Implementing Process Safety Management in Oil and Gas Operations

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American Society of Safety Engineers - Bakersfield Chapter
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Where Aera Operates

San Ardo

Bakersfield Headquarters

Coalinga

Belridge Lost Hills
Cymric/McKittrick

Coles Levee
Ecosystem Preserve

Midway Sunset

Ventura
Why Did PSM and RMP originate?

- 1980 Chemical Control, Elizabeth, NJ – 40,000 drums of unlabeled chemicals burn, 400 emergency responders w/chronic respiratory and other diseases
- 1984 PEMEX LPG Terminal, Mexico City, Mexico – 650 deaths, 6400 injuries
- 1984 Union Carbide, Bhopal, India - 4,000 deaths and 20,000 + injuries and diseases among community residents
- 1984 Union Oil, Romeoville, IL - 17 deaths, 22 injuries
- 1985 Bayer Chemical, Institute, WV - 135 injures
- 1986 ARCO, Carson, CA - 2 deaths, 44 injuries
- 1988 Shell Oil, Norco, LA - 7 deaths and 24 injuries
- 1989 Phillips Petroleum, Pasadena, TX - 23 deaths and 132 injuries
- 1990 BASF, Cincinnati, OH - 2 deaths
- 1990 ARCO, Houston, TX - 17 deaths
- 1991 IMC, Sterlington, LA - 8 deaths and 128 injuries
How Did PSM and RMP originate?

• 1985 American Institute of Chemical Engineers forms the Center for Chemical Process Safety
  – Publishes Guidelines for Hazard Evaluation Procedures
• January 1990, API published RP 750 Management of Process Hazards
• Clean Air Act (CAA) 1990
  – Chemical Safety Board established
  – Authorized the first federal regulations specifically designed to prevent major chemical accidents that threaten workers, the public, and the environment
How Did PSM and RMP originate?

• July 17, 1990 OSHA proposed PSM standard published in the Federal Register (55 FR 29150)
  – Incorporated API RP 750 into 29 CFR § 1910.119
    Process Safety Management of Highly Hazardous Chemicals

• 1992 OSHA promulgates 29 CFR 1910.119
  – Applies to storage of hazardous substances at or above the listed threshold quantity
  – 14 management system elements

• June 21, 1999 EPA promulgates RMP Rule
  – Program Levels 1, 2, 3
  – Offsite consequence determination
  – Emergency Response Planning with CUPA
Cal OSHA PSM overview

1. Process Safety Information: Foundational Information
2. Process Hazard Analysis
3. Operating Procedures
4. Training
5. Contractors
6. Pre-Start Up Safety Review
7. Mechanical Integrity
8. Hot Work Permit
9. Management of Change
10. Incident Investigation
11. Emergency Planning and Response
12. Injury and Illness Prevention Program (Auditing)
13. Employee Participation
   – Trade Secrets
First step - what is a “designated facility”?

- Facilities / processes that contain hazardous chemicals or flammable substances in a quantity, concentration, or process parameters sufficient to result in “elevated” risk to personnel or having potential for significant offsite impact, as determined by the company’s hazard registry (Haz ID)
Identified designated facilities

• Existing PSM/RMP facilities
  – gas plants, anhydrous ammonia

• Identified facilities or processes:
  – Acid plants; e.g., $\text{H}_2\text{SO}_4$, HCL
  – Aqueous ammonia
  – Sulfur recovery plants
  – DOT pipelines with potential public impact
  – Gas lift operations
  – Light oil thermal recovery
  – Process facilities in close proximity of public
  – Waste gas injection

• 29 facilities and processes identified
Management system model for PSM - EPA Title V Permit

• Some key aspects of Title V permit model that could be applied:
  – Permit for specific operating conditions
  – Deviation and breakdown reporting / (RCFA)
    • Any permit condition that is not met;
    • Annual compliance certifications
    • Facility management reviews the requirements and annually certifies compliance with terms of permit
Develop the management system framework

- Apply the basics of PSM/RMP
  - Not just blanket facilities with requirements
- Require more rigorous notification
  - Leading indicators or “early warning” of problems
- Standardize requirements for specific process hazards
- Metrics to measure facility progress
Internal operating permit (IOP) for designated facilities

- Each designated facility is issued an IOP with 50-70 operating conditions
- Example of sections in an IOP:
General permit conditions

- Management system
- RACI
- Deviation reporting (permit conditions)
- Annual compliance certification
- Specific piping codes
- Encroachment
- Internal incident reporting
- Emergency action plans and annual drills
- Variance procedure
- 3-year auditing of IOP
Process safety information

- PFDs, P&IDs,
  - Master drawings updated annually
- Material balances
- Equipment specifications and design codes
- Relief valve design basis
- MAWP calculations
- SAFE charts, cause and effect diagrams, effects of deviation from procedures
- Dedicated file location and documentation
Process hazard analysis (PHA)

- Initial PHA and five year revalidation
- Follow industry PSM standards (CCPS, API)
- Include: siting, human factors, external events, SIL level determination for ESDVs
- Document and track corrective actions
- Conduct PHAs on operating procedures
Mechanical integrity conditions

- Establish safety critical equipment
- Establish inspection and maintenance program
- Instrumentation included in MI program
- Equipment and piping conforms to design standards, at time of construction
- ANSI piping class and inspection frequency
- ESD documented functional testing frequency
- MI documentation available for inspection
MOC and PSSR

