REPORTING AND CLASSIFICATION OF PERSONAL H₂S ALARM INCIDENTS

Prioritizing Personal H₂S Alarm Incidents Using a Standard Risk Assessment Process

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AGENDA

Why Report and Risk Rank Personal H₂S Alarms?
Reporting and Risk Ranking Process
Data Analysis
Unexpected Discoveries and Benefits
Recommendations for Implementation
WHY REPORT PERSONAL H₂S ALARMS?

Additional data to identify H₂S Hazards

- Required use of monitors = entire population of all possible exposures is measured – **Capture This Data**

See a larger percentage of H₂S related incidents

- If no required reporting, do not see near misses – only see incidents with consequences
- 93.5% of H₂S alarms were near misses/potential incidents
- Identifies potentially more high risk incidents
WHY RISK RANK PERSONAL H\textsubscript{2}S ALARM INCIDENTS?

Prioritization

- Focus management’s attention on hazard sources
- Focus resources based on risk
- Triggers fact gathering
- Determines level of incident investigation
REPORTING AND RISK RANKING PROCESS

- Uses existing incident reporting, risk ranking and investigation processes

Diagram:

- Alarm
- Report → Fact Gathering → Risk Rank → Investigate
- Interim Controls
- Long-term Controls
- Policy requires all personal H₂S and CO alarms be reported
- First Report of Incident entered by a supervisor
FACT GATHERING

- First Report only includes the basic elements
- Additional information required for risk ranking:
  - Chemical involved
  - Source of chemical involved
  - Volume of chemical involved
  - Concentration of $\text{H}_2\text{S}$ in the chemical involved
  - Concentration of $\text{H}_2\text{S}$ measured by personal monitor
  - Full-shift and short term exposures, if available
  - Task performed at time of the alarm
- Conducted by site IH or H&S Professional
RISK RANKING PROCESS

- Focused specifically to Personal H\textsubscript{2}S alarms
- Standardized for U.S. Manufacturing Sites
- Step-by step method to classify H\textsubscript{2}S alarms: low, medium or high
- Considers:
  - Actual health effects
  - Respiratory protection
  - Volume of chemical involved
  - Concentration of H\textsubscript{2}S in chemical
  - Risk ranking using the Shell Risk Assessment Matrix (RAM)
- Conducted by site IH, incident management coordinator or lead investigator
**Entering and Classifying H2S Alarm Incidents in FIM**

**H2S Alarm**

- Does not apply to escape RPE use.

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**Yes**

- Supplied Air RPE used?

  - Yes
    - Enter in FIM as Near Miss / NM- People-Illness
  - No
    - No health effects reported.

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**Health effects?**

- Yes
  - Enter in FIM as an Incident with Consequences / People-Illness
- No
  - Supplied Air RPE used?
    - Yes
      - Enter in FIM as Near Miss / NM- People-Illness
    - No
      - No health effects reported.

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**Classification of Potential Risk**

<table>
<thead>
<tr>
<th>Volume of Substance</th>
<th>Classification of Potential Risk</th>
<th>Concentration of H2S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>Sample container, fixed volume sample, small analyzer / instrument leak</td>
<td>&lt; 0.01 % vol OR &lt; 100 ppm vapor space</td>
</tr>
<tr>
<td>Medium</td>
<td>Seal pot, opening isolated process line/equipment, drum/tote, minor process leak</td>
<td>&lt; 100 ppm (peak reading) OR Health effect ≤ First Aid</td>
</tr>
<tr>
<td>Large</td>
<td>Storage tank, ship/barge hold, tank truck, rail car, opening equipment or process line not isolated, major process leak</td>
<td>&gt; 0.01 % vol ≥ 100 ppm vapor space OR ≥ 100 ppm (peak reading) OR Health effect &gt; First Aid</td>
</tr>
</tbody>
</table>

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**Concentration of H2S**

- < 0.01 % vol OR < 100 ppm vapor space
- ≥ 0.01 % vol ≥ 100 ppm vapor space
- < 100 ppm (peak reading)
- ≥ 100 ppm (peak reading)

**FIM** – Fountain Incident Manager  
**H2S** – Hydrogen Sulfide  
**NM** – Near Miss  
**PPM** – Parts Per Million  
**RAM** – Risk Assessment Matrix  
**RPE** – Respiratory Protective Equipment

- **H₂S**: 67%
- **CO**: 35%
- **LEL**: 2%

- **H₂S** 67%
- **CO** 35%
- **LEL** 2%
RISK RANKING RESULTS


- Automated email to upper management for High incidents

- First 43 incidents:
  - Using general RAM: 6 of 43 incidents High
  - Using H₂S specific RAM: 1 of 43 incidents High
### CAUSES OF H₂S ALARM INCIDENTS

