Pragmatic Inclusion of Human Factors In Incident Investigation

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Norman Ritchie has worked in oil and gas for over 30 years. Educated as a Mechanical Engineer at the University of Glasgow in Scotland, he has gained broad expertise through engineering and management positions in exploration, production and capital projects. Ritchie's experience covers the full hydrocarbon development life cycle from conceptual design to decommissioning.

Since 1997, Ritchie has consulted in project management and enterprise risk management. As a Director of vPSI Group, LLC, which he co-founded in 2003, Ritchie provides consulting and training in performance measurement and improvement, principally in the areas of risk, loss prevention, safety, problem solving and human factors.

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What Is / Are Human Factors?

<table>
<thead>
<tr>
<th>OGP (From OGP 368)</th>
<th>UK HSE (From HSE Human Factors Briefing Note No. 1)</th>
<th>SPE (From SPE-170575-TR Human Factors Technical Report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CULTURE/WORKING ENVIRONMENT</td>
<td>Leadership and Culture</td>
<td>Communication of Risk and Decision-Making</td>
</tr>
<tr>
<td>• Social and community values</td>
<td>• Organizational change</td>
<td>• Individual and Team Capacity</td>
</tr>
<tr>
<td>• Communication flow within</td>
<td>• Organizational culture</td>
<td>• Collaborative and Distributed Team Working</td>
</tr>
<tr>
<td>• Acceptance and willingness</td>
<td>• Human Factors in Design</td>
<td>• Commercial and Contractual Environment</td>
</tr>
<tr>
<td>• Language, geography, climate</td>
<td>• Human Factors in Design</td>
<td>• Workload Transition</td>
</tr>
<tr>
<td>• Management support of safety systems</td>
<td>• Human Factors in Design</td>
<td>• Assurance of Safety-Critical Human Activities</td>
</tr>
<tr>
<td>MANAGEMENT SYSTEMS</td>
<td>• Leadership and Culture</td>
<td>• Human Factors in Design</td>
</tr>
<tr>
<td>• Compatible organizational goals</td>
<td>• Job safety analysis</td>
<td>• Assurance of Safety-Critical Human Activities</td>
</tr>
<tr>
<td>• Job safety analysis</td>
<td>• Quality of operating procedures</td>
<td>• Investigation and Learning from Incidents</td>
</tr>
<tr>
<td>• Quality of operating procedures</td>
<td>• Communication of risk</td>
<td></td>
</tr>
<tr>
<td>• Clear interfaces/responsibilities</td>
<td>• Human Factors in Design</td>
<td></td>
</tr>
<tr>
<td>• Leadership</td>
<td>• Commercial and Contractual Environment</td>
<td></td>
</tr>
<tr>
<td>• Safe working practices</td>
<td>• Work/task design issues</td>
<td></td>
</tr>
<tr>
<td>• Work/task design issues</td>
<td>• Leadership</td>
<td></td>
</tr>
<tr>
<td>PEOPLE</td>
<td>• Fatigue and stress</td>
<td>• Leadership</td>
</tr>
<tr>
<td>• Fatigue and stress</td>
<td>• Training systems</td>
<td>• Behavioral safety</td>
</tr>
<tr>
<td>• Training systems</td>
<td>• Workload and shift schedule</td>
<td>• Behavioral safety</td>
</tr>
<tr>
<td>• Workload and shift schedule</td>
<td>• Behavioral safety</td>
<td>• Physical and mental fitness</td>
</tr>
<tr>
<td>• Behavioral safety</td>
<td>• Physical and mental fitness</td>
<td></td>
</tr>
<tr>
<td>FACILITIES / EQUIPMENT</td>
<td>• Physical and mental fitness</td>
<td></td>
</tr>
<tr>
<td>• Ergonomics</td>
<td>• Design</td>
<td></td>
</tr>
<tr>
<td>• Design</td>
<td>• Maintenance</td>
<td>• Design</td>
</tr>
<tr>
<td>• Maintenance</td>
<td>• Reliability</td>
<td>• Design</td>
</tr>
<tr>
<td>• Reliability</td>
<td>• Physical layout of facilities and site</td>
<td>• Design</td>
</tr>
<tr>
<td>• Physical layout of facilities and site</td>
<td>• Noise, lighting, toxics, radiation</td>
<td>• Design</td>
</tr>
</tbody>
</table>

How much is covered elsewhere e.g. in PSM, or in a different organizational function? Where to start?

Common thread is Human Error / Failure

Challenges

• Large number of Unplanned Events
• Limited investigative resources
• Causal analysis often resource intensive
• High proportion of Unplanned Events have a Human Failure component
• Evidentiary basis often low fidelity
• Humans are complicated and unavoidable
• Certain types of Human Failure are not preventable
• Corrective Actions differ according to the Human Failure type involved
Human Failure in an Unplanned Event

Routine Violations
Normalized deviance: “This is how we do it around here”. The workplace consensus is that rules and processes are only selectively applicable.

Situational Violations
Non-compliance driven by context specific and temporary factors such as lack of appropriate equipment, pressure to complete a task, insufficient manpower or time.

Exceptional Violations
Violations arising from unusual circumstances, for example if an emergency arises, a piece of critical equipment breaks down, or something goes wrong during task execution.
Human Failure in an Unplanned Event

Evidentiary basis must be sufficient to differentiate between:

- Slip
- Lapse
- Mistake
- Violation

Evidentiary basis must also be sufficient to determine whether At-Risk Act are:

- Enabled
- Difficult
- Non-Enabled

Human Failure in an Unplanned Event

Enabled
The choice between a Safe or At-Risk act or behavior is entirely within the person's control; there are no external drivers (except possibly group norms).