- MOC for “not-in-kind” changes (equipment and/or personnel)
- PSSR requirements for new or modified facility/equipment
- Checklist PHA for equipment/small projects
- Documentation for review
- Project drawing package and equipment data files managed
Operating procedures

• Written operating procedures
  – Start up
  – Shutdown
  – Normal operation
  – Emergency shutdown
  – Consequences of deviation and steps to recover
  – Temporary operations

• Annual operating procedure certification
Process safety incident notifications

- Loss of primary containment (LOPC):
  - API 754 Incident Reporting: Tier 1, 2, or 3
- Fire (including electrical arc) directly on process equipment
- Explosion/detonation
- Mechanical integrity deficiencies (NDE < Tmin)
- Critical process alarms or unplanned activation of process ESD
- Encroachment (external influences on process integrity) not involving LOPC
Experience so far...

• Major effort to begin implementation in non-PSM/RMP/DOT facilities and processes

• Field awareness of IOP and PSM requirements made significant difference in positive outcome (success)

• Self reporting of deviations and process safety challenges enables increased management oversight and provides increased focus on RCFA Corrective Actions

• So far, so good...
Process safety regulations
California is an OSHA recognized “state plan state”

- Public Safety, 19 CCR, Chapter 4.5, California Accidental Release Prevention (CalARP) Program
- Other regulatory references that highlight process safety elements:
  - CCR § 6533 Pipe Lines, Fittings, and Valves (MI, PHA, PSI)
  - 8 CCR § 5605 Protection Tanks in Locations That May Be Flooded (External Events)
  - 8 CCR § 5603 Sources of Ignition (Hot Work)
  - 8 CCR § 6531 Gas and Vapor Testing (Hot Work)
  - 14 CCR § 1773 et. al AB 1960 rules (PSI, PHA, MI, Spill Control)
  - 49 CFR, Parts 191, 192, 195 DOT Pipeline Safety Rules (PSI, MI, SOPs, Training, PHA, offsite consequences)
  - 8 CCR § 336.10, 336.11 Multiemployer Worksite (Contractors)
  - 8 CCR § 6551. Vessels, Boilers and Pressure Relief Devices. (MI, PSI, Fitness for Service)
  - 8 CCR § 3203 Injury and Illness Prevention Program (Training, Incident Investigation, PSI, Audits)
Pressure to change PSM & RMP

- 2008 Bayer Crop Science, Institute, WV - 2 deaths, 8 injured
- 2010 Dupont, Belle, WV - 1 death
- 2010 Tesoro Refinery, Anacortes, WA - 7 death
- 2012 Chevron Richmond - 0 injured, 15,000 residents treated
- 2013 West Fertilizer, West, TX - 15 deaths, 160 injured
- 2014 Freedom Industries, Charleston, WV
  - water contamination, 300,000 residents impacted
- 2014 Chevron Upstream, Dunkard, PA – 1 death
  - shale gas well explosion/fire
Cal ARP changes under consideration

• Use of industry accident history for offsite consequence modeling and PHAs
• Written agreement with CUPA for resolution of
  – Incident investigation root causes (maximum 3 years)
  – PHA recommendations (maximum 5 years)
  – Compliance audit findings (maximum 3 years)
  – CUPA audit findings (maximum 1 year)
• Only one revalidation of PHA
  – Unless CUPA agrees in writing that full PHA is unwarranted
• Petition process for any person or business to add substances or change threshold limits
• Use of national consensus standards for citations
Cal OSHA potential changes

• Further adoption of consensus standards
  – ANSI, NFPA, NEC, API, NBIC, ASME

• Adoption of “Safety Case” methodology
  – Company sends their operating conditions to regulator for approval

• Utilize circular letters for regulatory changes

• Strict enforcement of PHAs and resolutions
  – Emphasis on vessel/piping corrosion and historical similar incidents
Executive Order 13650

• Establishes the Chemical Facility Safety and Security working group
  – Include EPA, OSHA, DHS

• Fed OSHA has issued a Request For Information (RFI)
  – Identify issues related to “modernization” of the PSM Standard
  – Response deadline is March 10, 2014
  – Changes drafted, approved & implemented??
RFI focus

- Potential impact associated with implementing the following changes:
  - Removal of the current exemptions the PSM
    - Atmospheric storage tanks containing flammables or in proximity of a covered process
    - Oil and gas drilling and servicing
    - Oil and gas production facilities
  - Adopting and defining RAGAGEP
  - Extending covered hazardous chemicals to include “reactives”
    - Reduce concentration threshold
  - Identifying and managing safety critical equipment
  - 3rd party compliance auditing
Potential PSM “modernization”

- Additional management system elements from consensus standards:
  - Process safety competency
  - PSM program effectiveness measures
  - Stop work authority safe work practice
- Enforcement of PSM at retail facilities
- Requiring inherently safer design
- Defining RAGAGEP
Closing thoughts

• Accident prevention politics will drive changes
• The basics of PSM apply to all upstream operations; e.g., PSI, MOC, PHAs, OP
• Take some time to develop and propose a framework for your business
• Focus on the basics
  – Take the time to plan the implementation
Closing thoughts

• Regulatory changes will happen
  – Option 1: Lead your business and prepare
  – Option 2: Wait and compete for resources later

• A considerable discretionary action is required to develop a framework and achieve “buy in”
  – The effort takes technical competency and persistence

• Build the knowledge while the regulatory framework is being developed

• Good way to run a business
Questions...comments