Safety Auditing Around the Well Site: A Case Study from an On-Shore Drilling Contractor

George Bunker and Craig Halpern
Safety Auditing Around the Well Site:
A Case Study from an On-Shore Drilling Contractor

Craig A. Halpern, CSP – VP IMA Risk Control
George Bunker – Safety Director – Frontier Drilling
Importance of Injury Prevention

To make sure you return home safely tonight so you can enjoy your time off!
## Importance of Injury Prevention

Is Occupational Safety Really Improving?

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2003</th>
<th>...</th>
<th>2009</th>
<th>2013</th>
</tr>
</thead>
</table>
| **TCR - Total Recordable Case Rate**  
(100 employees) | 5.3  | 5.0  |     | 3.9  | 3.7  |
| **TCR**                       | 3.4  | 1.8  |     | 1.6  | 2.1  |
| Oil & Gas Industry            |      |      |     |      |      |
| (Explor/Drill/Prod)           |      |      |     |      |      |
| **DART - Days Away, Restricted, and Transferred**  
(DART)  
(100 employees) | 2.8  | 2.6  |     | 1.9  | 1.8  |
| **DART - Oil & Gas Industry**  
(Explor/Drill/Prod) | 2.2  | 0.8  |     | 0.9  | 1.3  |

Do low injury rates ensure everyone will return home safe tonight?
Fatality Rates

The Oil & Gas Industry still has room for improvement

<table>
<thead>
<tr>
<th></th>
<th>2003</th>
<th>2004</th>
<th>...</th>
<th>2010</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupational Fatality Rate (per 100,000 employees)</td>
<td>4.0</td>
<td>4.1</td>
<td></td>
<td>3.6</td>
<td>3.2</td>
</tr>
<tr>
<td>Fatality Rate Oil &amp; Gas Industry (Explor/Drill/Prod)</td>
<td>21.8</td>
<td>43.9</td>
<td></td>
<td>17.4</td>
<td>16.0</td>
</tr>
</tbody>
</table>
Top 10 OSHA Citations in Energy

- 1910.23 Floor Openings/Guardrails
- 1910.130 PPE/Respiratory Protection/H₂S
- 1910.147 Lockout/Tagout
- 1910.184 Slings/Hoisting Equipment
- 1910.212 Machine Guarding
- 1910.305 Electrical Wiring
- 1910.1200 HazCom
- 1910.151 First Aid
- 1910.157 Fire Extinguishers
- 5(a)(1) Improper set up of Drilling Rig
Injury Statistics Reported to IADC
US Land Based Drilling Rigs

Lost Time Incident Rate
OSHA TRIR
# Injuries Statistics Reported to IADC

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experience on Drilling</td>
<td>60% of Incidents with people less than 1 year of experience</td>
</tr>
<tr>
<td>Position</td>
<td>Floorhand (53%)</td>
</tr>
<tr>
<td>Type of Incident</td>
<td>Caught Between (28%) Struck By (27%)</td>
</tr>
<tr>
<td>Equipment</td>
<td>Other (27%) Pipe/Collars/Tubulars (14%)</td>
</tr>
<tr>
<td>Work Activity</td>
<td>Tripping Pipe (21%) Rig Move (17%)</td>
</tr>
<tr>
<td>Part of the Body</td>
<td>Fingers/Hands (35%)</td>
</tr>
</tbody>
</table>
Top 10 Reasons People Don’t Return Home from the Oil Patch
Derrick man on a drilling rig was struck in the head by a stand of pipe and the traveling block. The crew was tripping in when the derrick man lost control of a stand of pipe causing it to fall into the derrick striking it and the traveling block. The pipe and traveling block recoiled back to the derrick board striking the employee in the head.
# 9 – Complacency

- A derrick hand fell approximately 50ft from the derrick board when he did not connect to the fall restraint after climbing the derrick. The employee climbed up the ladder using a climb assist tie-off. When he reached the derrick board, he unhooked the climb-assist from his lanyard when he exited the ladder. He did not connect to the restraint fall protection and fell from the derrick board.
Three oil field workers were hospitalized with burns when a crude well kicked during drilling operation, found an idling ignition source, and fire engulfed drilling rig. Four workers received burns from the incident. After evacuating the rig floor, two employees returned to the rig floor to turn off the racing diesel engines, and other two went under the rig floor to activate the blow-out preventers to close in the well. Ignition occurred before the BOP’s could be activated and the fire ensued. All four employees were wearing FRC.
While digging for a pipeline installation, an underground power line was struck. It was shown to be 2 feet away from the excavation by the locate service. Locates are only good +/- 18 inches.
#6 – Loading/Unloading

- Truck driver for a poly pipe company was making a delivery to a well site. He was struck by a coil of poly pipe when it was unstrapped and fell from trailer. The 500 ft coil of poly pipe weighed approximately 1,700 pounds.
During a flow back after a frac, an employee lit up a cigarette down wind and within the established no smoking boundaries. An improper sparking device was used and the pilot light stuffed out. The employee was engulfed in flames.
A water contractor at a frac job was struck by a high pressure hose while priming the water pump. The employee opened the 4” bypass valve fully causing the 4” flexible hose to whip striking him in the head. He fell into the water pit unconscious and drowned. The supply water pit and 1,200 p.s.i. pump was located approximately one mile from the fracking operation.
# 3 – Failure to Pre-Plan/Conduct JSA

