemma: how to present Human Factors work in the report?
- Should it stand out, or should it be seamlessly integrated?
- How is this relevant for
  - The customer (responsible for implementing the actions)?
  - The general reader (interested, may transfer lessons learned into their own organisation)?
  - The expert reader (Human factors specialists, regulators)?
In conclusion

Assessing Human Factors in the Incident Investigation process can lead to improved and sustainable corrective actions.

- Do your investigators have the skills, qualities and tools to effectively analyse Human Factors?
- Is investigation capability in your organisation adequately managed and maintained?
- Is Human Factors sufficiently acknowledged and managed in your organisation?
  - Design and projects
  - Operations & maintenance
  - Management, supervision and leadership
- Are consequences just and fair?

but
Intended Purpose of ‘Just & Fair Culture’

- To identify, reward & encourage positive behavior consistently
- To provide standardization, transparency & objectivity in how people are dealt with when behavior falls below expectation, taking consideration of:
  - Intentional & unintentional behavior
  - Mitigating factors & aggravating factors
  - Circumstances that shaped the individuals performance (& were out of their control)
  - Line managers role in influencing behavior
- Support a consistent approach to performance management
Early models

- Early model used widely in the oil & gas industry.

- Criticised on several counts:
  - Starts with intentional (seen as a model for punishment)
  - Doesn’t incorporate positive behavior
  - Doesn’t differentiate (enough) between all the reasons for intentional behavior (violations)
  - Substitution test is not objective
  - Does not sufficiently consider the role of managers in influencing behavior

Figure 1. The original Just Culture model
Research & development in the concept

- A new model ‘Meeting Expectations’ was presented at 2008 SPE International Conference on Health, Safety, and Environment in Oil and Gas Exploration and Production that accounted for the weaknesses in the model.
- New versions of the framework adopted by large organisations.
- Queensland Gas (part of BG Group) presented their ‘Enhancing Safe Behaviors’ model at The SBS User Conference held in the Netherlands (2012).

SPE 111977
Meeting Expectations: A New Model for a Just and Fair Culture
Patrick Hudson. SPE Leiden University, Margot Vuijk Dockwise BV, Robin Bryden Shell International EPS-HSE, Dominika Biala Leiden University, Charles Cowley Shell International
# Just Culture

<table>
<thead>
<tr>
<th>Action / Behavior Description</th>
<th>Expected Safety Behavior</th>
<th>Proactive Safety Behavior</th>
<th>Exceptional Safety Behavior</th>
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<tr>
<td>The person performed as expected, following all the rules, guidance and good practice.</td>
<td>Yes ✔️</td>
<td>Yes ✔️</td>
<td>Yes ✔️</td>
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<tr>
<td>The person demonstrated proactive behaviors that go beyond everyday expectations, such as contributing ideas to reduce risk and improve procedures.</td>
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<td>The person demonstrated an exceptional contribution to the long-term development of a mature safety culture.</td>
<td>Yes ✔️</td>
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<td>Yes ✔️</td>
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**Behavior Type**

- **EXPECTED SAFETY behavior**
  - Good housekeeping; learning and following procedures; using the correct PPE and equipment for the job.

- **PROACTIVE SAFETY behavior**
  - Acting as an advocate for safety; coaching others to do the same; taking a positive and lead role in safety discussions; sharing knowledge and experience.

- **EXCEPTIONAL SAFETY behavior**
  - A series of actions taken to prevent a serious incident.
  - An idea that made a long-term positive difference to safety culture with involvement in turning the idea into reality.

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Describes 3 levels of behavior that meet or exceed expectations.
# Just Culture

## Action / behavior Description

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<th>Description</th>
<th>Consequences for the Individual</th>
<th>Consequences for the supervisor / line manager*</th>
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<tr>
<td>The person performed as expected, following all the rules, guidance and good practice.</td>
<td>The person demonstrated proactive behaviors that go beyond everyday expectations, such as contributing ideas to reduce risk and improve procedures.</td>
<td>Encouragement from the Team Leader or Manager if most or all of the team demonstrate the same key behaviors.</td>
<td>Encouragement from the Manager if most or all of the team demonstrate the same key behaviors.</td>
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<td>The person demonstrated an exceptional contribution to the long-term development of a mature safety culture.</td>
<td>Recognition and/or reward at the discretion of the line manager / supervisor, in line with HR policy.</td>
<td>Recognition and/or formal reward at the discretion of the line manager / supervisor / site management team, in line with HR policy.</td>
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<td>Examples include: Encouragement to “keep it going” and that the behaviors have been noted; Praise and thanks.</td>
<td>Examples include: Recognition and/or reward at the discretion of the line manager / supervisor, in line with HR policy.</td>
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<td>Examples include: Praise and thanks; Share “best practice” with colleagues; Recognition locally with the team and/or small site-based reward.</td>
<td>Examples include: Encouragement and praise; Feedback in performance review; Share best practice with peers; Recognition locally with the team.</td>
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<td>If this behavior is common to most of the team, then the line manager / supervisor should also receive similar recognition and/or reward, in line with HR policy.</td>
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## Example

