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Process Safety Incidents

- Highest potential for multiple injuries/deaths
- Highest potential for significant environmental harm
- Highest potential for significant property damage
- Highest potential for significant business interruption
- Highest potential for damage to reputation
CSB Recommendation to API & USW

“Work together to develop two new consensus American National Standards Institute (ANSI) standards. In the first standard, create performance indicators for process safety in the refinery and petrochemical industries. Ensure that the standard identifies leading and lagging indicators for nationwide public reporting as well as indicators for use at individual facilities. Include methods for the development and use of the performance indicators.”
RP 754 – Committee Membership

- Academia (1)
- Associations (5)
- Engineering & Construction (1)
- Government (1)
- Labor (3)—withdrawn 8/09
- Owner/Operators – Refiners (10)
- Owner/Operator – Chemicals (4)
Expectation that RP-754 will aid in driving similar improvements in process safety performance
Process Safety Indicator Pyramid

- Tiers 1 & 2 are RP-754 standardized definitions
- Tiers 3 & 4 are company defined performance indicators
Tier 1 & 2 -- Process Safety Event

- An unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials from a process that results in one or more of the consequences listed below:
  - Harm to people; or
  - Impact upon the community; or
  - Damage to equipment; or
  - A release of a threshold quantity

- PSE Rate = \([\text{Total PSE Count}/\text{Total Work Hours}] \times 200,000\)
**Tier 3 – Challenge to Safety Systems**

- **Purpose**
  - Typically represent challenges to the barrier system that progressed along the path to harm, but were stopped short of a Tier 1 or Tier 2 PSE consequence

- **Examples**
  - Safe Operating Limit Excursions
  - Primary Containment Inspection or Testing Results Outside Acceptable Limits
  - Demands on Safety Systems
  - Other LOPC Events
Tier 4 – Operating Discipline & Management System

Performance

• Purpose
  - Typically represent the performance of individual components of the barrier system
  - Indicative of process safety system weaknesses that may contribute to future Tier 1, 2 or 3 PSEs

• Examples
  - Process Safety Action Item Closure
  - Training Completed on Schedule
  - Safety Critical Equipment Inspection
  - Completion of Emergency Response Drills
Primary Modes of Implementation

- Report everything . . . Database sorts it out
- Train personnel to identify and report Tier 1 & 2 events
RP 754 Adoption Plans

- API, NPRA, OGP, and CONCAWE have committed to 2010 data collection
- CCPS is reviewing the future of its document
- ACC plans to pilot
- IPIECA is vetting the reporting requirements with their stakeholders
- UK HSE provided positive comments during the ballot period
Benefits of Participation

- Consequence analysis
  - No. & % DAFWC / Fatalities
  - No. & % Fires
  - No. & % Explosions
  - No. & % Acute Releases

- Industry benchmarking

- Event analysis
  - Type of process
  - Mode of operation
  - Point of release
  - Type of material
Annually, each Company publicly reports Tier 1 and Tier 2 PSE information.

- 2010 – Implementation
- 2011 – Data validation
- 2012 – Industry aggregated result
- 2013 – Industry and Company blinded results
- 2014 – Industry and Company transparent results
- Tier 2 reporting may lag Tier 1 by one year
Local [Site] Public Reporting

- Each site determines the appropriate methods to communicate PSE information

- Annual report of site-specific Tier 1, 2, 3 and 4 PSE information to employees and employee representatives

- Annually, each Company makes available a summary of site-specific Tier 1 and 2 PSE information and may report site-specific Tier 3 and 4 PSE information to the local community and emergency management officials
Performance Targets

- Process safety performance is dynamic and complex, and must be managed over the entire life cycle of a facility.

- Due to the “long wave length,” performance targets should be multi-year.

- For example, a 25% reduction in total Tier 1 PSE’s over 5 years is a more appropriate target than a 5% reduction year over year.
Conclusions

- Process safety incidents result in devastating consequences

- Adopting RP-754 provides a significant opportunity for industry to improve process safety performance

- Similar success has been demonstrated in occupational safety performance

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RP 755 – Committee Membership

- Owner/Operators – Refiners (8)
- Engineering & Construction (2)
- General Interest (2)
- Labor (2) – Withdrew 8/09

- Owner/Operator – Chemicals (4)
- Academia (1)
- Associations (3)
- Government (0)
Finding:
“It has not been possible for the Investigation Team to directly attribute actions or inactions of the operators and supervisors to fatigue. However, this extended working period clearly has the potential to contribute to a lack of attentiveness, and slowness to identify and respond to process upsets.”