- A roustabout crew was removing a 20+ year old upright Heater Treater. The side of the treater with the fixed ladder and burner exhaust had been leaking water at the base. All of the piping had been disconnected when an employee climbed up the ladder to attach the winch line. The Heater Treater fell over crushing the employee.
# 2 – Lack of Education/Communication

- A Work over unit was pulling tubing out of the hole through an X-ray Tube-o-Scope. The X-ray contractor failed to install the nuts to bolt the X-ray to the top of the BOP. The anchor came up earlier than the well chart said. The X-ray pulled up, forcing the work table to bend at the hinge, throwing the crew off of the table, one striking his head on the tongs.
# 1 – Improper Maintenance

- Drilling rig crew was tripping out of the hole when the traveling block fell to the rig floor. A joint of pipe was being hoisted out of the hole with the floor hand working at the elevators on the rig floor when the traveling block fell striking the floor hand. A retaining device on the wire rope that hoisted the traveling block up and down came off allowing block to fall resulting in fatal injuries to the floor hand.
Safety Management Best Practices

- Management Commitment
- Staffing for Safety
- Project Pre-Planning
- Safety Orientation/Job Specific Training
- Employee Involvement in Safety
- Accident Investigation
- Substance Abuse Testing
- Subcontractor Management
- Metrics and Recognition at all levels
- **Safety Evaluation and Hazard Identification**
Safety Assessments

W. Edwards Deming was famous for stating “You can only manage what you can measure.”

Furthermore, most Quality focused organizations use the Plan, Do, CHECK, Act.....Model to drive improvement.

And in our industry, when your life and livelihood depend on a drilling rig working 24 x 7 x 365, on a jobsite that is constantly changing, with a variety of contractors and employees coming and going....

Safety Assessments/Audits still can be a powerful tool to ensure accountability for safety, and regularly elevate the attention to safety, where there are a variety of things competing for the attention of the crew.
Assessment Program Highlights

Frontier Drilling EHS Management System (FDMS)
Four Year Plan of Incident Reduction

Goal/ Projections

<table>
<thead>
<tr>
<th>Year</th>
<th>Qtr 1</th>
<th>Qtr 2</th>
<th>Qtr 3</th>
<th>Qtr 4</th>
<th>2017</th>
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<tbody>
<tr>
<td>2012</td>
<td>3.62</td>
<td>3.00</td>
<td>2.49</td>
<td>2.07</td>
<td>1.72</td>
</tr>
<tr>
<td>Qtr 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qtr 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qtr 3</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Qtr 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.64</td>
</tr>
</tbody>
</table>

IMA
FRONTIER DRILLING
December 2-3, 2014
Four Year Plan of Incident Reduction

Goal/Projections

Year End Actual

2012: 3.62
Quarter 1: 3.00
Quarter 2: 2.49
Quarter 3: 2.07
Quarter 4: 1.72
2017: 0.64

IMA • FRONTIER DRILLING
December 2-3, 2014
Four Year Plan of Incident Reduction (Eastern Division)

Goal/Projections

- 2012: 6.3
- Qtr 1: 5.23
- Qtr 2: 4.34
- Qtr 3: 3.60
- Qtr 4: 2.99
- 2017: 0.51

IMA
FRONTIER DRILLING
December 2-3, 2014
Four Year Plan of Incident Reduction (Eastern Division)

Goal/Projections

<table>
<thead>
<tr>
<th>Year</th>
<th>Goal/Projections</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>6.3</td>
</tr>
<tr>
<td>Qtr 1</td>
<td>5.23</td>
</tr>
<tr>
<td>Qtr 2</td>
<td>4.34</td>
</tr>
<tr>
<td>Qtr 3</td>
<td>3.60</td>
</tr>
<tr>
<td>Qtr 4</td>
<td>2.99</td>
</tr>
<tr>
<td>2017</td>
<td>1.78</td>
</tr>
</tbody>
</table>
Eastern year End TRIR

2012: 6.30
2013: 1.78
Risk Reduction = Incident reduction

Rollout: 732
2013 end: 357

Combined Risk Scores: 6.41
TRIR: 1.78
Performance Measurement

Rig Manager Score

<table>
<thead>
<tr>
<th>Positions</th>
<th>Helms</th>
<th>Howarth</th>
<th>Loftis</th>
<th>Duffield</th>
<th>Herrera</th>
<th>Shaffer</th>
<th>Taylor</th>
<th>Hatfield</th>
<th>Nelson</th>
<th>Springer</th>
<th>Bryan</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>17</td>
<td>17</td>
<td>15</td>
<td>11</td>
<td>10</td>
<td>20</td>
<td>12</td>
<td>84</td>
<td>26</td>
<td>63</td>
<td>75</td>
</tr>
</tbody>
</table>

