Outline

- CSB Recommendation
- RP-754 Development
  - Committee Membership
  - Scope & Applicability
  - Guiding Principles
- RP-754 Process Safety Indicators
  - Tier 1, 2, 3 & 4
  - Guidelines for Selection & Use of Indicators
- RP-754 Process Safety Indicator Reporting
  - Broad Access (Nationwide) Public Reporting
  - Local (Site) Public Reporting
  - Data Capture
- Path Forward / Timeline
“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.”
Expectation that RP-754 will aid in driving similar improvements in process safety performance
RP 754 – Committee Membership

- Academia (1)
  - MKO Process Safety Center
- Associations (5)
  - ACC
  - CCPS
  - NPRA
  - UKPIA
  - ORC
- Engineering & Construction (1)
  - UOP
- Government (1)
  - CSB
- Labor (3) (Withdrawn 04-Aug-09)
  - USW
  - ICWUC
  - Teamsters
- Owner/Operators – Refiners (11)
  - BP
  - Chevron
  - CHS Inc.
  - Chevron Phillips
  - Koch Ind.
  - Pasadena Ref
  - ExxonMobil
  - ConocoPhillips
  - Shell
  - Marathon
  - Valero
- Owner/Operator – Chemicals (2)
  - DuPont
  - Dow
  - Air Products
  - Observer
RP-754 Guiding Principles

- Starting Point – Capitalize on Previous Work
  - API / ACC / CCPS loss of primary containment definition
  - API other loss of primary containment definition
  - UK HSE and CCPS guidelines for process safety metrics
Key Concepts – Indicator Attributes / Principles

- Objective, few and simple
- Well defined, capable of being applied consistently across the industry
- Indicators should drive process safety performance improvement and learning.
- Indicators useful to all stakeholders and allow internal and external benchmarking
- Indicators should be statistically valid, provide appropriate sensitivity to be useful for continuous improvement; sufficient # of events to allow predictive monitoring and identification of performance trends.
Process Safety Indicator Pyramid

- **Tier 1**: LOPC Events of Greater Consequence
  - Broad Access [Nationwide] Public Reporting

- **Tier 2**: LOPC Events of Lesser Consequence

- **Tier 3**: Challenges to Safety Systems

- **Tier 4**: Operating Discipline & Management System Performance Indicators

- Tiers 1 & 2 are RP-754 standardized definitions
- Tiers 3 & 4 are company defined performance indicators
RP-754 Applicability

- Developed for the refining and petrochemical industries, but may also be applicable to other industries where loss of containment has the potential to cause harm.
- “Process Safety” as used in the document is independent of and broader than OSHA regulatory requirements.
- Applicability not limited to facilities covered by OSHA PSM or similar national or international regulations.
- Exclusions to focus metrics on Process Safety vs. all other areas.
Applicability / Events Excluded from Process Safety Reporting

Applicability is not limited to those facilities covered by the OSHA Process Safety Management Standard, 29 CFR 1910.119 or similar national and international regulations.

Events associated with the following activities fall outside the scope of this RP:

a) Releases from pipeline transfer operations occurring outside the process or storage facility fence line;

b) Marine transport operations, except when the vessel is connected to the process for the purposes of feedstock or product transfer;

c) Truck or rail operations, except when the vessel is connected to the process for the purposes of feedstock or product transfer, or if the truck or rail car is being used for on site storage;

d) Vacuum truck operations, except on-site truck loading or discharging operations, or use of the vacuum truck transfer pump;

e) Routine emissions that are allowable under permit or regulation;

f) Office, shop and warehouse building events (e.g. office fires, spills, personnel injury or illness, etc.)
Applicability / Events Excluded from Process Safety Reporting