Recommendation:
“...API and the United Steel Workers union work together to develop fatigue prevention guidelines that would, at a minimum, limit hours and days of work and address shift work ... developed in conformance with ANSI principles and the composition of the working group developing the guidelines should be diverse”
Overview of Key Concepts

- Committee recognized that addressing fatigue goes well beyond hours of service and days of work
  - Comprehensive Fatigue Risk Management System (FRMS) approach adopted

- FRMS to be integrated with other safety management systems

- FRMS should be informed by sound science and recognize operational issues

- Key stakeholders shall be consulted in developing and implementing the local application of the FRMS

- Culture of fatigue risk management should be created in which the shared responsibility of mitigating risk is recognized

- Scope of work excluded matters subject to collective bargaining like “overtime”
Scope & Positions Covered

• Refineries, petrochemical and chemical operations, natural gas liquids extraction plants, and other facilities such as those covered by the OSHA Process Safety Management Standard, 29 CFR 1910.119
  - Applies to locations where employees commute to work
  - Does not apply to locations where employees are housed on-site
  - On-site contractors expected to have equivalent programs

• Employees working night shifts, rotating shifts, extended hours/days or call outs involved in process safety sensitive actions
RP 755 - FRMS Framework

- Staff-Workload Balance
- Safety Promotion: Training, Education & Communication
- Work Environment
- Incident/Near Miss Investigation
- Hours of Service Guidelines
  - 8, 10 & 12 hour shifts
  - Normal Operations, Outages & Extended Shifts
  - Call-outs
  - Exception Process
- Periodic Review of FRMS to Achieve Continuous Improvement
Staff – Workload Balance & Work Environment

• Assess staffing levels and workload balance initially and periodically, including consideration of:
  - Workload variability incl. start-ups, shutdowns, unplanned events and emergency management situations
  - Turnover, absenteeism & workforce demographics

• FRMS should consider type of work being performed

• Where possible, the work environment should be designed to enhance alertness
  - Brightly lit utilizing indirect lighting to avoid glare and eye strain
  - Indoor temperature and humidity should be in a comfortable range
  - Workstations should be designed utilizing ergonomic principles
Training, Education & Communication

• Employees & Family Members: Initial and recurring training that includes:
  - Basic sleep, circadian & fatigue physiology
  - Strategies for achieving good quality, restorative sleep
  - Healthy lifestyle choices in 24/7 operations
  - Risks & signs of fatigue impairment in their work environment and work duties and effective ways of mitigating them

• Supervisors: Initial and recurring training that includes:
  - The scientific basis, structure and management of the corporate FRMS
  - Influence of staffing levels on employee fatigue
  - Effects of work and rest scheduling on employee fatigue
  - Managing a team of employees to minimize fatigue risk
Incident/Near Miss Investigation

• Investigations of incidents should consider role of fatigue

• Fatigue-related information collected should include:
  - time of incident
  - shift pattern incl. number of consecutive shifts worked
  - number of hours awake
  - number of hours slept in last 24 hours for individuals involved

• For some incidents, concluding a definitive role of fatigue may not be possible

• Aggregate analysis of incidents may reveal patterns suggestive of the role of fatigue that may not be apparent when evaluating individual incidents
Hours of Service Guidelines

- Hours of Service Guidelines have been developed:
  - In the context of the existence of a comprehensive FRMS
  - Recommendations for 8, 10 & 12 hour shifts
  - Will address normal operations, outages and extended shifts
  - Guidelines will identify the upper limits for hours of service
  - Consistently working at the upper limits is not sustainable and may lead to chronic sleep debt
  - In addition to the upper limits, the FRMS should provide target hours of service for normal operations
  - Objective of limits is to establish triggers at which additional fatigue risk evaluations need to be performed
12 Hour Shifts

