Creating a Process Safety Culture

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A Major Incident Viewed From a Process Safety Perspective - *Piper Alpha*

- Operated by Occidental Petroleum
- Located in North Sea, generated almost 10% of UK oil revenues
- On July 6, 1988, burned to the sea, killing 167 people, including two attempting rescue
## Context of Piper Alpha

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Deaths</th>
<th>Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974</td>
<td>Flixborough, England</td>
<td>28</td>
<td>104</td>
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<tr>
<td>1980</td>
<td>New Castle, DE</td>
<td>5</td>
<td>23</td>
</tr>
<tr>
<td>1984</td>
<td>Lemont, IL</td>
<td>17</td>
<td>17</td>
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<tr>
<td>1984</td>
<td>Mexico City, Mexico</td>
<td>650</td>
<td>4000+</td>
</tr>
<tr>
<td>1984</td>
<td>Bhopal, India</td>
<td>3000+</td>
<td>25,000+</td>
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<tr>
<td>1985</td>
<td>Institute, WV</td>
<td>0</td>
<td>135</td>
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<tr>
<td>1987</td>
<td>Texas City, TX</td>
<td>0</td>
<td>~1000</td>
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<tr>
<td>1988</td>
<td>Norco, LA</td>
<td>7</td>
<td>23</td>
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<tr>
<td><strong>1988</strong></td>
<td>North Sea</td>
<td><strong>167</strong></td>
<td><strong>63</strong></td>
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<tr>
<td>1989</td>
<td>Pasadena, TX</td>
<td>23</td>
<td>132</td>
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<tr>
<td>1990</td>
<td>Channelview, TX</td>
<td>17</td>
<td>5</td>
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<tr>
<td>1990</td>
<td>Cincinnati, OH</td>
<td>2</td>
<td>41</td>
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<tr>
<td>1991</td>
<td>Lake Charles, LA</td>
<td>6</td>
<td>6</td>
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<td>1991</td>
<td>Sterlington, LA</td>
<td>8</td>
<td>128</td>
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<tr>
<td>1991</td>
<td>Charleston, SC</td>
<td>9</td>
<td>33</td>
</tr>
</tbody>
</table>

Industry Drove Conceptual Development

Collaborative Efforts

- Four parallel industry development projects (Organization Resources Counselors, American Institute of Chemical Engineers/Center for Chemical Process Safety (CCPS), API and American Chemical Council) led to the creation of process safety.
- Subsequent U.S. government regulations based upon industry concepts.

Partial list of Participants

- Du Pont
- Exxon
- Imperial Chemicals
- Shell
- Chevron
- Eastman
- British Petroleum (BP)
- Amoco
- Rohm and Haas
- Mobil
- Unocal
- Marathon
- Dow
- 25+ others

The fundamental concepts of process safety were developed by industry and not by regulating authorities, as is commonly presumed.
CCPS Vision 20/20
Centered Around Committed Culture

- Enhanced Stakeholder Knowledge
- Enhanced Application of Lessons Learned
- Meticulous Verification
- Committed Culture
- Intentional Competency Development
- Vibrant Management Systems
- Disciplined Adherence to Standards
- Responsible Collaboration
- Harmonization of Global Standards
Committed Culture

- Felt leadership from senior executives through plant personnel
- Leadership instills disciplined adherence to the policies and procedures
- Strong sense of vulnerability
OE Management System (OEMS) Key Components

OE Management System

- Leadership Accountability
- Management System Process
- OE Expectations

OEMS addresses:

- Roles and Responsibilities
- Accountability
- Activities and Tasks
- OE Behaviors
- OE Processes and Standards
- Metrics and Verification

Chevron’s Overview of the OEMS Document is publically available at: chevron.com/about/operationalexcellence
Operational Excellence Assurance
Keeping the Layers of Protection in Place
Measuring Process Safety Performance
Moving from lagging to leading metrics