Events associated with the following activities fall outside the scope of this RP:

g) Personal safety events (e.g. slips, trips, falls) that are not directly associated with on-site response to a loss of primary containment (LOPC) event;

h) LOPC events from ancillary equipment not connected to the process (e.g. small sample containers);

i) Quality assurance (QA), quality control (QC) and research and development (R&D) laboratories (pilot plants are within RP scope);

j) Retail service stations; and

k) On-site fueling operations of mobile and stationary equipment (e.g. pick-up trucks, diesel generators, and heavy equipment).
Tier 1 -- Process Safety Event

Tier 1 – An unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials (e.g., steam, hot condensate, nitrogen, compressed CO2 or compressed air) from a process that results in one or more of the consequences listed below:

– An employee, contractor or subcontractor “days away from work” injury and/or fatality; or
– A hospital admission and/or fatality of a third party; or
– An officially declared community evacuation or shelter-in-place; or
– A fire or explosion resulting in greater than or equal to $25,000 of direct cost to the Company; or ...
I would keep these Tier 1 and 2 slides but would also use the Annex C Decision Logic Tree as part of the webinar in some fashion. It emphasizes the thought process you must go through to classify an event as a PSE.

paulkl, 2/22/2010
Tier 1 -- Process Safety Event – Cont’d

– A pressure relief device (PRD) discharge to atmosphere whether directly or via a downstream destructive device that results in one or more of the following four consequences:
  • Liquid carryover, or
  • Discharge to a potentially unsafe location, or
  • On-site shelter-in-place, or
  • Public protective measures (e.g., road closure);

  where the PRD discharge quantity is greater than the threshold quantities in Table 1; or

  – A release of material greater than the threshold quantities described in Table 1 in any one-hour period.

- Tier 1 PSE Rate = (Total Tier 1 PSE Count/Total Work Hours) x 200,000
I would keep these Tier 1 and 2 slides but would also use the Annex C Decision Logic Tree as part of the webinar in some fashion. It emphasizes the thought process you must go through to classify an event as a PSE.

paulki, 2/22/2010
<table>
<thead>
<tr>
<th>Threshold Release Category</th>
<th>Material Hazard Classification</th>
<th>Threshold Quantity (outdoors)</th>
<th>Threshold Quantity (indoors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TIH Hazard Zone A Materials</td>
<td>5 kg (11 lbs)</td>
<td>2.5 kg (5.5 lbs)</td>
</tr>
<tr>
<td>2</td>
<td>TIH Hazard Zone B Materials</td>
<td>25 kg (55 lbs)</td>
<td>12.5 kg (27.5 lbs)</td>
</tr>
<tr>
<td>3</td>
<td>TIH Hazard Zone C Materials</td>
<td>100 kg (220 lbs)</td>
<td>50 kg (110 lbs)</td>
</tr>
<tr>
<td>4</td>
<td>TIH Hazard Zone D Materials</td>
<td>200 kg (440 lbs)</td>
<td>100 kg (220 lbs)</td>
</tr>
</tbody>
</table>
## Tier 1 Material Release Threshold Quantity

<table>
<thead>
<tr>
<th>Threshold Release Category</th>
<th>Material Hazard Classification</th>
<th>Threshold Quantity (outdoors)</th>
<th>Threshold Quantity (indoors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Flammable Gases or Liquids with IBP ≤ 35 °C &amp; FP &lt; 23 °C, or Other Packing Group I Materials excluding strong acids/bases</td>
<td>500 kg (1100 lbs)</td>
<td>250 kg (550 lbs)</td>
</tr>
<tr>
<td>6</td>
<td>Liquids with IBP &gt; 35 °C and Flash Point &lt; 23 °C, or Other Packing Group II Materials</td>
<td>1000 kg (2200 lbs) or 7 bbls</td>
<td>500 kg (1100 lbs) or 3.5 bbls</td>
</tr>
<tr>
<td>7</td>
<td>Liquids with FP ≥ 23 °C and &lt; 60 °C, or Liquids with Flash Point &gt; 60 °C released at or above FP, or Strong acids/bases, or Other Packing Group III Materials</td>
<td>2000 kg (4400 lbs) or 14 bbls</td>
<td>1000 kg (2200 lbs) or 7 bbls</td>
</tr>
</tbody>
</table>
Materials Typical of Threshold Release Categories