- **Leading causes:**
  - **Leaks** – 29%
  - **Line breaks / Opening equipment** – 23%
  - **Lab analysis** – 12%
  - **Draining equipment** – 13%
  - **Process sampling** – 13%

CAUSES OF H₂S ALARM INCIDENTS OVER TIME


Last Lab Analysis Incident June 2010

Dec-09 & Apr-11 incomplete months

- Unknown
- Refractory Removal
- Process Sampling
- Loading / Offloading Truck, Rail, Barge, Ship
- Line Break / Opening Equipment
- Leak
- Lab Analysis
- Draining Equipment

Leaks
Line breaks / Opening Equipment
Draining Equipment
UNEXPECTED DISCOVERIES AND BENEFITS

- Reporting all types of personal alarms – H₂S, CO, LEL
- Alarms triggered by chemicals other than that intended
  - H₂S alarms: 7% H₂
  - CO alarms: 65% H₂, 3% hydrocarbon
- Improved environmental responsibility
  - Incidents are reviewed and risk ranked by environmental engineers
  - Detect and repair leaks not found by LDAR program
- Improved safety and reliability
  - Incidents are reviewed and risk ranked by reliability engineers
  - Detect and repair H₂ and hydrocarbon leaks
RECOMMENDATIONS FOR IMPLEMENTATION

- Require reporting of personal alarms – don’t just recommend
- Provide written guidance and training on:
  - Information required for initial report
  - Entry of initial report
  - Documenting closing the incident loop: alarm, report, control, verify
- Minimize number of individuals conducting risk ranking
- Configure incident database for accurate data retrieval
  - Add incident flag for “Personal gas monitor alarm”
- Communicate benefits of reporting to site personnel repeatedly
- Use interim controls other than SARs where possible
- Standardize personal gas monitors
Q & A
BACKGROUND

MOTIVA Enterprises, L.L.C. – Convent Refinery:

- SE Louisiana
- 50/50 JV - Shell Group and Saudi Refining Inc.
- Constructed: 1964
- Throughput: 245,000 bpd
- Crude slate: predominately sour crude
- Products: Fuel oil and lighter
HISTORY OF PROCESS

Path to standardized reporting and risk ranking:

- 1998, Feb. – H₂S related fatality
- 1998 – Required personal H₂S monitors for company personnel
- 2007, Aug. – Required personal H₂S monitors for anyone entering the refinery
- 2009, Dec. – Required personal CO monitors in some areas
- 2009, Dec. – Required reporting of personal H₂S and CO alarms
- 2010, Mar. – H₂S Team, Goal: Zero personal H₂S Alarm Incidents
- 2010, Apr. – H₂S Alarm Incident Risk Ranking Pilot
CONTROLS - LEAKS

- Most leaks were unknown prior to personal alarm incident
- LDAR program, PEI program and operator rounds play a large role in control
- Added:
  - Personal alarm reporting process itself – repair identified leaks
**CONTROLS – LINE BREAKS / OPENING EQUIPMENT**

- Equipment draining and decontamination procedures, permit to work process and energy isolation play a large role in control.
- Zero Energy Isolation reduced splash/spray incidents.
- Added:
  - Decontamination of Process Equipment Chemical Exposure Control Policy
  - Line Break Policy
  - Full-time respirator technician

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controls – lab analysis

- Lab ventilation systems, analytical procedures, lab design, sample cooling and limiting chemical volume play a large role in control

- Added:
  - Move problem analysis into lab hoods
  - Vent instruments to ventilation systems
  - High flowrate fans for outside operations
  - Increase emphasis on process sample labeling
Equipment draining and decontamination procedures, closed drain lines and hoses, closed decontamination headers (T/A) and decontamination stream analysis (T/A) play a large role in control.

Added:
- Additional closed drain lines
- Improve drain/vent to flare
Closed-loop sample stations, eductor box sample stations and process sampling procedures play a large role in control.

Added:
- Hierarchy of controls specific to process sampling
- Discontinue/minimize sampling
- Additional closed-loop sample stations
- Microwave gauges on tanks
- Mini SAR carts
NEXT STEPS

- Automatic download of personal monitor data – see all alarms
- Increase emphasis on reporting requirements
  - Communicate data analysis and benefits to site personnel
  - Communicate unreported alarms to management
- Configure hand-held instruments with H₂ null CO sensors and H₂ sensors to investigate H₂ and CO sources
- Adjust H₂S alarm set points: 5 ppm low, 10 ppm high
- Required reporting and classification of personal H₂S alarms at Shell Group U.S. Manufacturing sites