Tier 1 Events
LOPC Events of Significant Consequence

Tier 2 Events
LOPC Events of Minor Consequence

Tier 3 Events
Challenges to Safety Systems

Tier 4 Events
Operating Discipline & Management System Performance Indicators

Measurement
Tier 1 – Significant LOPC events
Tier 2 – Events of Lesser Consequence
Tier 3 – Challenges to Safety Systems
Tier 4 – Management System Indicators

Tiered approach Informed by CCPS and API Process Safety Metrics Work
Setting Expectations
What is required

Elements
- Security of Personnel & Assets
- Facility Design & Construction
- Safe Operations
- Management of Change
- Reliability & Efficiency
- Third Party Services
- Environmental Stewardship
- Product Stewardship
- Incident Investigation
- Community & Stakeholder Engagement
- Emergency Management
- Compliance Assurance
- Legislative & Regulatory Advocacy

OE Management System
- Leadership Accountability
- Management System Process
- OE Expectations

Corporate-wide requirements:
Put OE Processes and Standards in place to manage specific risks and/or opportunities

There are 47 OE Expectations categorized under 13 elements

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Projects are increasingly complex

Expectations continue to increase

- Internal/Company
- Communities
- Governments
- Investors
Some High-Consequence Events

Texas City

Petrobras

Courtesy of the BBC, 2001
BP, Gulf of Mexico Oil Spill

The Long-Term Cost of Major Accidents?

Since April 20 when the Gulf oil spill began, BP shares have tumbled about 40%.
Three Truths About Major Incidents

**Truth 1: Little Things can Lead to Big Incidents**

- Major incidents are often chains of events linked by seemingly minor failures or discrepancies (for example):
  - A small part with the wrong metallurgy
  - One step of a procedure not followed
  - A valve not fully closed
  - A safety device not tested
  - A simple change not documented and communicated

- The Bhopal tragedy (3000+ fatalities) was enabled by a $50 piping modification.

- Because of the complexity of many of our large systems, the interconnectedness of “small” failures is difficult to detect ahead of time and only becomes apparent when an event occurs.
Truth 2: *Low Probability Events Can, and Do, Occur*

- When a major accident happens, there is always an element of surprise that such an accident *could* actually happen:
  - “You’ve got to remember that this is the first time that anything like this has happened to one of our rigs in the North Sea.” Armand Hammer, CEO Occidental Petroleum, following Piper Alpha tragedy
  - An “unprecedented combination of failures … industry will need to reevaluate its paradigms.” Tony Hayward, CEO British Petroleum

- Effective accident prevention undermines effective accident prevention.
  - Organizational memory fades over time, along with a sense of vulnerability.
  - Most people never experience a major accident event in their lifetimes.
  - The absence of apparent negative consequences can increase risk taking.
Truth 3: *Most Major Incidents Are Characterized by Remarkably Uninteresting Similarities*

“I wouldn't put it (Piper Alpha) above or below other disasters. There is, actually, an awful sameness about these incidents. They’re nearly always characterized by lack of forethought, lack of analysis and nearly always the problem comes down to poor management. It’s not just due to one particular person not following a procedure or doing something wrong. You always come back to the fact that things are sloppy, ill organized and unsystematic (up and down the organization).”

*Dr. Tony Barrel, Head of UK HSE Offshore Safety Division*
One Way of Looking at Accidents

Figure 2 – Graphical Representation of Little Details
Dynamic Nature of Managing “The Dots”

- The effectiveness of safeguards can change;
  - Safety systems can degrade, go untested, be compromised, or improve in functionality

- Process safety management systems change;
  - Critical controls such as management of change can get overwhelmed, allowing higher risk changes to “sneak” through
  - If not planned for, personnel movements can lead to lost understanding of risks, or bring new, beneficial approaches

- Overriding process safety culture can degrade or strengthen with changes like retirements and reassignments of key personnel, acquisitions or external pressures.
Measuring Process Safety Performance
Moving from lagging to leading metrics

Tier 1 Events
- Significant LOPC events

Tier 2 Events
- Events of Minor Consequence

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