The following are UN DGL & GHS designations for Flammable Liquids & Gases

Flammable Gases and Liquids with IBP < 35°C

Hydrogen, Methane, Ethane, LPG, Ethylene, isopentane

Flammable Liquids with IBP > 35°C and FP < 23°C

N-pentane, cyclopentane, hexane, cyclohexane, gasoline / petrol, toluene, o-xylene (but not meta or para-xylene), MTBE, ethanol, some crude oils

Flammable Liquids with FP > 23°C and ≤ 60°C

Diesel fuel, most kerosenes, p-xylene, n-butanol, isobutanol, some crude oils

Flammable Liquids with FP > 60°C (Must be released above Flash Point for Tier 1)

Most asphalts, tars, molten sulfur (160°C), ethylene glycol (110°C), propylene glycol (99°C)
Materials Typical of Threshold Release Categories

TIH – Toxic Inhalation Hazard & Zones

TIH – Zone A: Br, HCN, Nickel Carbonyl, Phosgene, Methyl Isocyanate (MIC)

TIH – Zone B: Boron Trifluoride (BF$_3$), Chlorine, H$_2$S, Red Fuming Nitric Acid

TIH – Zone C: Hydrogen Chloride (HCl), Hydrogen Fluoride (HF), Sulfur Dioxide (SO$_2$)

TIH – Zone D: Ammonia (NH$_3$), Carbon Monoxide (CO), Ethylene Oxide

Other hazardous materials are assigned to a Packing Group (I, II, or III) depending upon level of hazard.

PG I: Aluminum Alkyls, Some Liquid Amines, Sodium Cyanide, Sodium Peroxide

PG II: Aluminum Chloride, Calcium Carbide, Carbon Tetrachloride, Nicotine, Some Organic Peroxides, Phenol

PG III: Calcium Oxide (CaO), Activated Carbon, Chloroform, Some Organic Peroxides, Sodium Fluoride, Sodium Nitrate, Sulfur
Tier 2 -- Process Safety Event

- **Tier 2** -- An unplanned or uncontrolled release of any material, including non-toxic and non-flammables materials (e.g., steam, hot condensate, nitrogen, compressed CO2 or compressed air) from a process which results in one or more of the consequences listed below and is not reported in Tier 1:
  - An employee, contractor or subcontractor recordable injury; or
  - A fire or explosion resulting in greater than or equal to $2,500 of direct cost to the Company; or
Tier 2 -- Process Safety Event

– A pressure relief device (PRD) discharge to atmosphere whether directly or via a downstream destructive device that results in one or more of the following four consequences:
  - Liquid carryover, or
  - Discharge to a potentially unsafe location, or
  - On-site shelter-in-place, or
  - Public protective measures (e.g., road closure);
where the PRD discharge quantity is greater than the threshold quantities in Table 2; or
– A release of material greater than the threshold quantities described in Table 2 in any one-hour period.

- Tier 2 PSE Rate = (Total Tier 2 PSE Count/Total Work Hours) x 200,000
## Tier 2 Material Release Threshold Quantity

<table>
<thead>
<tr>
<th>Threshold Release Category</th>
<th>Material Hazard Classification</th>
<th>Threshold Quantity (outdoors)</th>
<th>Threshold Quantity (indoors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TIH Hazard Zone A Materials</td>
<td>0.5 kg (1.1 lbs)</td>
<td>0.25 kg (.55 lbs)</td>
</tr>
<tr>
<td>2</td>
<td>TIH Hazard Zone B Materials</td>
<td>2.5 kg (5.5 lbs)</td>
<td>1.2 kg (2.8 lbs)</td>
</tr>
<tr>
<td>3</td>
<td>TIH Hazard Zone C Materials</td>
<td>10 kg (22 lbs)</td>
<td>5 kg (11 lbs)</td>
</tr>
<tr>
<td>4</td>
<td>TIH Hazard Zone D Materials</td>
<td>20 kg (44 lbs)</td>
<td>10 kg (22 lbs)</td>
</tr>
</tbody>
</table>
## Tier 2 Material Release Threshold Quantity