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<th>EXCEPTIONAL SAFETY behavior</th>
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<td>A series of actions taken to prevent a serious incident. An idea that made a long-term positive difference to safety culture with involvement in turning the idea into reality.</td>
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*Where the behavior is displayed by a whole team, or regularly by members of their team*
**Just Culture**

Describes 2 unintentional and 4 intentional categories.

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Assessment of Consequences

**Were Mitigating or Aggravating Factors present?**

- These contributory factors should be identified during the investigation process and taken into account when assessing consequences.

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<th>Aggravating Factors</th>
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</thead>
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<tr>
<td>▶ include (but are not limited to) factors to do with other people’s example and expectations; quality of tools and equipment; excessive work pressure; poorly written procedures &amp; documentation; the environment; training &amp; experience; personal factors. e.g. if someone is fatigued they are more likely to make poor decisions.</td>
<td>▶ the individual has shown a lack of care, caution or attention where the situation requires it. e.g. driving into a pedestrian whilst they are crossing at a recognised pedestrian crossing</td>
</tr>
<tr>
<td>If a behavior was shaped by mitigating factors this must be considered and impact the consequence for the individual favorably.</td>
<td>▶ there is a personal history of similar incidences</td>
</tr>
<tr>
<td></td>
<td>▶ previous warnings have been given</td>
</tr>
<tr>
<td></td>
<td>▶ conditions to manage the error were in place.</td>
</tr>
<tr>
<td></td>
<td>If a behavior was shaped by aggravating factors this must be considered and impact the consequence for the individual adversely.</td>
</tr>
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</table>
# Just Culture

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<th>Recommended level of consequence</th>
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<td>No formal discipline. Coach in raising awareness of the sources of potential error. Involve in implementing solution to prevent future re-occurrence.</td>
<td>No formal discipline. Coach in raising health and safety awareness. Ensure knowledge of rules and procedures to perform tasks correctly.</td>
<td>Consider an informal warning and discussion of safe behaviors, including the need to speak up when a situation is unsafe.</td>
<td>Consider a more formal warning in line with disciplinary procedures / corrective action plan / change of job role / impact on performance appraisal.</td>
<td>Likely to involve formal warning and possible suspension / dismissal.</td>
<td></td>
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## Mitigating Factors

- No formal discipline. Coach in raising awareness of the sources of potential error. Involve in implementing solution to prevent future re-occurrence.

## Aggravating Factors

- Consider an informal warning and discussion of safe behaviors, including the need to speak up when a situation is unsafe.

## Recommended Level of Consequence

- LOWEST: No formal discipline. Coach in raising awareness of the sources of potential error. Involve in implementing solution to prevent future re-occurrence.
- LOW: No formal discipline. Coach in raising health and safety awareness. Ensure knowledge of rules and procedures to perform tasks correctly.
- MEDIUM: Consider an informal warning and discussion of safe behaviors, including the need to speak up when a situation is unsafe.
- HIGH: Consider a more formal warning in line with disciplinary procedures / corrective action plan / change of job role / impact on performance appraisal.
- SEVERE: Likely to involve formal warning and possible suspension / dismissal.

---

**Describes what the level of consequence should be for the individual for each category. Considers whether it was unintentional or intentional, and what the mitigating or aggravating factors were.**
# Just Culture

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**Mitigating Factors**

Coaching in error prevention and management – focus on reducing the causes of error.

Consider an informal warning. Coaching on managing error and acting on the warning signs.

Consider an informal warning. Coaching on observing and addressing unsafe behaviors early and encouraging a more open culture in the team.

Consider a more formal warning in line with disciplinary procedures leadership skills development and coaching on how to ensure compliance.

Likely to involve a more formal warning in line with disciplinary procedures, leadership skills development and coaching on how to ensure compliance.

**Aggravating Factors**

Describes what the level of consequence should be for the supervisor/manager for each category. Considers whether it was unintentional or intentional, any mitigating or aggravating factors, the level of supervisor awareness of the behavior and the level of effort put into managing it.
Example 1

- A mechanic was working on top of the boiler of an engine and needed to open the valve in order to use a pneumatic tool. When the mechanic was about to go down the stairs to open the valve, he saw a 2nd mechanic walking in the hallway of the air intake filters and signaled to him to open the valve.