Difficult
Safe performance of the task has obstacles imposed upon it (e.g. time required to fetch equipment located remotely from the task site). Safe behavior is possible but the At-Risk act or behavior is easier. Before engaging in an At-Risk act or behavior, the worker may conduct a form of cost / benefit analysis, with cost being based on a risk assessment. Note that this process may be unconscious.

Non-Enabled
The worker is forced to engage in an At-Risk act or behavior; there is no other way to perform the task at hand. (e.g. equipment required to do the task safely is not available).
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In Incident Investigation

Pragmatic Resource Investment

- Should all Human Failure related Unplanned Events be fully investigated?
- Which Human Failure related Unplanned Events are worth investing resources in to prevent reoccurrence?
- How do you decide?

Event / Action Process Overview

Unplanned Event → Preventable & Significant? → NO

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Context: Preventability

- Preventable
- Unpreventable

Organization chooses not to prevent
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Determining Risk-Based Significance

Unplanned Event

- Energy release
- Chemical release
- Mobile equipment operation
- Fall from height

For each category, determine (yes or no) if event exceeds or could have exceeded company risk acceptance criteria

Note: this process applies to both preventable and unpreventable Unplanned Events

High risk vehicle collision
- Excavation collapse
- Confined space issue
- Personal injury

Significant Event

Not a Significant Event

Event / Action Process Overview

Unplanned Event

Preventable & Significant?

YES

Causal Analysis (If Required / Possible)

Data Quality Ladder

Fact
- Precise, accurate, verifiable, measurable
- Logical inference

Assumption
- Something taken for granted; a supposition
- May be based on gut feelings, experience

Opinion
- A strongly held conviction

Hearsay
- Second- or third-hand information
- May be “wild” or “educated” (WAGs or SWAGs)

Fantasy
- No basis in reality

Causal Analysis (If Required / Possible)
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Resource Efficient Analysis

<table>
<thead>
<tr>
<th>Event Complexity</th>
<th>Effort Required</th>
<th>Required Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td>LOW</td>
<td>Two Box (Acts)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Why</td>
</tr>
<tr>
<td></td>
<td>HIGH</td>
<td>5 Why</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cause &amp; effect analysis tools</td>
</tr>
</tbody>
</table>

* C&E: Cause and Effect analysis

Event / Action Process Overview

Unplanned Event → Preventable & Significant? → NO → Causal Analysis (If Required / Possible) → Immediately Preventable?

Purpose of resource spend is to prevent Unplanned Event from happening again.
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Unplanned Event

What is happening now? Current Undesirable Acts of People

Related to Human Error?
• Slip
• Lapse
• Mistake
• Violation

What will happen? Desired Future Acts of People

Immediately Preventable?

If no such action can be defined, Unplanned Event is not immediately preventable.

Implement an achievable Corrective Action that will result in this behavior change in the real world.

Validation of Corrective Actions

Corrective Action

Cause something to happen

Relevant and effective in preventing the unplanned event

+ that addresses Human Factors (reliably, in real life)
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Examples of HF Corrective Actions

<table>
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<tr>
<th>Human Failure Type</th>
<th>Description</th>
<th>Example Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slip</td>
<td>Act other than intended, Action-based</td>
<td>Difficult to eliminate the human failure completely. Reduce probability of error escalating via independent verification of critical items. Make work process error tolerant.</td>
</tr>
<tr>
<td>Lapse</td>
<td>Act other than intended, Memory-based</td>
<td></td>
</tr>
<tr>
<td>Mistake</td>
<td>Act as intended, should have done something else, Rule-based</td>
<td>What if analysis generated scenario based training. Job / system specific competency training. Procedure revision. Improved system data delivery.</td>
</tr>
<tr>
<td>Mistake</td>
<td>Act as intended, should have done something else, Knowledge-based</td>
<td></td>
</tr>
<tr>
<td>Violation (Routine)</td>
<td>Act as intended, should have done something else, Deliberate Non-Compliance</td>
<td>Depends on whether Violations are Enabled, Difficult or Non-Enabled. Engaged supervision increasing reward probability for desired behaviors and negative outcomes for Violations. Modify work environment to eliminate forcing conditions. Eliminate unnecessary rules and bureaucracy.</td>
</tr>
<tr>
<td>Violation (Situational)</td>
<td>Act as intended, should have done something else, Deliberate Non-Compliance</td>
<td></td>
</tr>
<tr>
<td>Violation (Exceptional)</td>
<td>Act as intended, should have done something else, Deliberate Non-Compliance</td>
<td></td>
</tr>
</tbody>
</table>

* Note these are only Corrective Actions when validated in context for a specific Unplanned Event

Event / Action Process Overview

Unplanned Event → Preventable & Significant? → YES → Causal Analysis (If Required / Possible)

- Potentially problematic wrt Human Factors issues
- Immediately Preventable?
  - NO → Consequence Management
  - YES → Preventive / Corrective Action

NO → OR / AND → Long Lead Corrective Action
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Actions You Can Take

- Gap / Opportunity Analysis of current processes from Human Factors perspective
- Implement significance and preventability filters
- Facilitate HAZOP-like Human Factors reviews
- Develop and train onsite Data / Evidence Gathering Protocol to allow incorporation of Human Factors in incident investigation process
- Train personnel in resource efficient and effective analysis of Human Factors issues
- Train personnel in development of efficient and effective corrective actions against Human Factors issues
- Measure the effectiveness of the organization’s response to Unplanned Events, including those involving Human Factors

* Note “Train” in this context means impart and maintain competence

Questions?

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