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<td>50 kg (100 lbs)</td>
<td>25 kg (50 lbs)</td>
</tr>
<tr>
<td>6</td>
<td>Liquids with FP ≥ 23 °C and &lt; 60 °C or Liquids with FP &gt; 60 °C released at or above FP; or Other Packing Group II and III Materials excluding moderate acids/bases; or Strong acids and bases</td>
<td>100 kg (220 lbs) or 1 bbl</td>
<td>50 kg (110 lbs) or 0.5 bbl</td>
</tr>
<tr>
<td>7</td>
<td>Liquids with FP &gt; 60 °C released below FP; or Moderate acids/bases</td>
<td>1000 kg (2200 lbs) or 10 bbl</td>
<td>500 kg (1100 lbs) or 5 bbl</td>
</tr>
</tbody>
</table>
Tier 3 & 4 versus Tier 1 & 2

The Swiss Cheese Model (Reason, 1990) helps to compare and contrast:

- Tier 1 events result in some level of harm (fire, LWC, release, etc.)
- Tier 2 events result in a lesser level of harm.
- Tier 3 and 4 indicators provide information about the strength (or lack thereof) of barriers and weaknesses in the equipment and hazard control systems.
Tier 3 – Challenge to Safety Systems

- **Purpose**
  - Tier 3 indicators are likely to provide the greatest opportunity for identification of areas for improvement in Process Safety at the site level.
  - Intended for internal company use and local (site) public reporting.

- **Application of the Barrier concept**
  - Tier 3 indicators 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 LOPC consequence.

- **Examples**
  - Safe Operating Limit Excursions
  - Primary Containment Inspection or Testing Results Outside Acceptable Limits
  - Demands on Safety Systems
    - Activation of a Safety Instrumented System
    - Activation of a Mechanical Shutdown System
    - Activation of Pressure Relief Device (not counted as Tier 1 or Tier 2)
  - Other LOPC Events
Safe Operating Limit Excursions

- This is a process parameter deviation that exceeds the safe operating limit applicable to the phase of operation.
- Different operating phases (startup, ongoing operation, steps in a batch process, etc.) may have different SOL’s for the same equipment.
- Safe Operating Limits represent the point beyond which troubleshooting ends and pre-determined action occurs to return the process to a known safe state.
- Pre-determined actions may range from manually executed operating procedures to a fully automated safety instrumented system.

Example of Safe Operating Limit for Tank Level
Primary Containment Inspection or Testing Results Outside Acceptable Limits

- This is an inspection or test finding that indicates primary containment equipment has been operated outside acceptable limits.

- Findings typically trigger actions such as replacement-in-kind, repairs to restore fitness-for-service, replacement with other materials, increased inspection or testing, or de-rating of process equipment.

- Counted for vessels, atmospheric storage tanks, piping or machinery when previous operating pressures or levels exceed the acceptable limits based upon wall thickness inspection measurement.
Tier 3 Indicator #3

Demands on Safety Systems

- This is a demand on a safety system designed to prevent a loss of primary containment (LOPC) or to mitigate the consequences of a LOPC.

- Examples include safety instrumented systems, mechanical shutdown devices, and pressure relief devices.