• Normal Operations
  ➢ Work sets shall not exceed 7 consecutive day or night shifts
  ➢ To permit 2 consecutive nights sleep after a work set:
    + There shall be 36 hours off after a work set or
    + Minimum of 48 hours off after a work set containing 4 or more night shifts or
    + Minimum of 48 hours off after a total of 84 hours worked regardless of day or night shift

• Outages
  ➢ Work sets shall not exceed 14 consecutive day or night shifts
  ➢ There shall be a minimum of 36 hours off after a work set
  ➢ Time off beyond 36 hours shall be addressed at the plant level

• Extended Shifts (i.e., shifts greater than 14 hours)
  ➢ Shall occur only when necessary to avoid an unplanned open safety critical position or accomplish an unplanned safety critical task
  ➢ Shall be managed by an established management process
  ➢ After shifts of 14 -16 hours, a minimum of 8 hours off shall be provided before returning for next shift
  ➢ After shifts greater than 16 hours, a minimum of 10 hours off shall be provided before returning for next shift
  ➢ Extended shifts shall not exceed 18 hours
  ➢ No more than 1 extended shift longer than 14 hours should occur in a work set
Periodic Review of FRMS – Continuous Improvement

• FRMS should undergo periodic assessments of its effectiveness and identify opportunities for continuous improvement

• Targets should be set for key parameters of FRMS such as:
  - Percentage overtime
  - Number of open shifts
  - Number of extended shifts
  - Number of exceptions

• Metrics gathered to determine if targets are being met

• Plans should be developed to close gaps between targets and actual FRMS performance
Questions?

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Electronic download of RP 754 and RP 755
http://api.org/standards/psstandards/
## Hours of Service Guidelines

<table>
<thead>
<tr>
<th>Operational Situation</th>
<th>12-Hour Shift</th>
<th>10-Hour Shift</th>
<th>8-Hour Shift</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum Consecutive Shifts (Day or Night) In a Workset</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Normal Operations</td>
<td>7 shifts</td>
<td>9 shifts</td>
<td>10 shifts</td>
</tr>
<tr>
<td>b) Outages</td>
<td>14 shifts</td>
<td>14 shifts</td>
<td>19 shifts</td>
</tr>
<tr>
<td><strong>Minimum time off after a workset</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Normal Operations</td>
<td>36 hours</td>
<td>36 hours</td>
<td>36 hours</td>
</tr>
<tr>
<td>▪ Workset of 4 or more night shifts</td>
<td>48 hours</td>
<td>48 hours</td>
<td>48 hours</td>
</tr>
<tr>
<td>▪ After 84 hours or more regardless of day or night</td>
<td>48 hours</td>
<td>48 hours</td>
<td>48 hours</td>
</tr>
<tr>
<td>b) Outages</td>
<td>36 hours</td>
<td>36 hours</td>
<td>36 hours</td>
</tr>
<tr>
<td><strong>Extended Shifts</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Unscheduled maximum shift</td>
<td>18 hours</td>
<td>16 hours</td>
<td>16 hours</td>
</tr>
<tr>
<td>b) Time off after shift</td>
<td>N/A</td>
<td>N/A</td>
<td>8 hours</td>
</tr>
<tr>
<td>▪ 10 – 16 hour shift</td>
<td>N/A</td>
<td>N/A</td>
<td>8 hours</td>
</tr>
<tr>
<td>▪ 12 – 16 hour shift</td>
<td>N/A</td>
<td>8 hours</td>
<td>N/A</td>
</tr>
<tr>
<td>▪ 14 – 16 hour shift</td>
<td>8 hours</td>
<td>8 hours</td>
<td>N/A</td>
</tr>
<tr>
<td>▪ &gt;16 – 18 hour shift</td>
<td>10 hours</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Maximum Number of Extended Shifts per Workset</strong></td>
<td>1</td>
<td>1 – 14 hour shift or 2 – 12 hour shifts or for 3 or more 12 hour shifts, follow 12 hour normal operations guidelines above</td>
<td>2 – if greater than 12 hours in duration; extended shifts must be non-consecutive If &gt;2, follow 12 hour normal operations above</td>
</tr>
</tbody>
</table>