Safety Culture Condition Monitoring

*Can predictive models be applied to address the Human Factor?*
Final Report on the Investigation of the Macondo Well Blowout

Deepwater Horizon Study Group (DHSG), Catastrophic Risk Management (CCRM) at the University of California Berkeley

“This disaster was preventable had existing guidelines and practices been followed.”

“Once the blowout occurred, additional weaknesses in the system’s barriers and defenses were exposed and exploited to develop the Macondo well disaster.”

“While this particular disaster involves a particular group of organizations, the roots of the disaster transcend this group of organizations. This disaster involves an international industry and its governance.”
Barrier or “Swiss Cheese” Model (Jim Reasons)
## Human factor research findings on major accidents...

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>60%</strong></td>
<td>60% of all incidents identified as human factors</td>
</tr>
<tr>
<td><strong>80%</strong></td>
<td>80% will have a cause related to human performance</td>
</tr>
<tr>
<td><strong>14.2%</strong></td>
<td>14.2% annualized cost of accidents and poor safety performance</td>
</tr>
</tbody>
</table>

Human factors guidance for selecting appropriate maintenance strategies for safety in the offshore oil and gas industry (RR213)

Safety and performance enhancement in drilling operations by human factors intervention (RR264)

The role of managerial leadership in determining workplace safety outcomes (RR044)
## Research findings on human factor elements that are key indicators of safety culture

<table>
<thead>
<tr>
<th>Leadership</th>
<th>“Clear and decisive leadership is required within individual companies.”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective Communication</td>
<td>“...communications were, or should be, a two-way process, and hence provided essential feedback to management.”</td>
</tr>
<tr>
<td>Workforce Engagement</td>
<td>“There can be no doubt that, if the industry is to reach the level of performance required, highly motivated staff at all levels will be required.”</td>
</tr>
<tr>
<td>Continuous Learning</td>
<td>“...the industry should learn the lessons from previous accidents, near misses and the analysis of information regarding the non-compliant behavior of people and systems…”</td>
</tr>
<tr>
<td>Just Culture</td>
<td>“...the industry the development of a acts and ‘blame culture’ culture in which information is communicated without fear of recrimination and blame…”</td>
</tr>
</tbody>
</table>

1 A review of safety culture and safety climate literature for the development of the safety culture inspection toolkit (RR367 HSE Safety Executive)
“…<the research> identified perceived management commitment to safety, willingness to report accidents, and perceived supervisor competence as significant predictors of safety performance”

“…linear regression, favorable communication scores significantly predicted lower accident proportions”

“Structural equation modeling is well suited to safety climate research because theoretical chains of influence among the dimensions of safety climate may be explored.”

---

1 Factoring the human into safety: Translating research into practice Benchmarking human and organisational factors in offshore safety (RR059) HSE Executive
Putting the pieces together to monitor safety performance…

Safety Management System

Organizations should have effective systems in place for the management and co-ordination of safety.

Diagnosis Models

Leadership
Communication
Engaged Workforce
Continuous Learning
Just Culture

Confidence

SMS

Most Confident Assessment: 29.3

- Collect evidence of an effective SMS
- Mine patterns from un/structured data
- Run models for broad assessment
- Score confidence in each assessment based on evidence so far

© 2012 IBM Corporation
Putting the pieces together to monitor safety performance…

Safety Climate Surveys / Audits

Sustained levels of employee participation and interest in climate surveys has more to do with visible actions being undertaken as a result, rather than undertaking the survey itself.

Diagnosis Models

- Leadership
- Communication
- Engaged Workforce
- Continuous Learning
- Just Culture

Most Confident Assessment: 42.8

- Collect climate surveys (annual or on-going)
- Mine patterns from surveys and interviews
- Run models for broad assessment
- Score confidence in each assessment based on evidence so far
Let's build a smarter planet: Safety Culture Condition Monitoring

Putting the pieces together to monitor safety performance...

Integrity / Reliability Management

Asset integrity programs help operators identify and reduce safety risks before they escalate, but can also play a major role in achieving operational excellence and extending the life of ageing assets.

Most Confident Assessment: 67.2

- Collect integrity and reliability data
- Mine patterns from integrity and reliability data
- Run models for broad assessment
- Score confidence in each assessment based on evidence so far
Putting the pieces together to monitor safety performance...

**Fleet / Industry Data Sources**

Broader data set beyond a single system, single region or fleet, across the industry including oilfield services firms, equipment manufacturers, academics, industry associations, regulators…

**SMS**

- risk assessments
- operating procedures
- permit to work
- maintenance management
- management of change
- incident investigations
- audit and action tracking

**Climate Survey**

- leadership
- supervision
- competency
- training
- engaged workforce
- Just culture

**Integrity Mgmt**

- engineering standards
- corrosion
- reliability
- safety critical equipment
- maintenance history
- instrumentation

**Fleet / Industry**

- fleet performance
- OEM technical alerts
- configuration notices
- research models
- standards updates
- industry climate survey
- technical upgrades

**Diagnosis Models**

- Leadership
- Communication
- Engaged Workforce
- Continuous Learning
- Just Culture

**Confidence**

- Most Confident Assessment: 84.2

- Collect fleet and industry data feeds
- Mine patterns from fleet and industry data
- Run models for broad assessment
- Score confidence in each assessment based on evidence so far

© 2012 IBM Corporation
Concluding remarks…

80% will have a cause related to human performance

Safety and performance enhancement in drilling operations by human factors intervention\(^1\)

Structural equation modeling is well suited to safety climate research

“The stepwise procedure identified perceived management commitment to safety, willingness to report accidents, and perceived supervisor competence as significant predictors of safety performance”\(^2\)

Technical capabilities are available today…

A system with the capability to understand the meaning and context of human language, and rapidly process information to find precise answers to complex questions – holds enormous potential for businesses
Thank You

William (Bill) Ely
Global Industry Executive
Enterprise Asset Management, Oil and Gas
IBM Software Group

Mobile: +1 843 329 9575
Email: wsely@us.ibm.com