- The 2nd mechanic agreed, and instead of walking toward the steps in order to go down from the hallway of the air intake filters toward the level of the floor where the valve was located, the mechanic decided to go down in front of the boiler, passing through the safety railing, stepping on the steam pipe. But when he did so, one of his feet hit and broke a valve one half inch in diameter on the steam pipe. The pressurized steam struck the inside of his legs, burning him and causing the mechanic to fall to the floor.
Incident behaviors

This incident involved two key behaviors (both relating to the 2\textsuperscript{nd} mechanic):

1. The 2\textsuperscript{nd} mechanic, whilst making his way to a lower level to turn a valve, took a shortcut in front of the boiler through the safety railings instead of the designated safe route. This resulted in an increased risk of scalding and damage to equipment. This was the third occasion this type of behavior has been observed and there were no mitigating factors.
   - This was an intentional behavior. A shortcut was taken for a personal gain (saving time).

2. The 2\textsuperscript{nd} mechanic, whilst crossing the steam pipe, hit & broke a valve on the steam pipe with his foot. This resulted in a release of pressurised steam that burned his leg.
   - This was an unintentional error.
### Applying the Just Culture model

**Behavior:** The 2nd mechanic, whilst making his way to a lower level to turn a valve, took a shortcut in front of the boiler through the safety railings instead of the designated safe route. This resulted in an increased risk of scalding and damage to equipment. This was the third occasion this behavior has been observed and there were no mitigating factors.

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<td>Step 1: Determine the behaviour type</td>
<td>Yes</td>
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### Step 2:
Were mitigating factors present?
Were aggravating factors present?

<table>
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<th>Aggravating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
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### KEY for Individual Consequences

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<td>No formal discipline. Coach in raising awareness of the sources of potential error. Involve in implementing solution to prevent future re-occurrence.</td>
<td>No formal discipline. Coach in raising health and safety awareness. Ensure knowledge of rules and procedures to perform tasks correctly.</td>
<td>Consider an informal warning and discussion of safe behaviors, including the need to speak up when a situation is unsafe.</td>
<td>Consider a more formal warning in line with disciplinary procedures / corrective action plan / change of job role / impact on performance appraisal.</td>
<td>Likely to involve formal warning and possible suspension / dismissal.</td>
<td></td>
</tr>
</tbody>
</table>
Positive examples

Consider this positive behavior:

2. A line manager identified an issue with a standard procedure that was likely to cause confusion to colleagues. She suggested significant improvements and helped implement and supported the implementation of an improvement plan.

<table>
<thead>
<tr>
<th>Action / Behavior Description</th>
<th>The person performed as expected, following all the rules, guidance and good practice.</th>
<th>The person demonstrated proactive behaviors that go beyond everyday expectations, such as contributing ideas to reduce risk and improve procedures.</th>
<th>The person demonstrated an exceptional contribution to the long-term development of a mature safety culture.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavior Type</td>
<td>EXPECTED SAFETY behavior</td>
<td>PROACTIVE SAFETY behavior</td>
<td>EXCEPTIONAL SAFETY behavior</td>
</tr>
<tr>
<td>Example</td>
<td>Good housekeeping; learning and following procedures; using the correct PPE and equipment for the job.</td>
<td>Acting as an advocate for safety; coaching others to do the same; taking a positive and lead role in safety discussions; sharing knowledge and experience.</td>
<td>A series of actions taken to prevent a serious incident. An idea that made a long-term positive difference to safety culture with involvement in turning the idea into reality.</td>
</tr>
</tbody>
</table>
Benefits

- Supports more consistent praise and reward for positive safety behaviors
- Gives more guidance, tools, and encouragement to reward safe behaviors
- A fair & transparent way of treating those involved in incidents
- Fosters a more open and trusting culture where criticism, incidents, near-misses and suggestions can be made without any fear of retribution
- Reduces the likelihood of disruption & complaints that people are being treated unfairly
Issues & considerations

- AVOID a heavy handed top-down approach with an emphasis on discipline
  - Involve the workforce; seek feedback and agreement

- Relies on the investigators identifying the human factors elements e.g. describing and identifying type of behavior

- Most incident involve several behaviors. Any one individual may have performed several behaviors which contributed to the incident. May have to apply more than one behavior to the JUST culture model to understand the consequence.

- Needs a procedure to guide usage
Thank You

Comments & Questions?