- Excluded from the metric:
  - Intentional activation of the safety system during periodic testing or manual activation as part of the normal shutdown process.
  - SIS activation configured for equipment protection with no LOPC consequence.
  - Mechanical shutdown system activation for equipment protection with no LOPC consequence.
Tier 3 Indicator #4

Other LOPC Events

- These are a loss of primary containment with a consequence less than Tier 2 events.
- Companies establish the appropriate thresholds meaningful to your operations and your process safety goals.
- Consequences should reflect process safety hazards rather than health (e.g. personnel exposure limits) or environmental (e.g. fugitive emissions) hazards.
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.
  - Intended for internal company use and local (site) public reporting.

- **Examples**
  - Process Hazards Evaluation Completion
  - Process Safety Action Item Closure
  - Training Completed on Schedule
  - Procedures Current and Accurate
  - Work Permit Compliance
  - Safety Critical Equipment Inspection
  - Safety Critical Equipment Deficiency Management
  - MOC and PSSR Compliance
  - Completion of Emergency Response Drills
  - Fatigue Risk Management
Guidelines for Selection of Process Safety Indicators

- High-level overview of some key aspects of process safety indicator selection and development.
- Defer to more exhaustive references such as:
- Characteristics of Effective Indicators
  - Reliable, Repeatable, Consistent, Independent of Outside Influence, Relevant, Comparable, Meaningful, Appropriate for the Intended Audience, Timely, Easy to Use, Auditable
- Selection of Indicators
Reporting Performance Indicators

- **Broad Access (Nationwide) Public Reporting**
  - Annually, each Company shall publicly report Tier 1 and Tier 2 PSE information.
  - Options for public reporting include:
    - Company specific reports or web sites
    - Industry association or professional society reports or web sites
    - Government agency or other organizations

- **Local (Site) Public Reporting**
  - Determine the appropriate methods to communicate PSE information.
  - Report a summary of its site-specific Tier 1, 2, 3 and 4 PSE information to employees and their representatives. Unattended, remote-operated, or single-manned facilities are exempt.
  - Make available a summary of site-specific Tier 1 and 2 PSE information to the local community and emergency management officials along with information regarding measures taken to improve performance. May report site-specific Tier 3 and 4 PSE information. Remote sites where the worst potential-case LOPC cannot impact any public receptors are exempt.
### Table 3 – Stakeholder Report Information

<table>
<thead>
<tr>
<th>Tier</th>
<th>Industry</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1</td>
<td>PSE Count</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>PSE Rate</td>
<td>X</td>
</tr>
<tr>
<td>Tier 2</td>
<td>PSE Count</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>PSE Rate</td>
<td>X</td>
</tr>
</tbody>
</table>

**Notes:**
1. Comparisons among companies and industries are only statistically valid on a rate basis; therefore, Company PSE counts are not required to be reported publicly.
Broad Access [Nationwide] Public Reporting

- 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
PSE Data Capture

- **Site Information**
  - Type of Facility (NAICS or equivalent international code)
  - Corporate Name and Company Name (if different)
  - Site Location/Name (country, state/province, city, site name)
  - Site Identifier (unique number assigned by data collection group)
  - Total work hours

- **Tier 1 or 2 PSE Information**
  - Site Identifier
  - Tier 1 or 2 PSE Consequences / Triggers
    - Harm to people
    - An officially declared community evacuation or community shelter-in-place
    - A fire or explosion
    - A pressure relief device discharge to atmosphere whether directly or via a downstream destructive device
    - An acute release of flammable, toxic or corrosive chemicals
PSE Data Capture – Cont’d

- PSE Related Information
  - Type of Process
  - Date & Time of Event
  - Mode of Operation
  - Point of Release
  - Type of Material Released
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.
Link to API RP 754

The API RP 754 is available for free download from the site below:

http://www.api.org/Standards/psstandards/index.cfm

A series of hour-long Webinars are also being conducted on Tuesdays at 10:00 CDT (final is on 9/21) to introduce the standard. You can register for the Webinar at the link below.

https://www.livemeeting.com/lrs/8001817693/Registration.aspx?PageName=cd00qkwhh22zfx8q

These Webinars will be posted for future download on the API website.
Questions
Contact Information

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