Positions

<table>
<thead>
<tr>
<th>Positions</th>
<th>COMPANY MAN</th>
<th>RIG MANAGER</th>
<th>DRILLER</th>
<th>DERRICKHAND</th>
<th>MOTORMAN</th>
<th>FLOORHAND</th>
<th>EHS</th>
<th>SUPER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18.2%</td>
<td>29.4%</td>
<td>4.6%</td>
<td>6.8%</td>
<td>7.8%</td>
<td>8.0%</td>
<td>6.4%</td>
<td>11.0%</td>
</tr>
</tbody>
</table>
# Ownership and Risk Severity

## 4. DERRICKHAND

<table>
<thead>
<tr>
<th>Section</th>
<th>Comment</th>
<th>Picture #</th>
<th>Matrix</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.14</td>
<td>Caustic barrel warning signs are damaged and not legible</td>
<td>5</td>
<td>1 Probable Caused</td>
<td>4</td>
</tr>
<tr>
<td>4.35</td>
<td>PPE Box lid hinge is coming apart</td>
<td>6</td>
<td>0 Likely Caused</td>
<td>4</td>
</tr>
</tbody>
</table>

### Section Score: 2

## 5. MOTORMAN

<table>
<thead>
<tr>
<th>Section</th>
<th>Comment</th>
<th>Picture #</th>
<th>Matrix</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.48</td>
<td>Although housekeeping in generator area is excellent, there was a broken fluorescent bulb found concealed in the light box</td>
<td>11</td>
<td>2 Feasible Caused</td>
<td>2</td>
</tr>
</tbody>
</table>

### Section Score: 2

## 6. FLOORHANDS

<table>
<thead>
<tr>
<th>Section</th>
<th>Comment</th>
<th>Picture #</th>
<th>Matrix</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.13</td>
<td>Grinder guard not in place</td>
<td>31</td>
<td>5 Probable Caused</td>
<td>6</td>
</tr>
<tr>
<td>10.01</td>
<td>Pipe rack without chalks in place</td>
<td>21</td>
<td>3 Probable Caused</td>
<td>6</td>
</tr>
<tr>
<td>14.05</td>
<td>Tong weight buckets are not draining water properly causing buildup of water. Tongs are raising on their own presenting a risk of hand injury during operation</td>
<td>N/A</td>
<td>3 Unlikely Caused</td>
<td>6</td>
</tr>
<tr>
<td>14.33</td>
<td>Broom handle broken in half presenting very sharp edges</td>
<td>32</td>
<td>2 Probable Caused</td>
<td>6</td>
</tr>
<tr>
<td>7.69</td>
<td>Light cover on Rig Manager house is broken</td>
<td>14</td>
<td>1 Feasible Caused</td>
<td>6</td>
</tr>
<tr>
<td>14.12</td>
<td>Hammer handle is damaged</td>
<td>30</td>
<td>1 Probable Caused</td>
<td>6</td>
</tr>
</tbody>
</table>

### Section Score: 14

## 7. EHS

<table>
<thead>
<tr>
<th>Section</th>
<th>Comment</th>
<th>Picture #</th>
<th>Matrix</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.02</td>
<td>Hands are receiving First Aid/ CPR training but the certification cards are not getting to the hands or the office</td>
<td>N/A</td>
<td>1 Likely Caused</td>
<td>7</td>
</tr>
<tr>
<td>2.35</td>
<td>Emergency response plan not yet developed for company</td>
<td>N/A</td>
<td>1 Probable Caused</td>
<td>7</td>
</tr>
</tbody>
</table>

### Section Score: 14
Risk Ownership

74.22% Frontier
25.78% Operator
Profile Each Asset

Rig 23

- Arrival To Location: 8.5
- Mud Pump Area: 16
- Mud Tanks & Pits: 3.5
- Material Handling Equipment: 9.5
- Generator Area & Electrical Systems: 9
- Fire Protection: 18.5
- Flammable Liquid: 5.5
- Pipe Rack Area: 2.5
- BOP's: 2.5
- Derrick & Substructure: 10
- Drill Floor Area: 9
- Power & Hand Tools: 5
- Hoisting Tools: 2.5
- Stairs Ladders Handrails Guardrails: 0
- Confined Spaces & Haz. Environ.: 0
- Hotwork: 0
- Special Services: 1

December 2-3, 2014
Profile all Assets

Fleet

Arrival To Location: 41.5
Mud Pump Area: 19
Mud mixing Area: 88.5
Material Handling Equipment: 36.5
Generator Area & Electrical Systems: 24.5
Fire Protection: 73
Flammable Liquid: 34
Pipe Rack Area: 2
BOP's: 13
Drill Floor Area: 15.5
Power & Hand Tools: 39.5
Hoisting Tools: 64
Stairs Ladders Handrails Guardrails: 23.5
Confined Spaces & Haz. Environ.: 8
Hotwork: 14
Special Services: 12

Benefits

• Reduced Costs
  ◦ Fewer lagging indicators
  ◦ Improved machinery efficiency & run-time
  ◦ Lower incident cost
  ◦ Lower NPT
• Improved morale
• More favorable reputation
• Increased productivity
• Higher Employee Retention
• Lower operating cost