Meeting Today’s Societal Expectations: Process Risk Management Programs of The Dow Chemical Company

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Chief Process Safety Engineer
The Dow Chemical Company
Growing Concerns About Safety in the Chemical Industry
An Overview

- Dow’s Commitment to EH&S Excellence
  - Drive to Zero
  - 2005 EH&S Goals
  - 2015 Sustainability Goals
- Developing a Rigorous Process Safety Program
  - Work Processes and Operating Discipline
  - Metrics
  - Culture
  - Personalization
- The Role of the Chemical Industry
Goals set in 1996 for 2005

- Injuries and Illnesses: Reduce 90%
- LOPCs: Reduce 90%
- Transportation incidents: Reduce 90%
- Process Safety incidents: Reduce 90%
- Motor vehicle incidents: Reduce 50%
• Process Safety: Goal to reduce by 90%  
  Actual reduction: 71%
• LOPCs: Down 72%

• Transportation incidents: Down 65%

• Injury and Illnesses: Down 84%

• Motor vehicle incidents: Down 39%
During the past 10 years...

- 13,000 employees did not suffer an injury or illness
- 10,500 LOPCs did not occur
- 150 motor vehicle accidents, with potential to cause injury or fatality did not occur
- 1,100 Process Safety incidents did not occur
2015 Sustainability Goals

Collaborate
Listening, learning, talking and taking action – we’re helping our communities to be better places to live and work for everyone.

Elevate
We seek to understand our impact on global ecosystems, and will work towards the efficient and effective use of our precious resources.

Innovate
We will use our technology to develop products to improve the quality of life around the world, while ensuring those products are managed safely throughout their lifecycles.

Perform
We’re raising the sustainability bar, setting targets to address some of the world’s most pressing challenges and tracking our performance publicly, year after year.

This is sustainability at Dow.
By 2015, Dow will achieve, on average, a 75 percent improvement based on 2005 results.

- Injury rate of 0.08 for Dow and contractors combined
  - 75 percent reduction in severity, and NO FATALITIES
- All sites combined will have fewer than 75 LOPCs
- All sites will reduce process safety incidents by 75 percent, reduced severity rate by 95 percent
- All Dow employees combined will reduce the MVA rate to 1.5
- Additional goals: security, waste and emission reduction or resource conservation
- ....(other goals)
Pyramid of Process Safety Performance

Organization, Work Processes and Operating Discipline
Organization, Work Process and Operating Discipline

- **Process safety begins with the design and control of a facility**

Organization:
- 25 Technology Centers worldwide
- 30 full-time process safety professionals (Process Safety Technology Leaders)
- Chief Process Safety Engineer
- Dedicated analytical research roles for reactive chemicals program
- Strong dedication to process safety issues by internal Process Automation and Process Engineering functions
- Key Manufacturing and EH&S roles: Production Leaders, Business Manufacturing Leader, EH&S BOL, Site EH&S Responsible Care Leaders
Dow’s Process Safety History

Pre-1960 - Fire Protection Engineering
1963 - Corporate Safety & Loss Prevention Department formed
1964 - Fire and Explosion Index (Risk Analysis)
1966 - Reactive Chemicals Program
1974 - Loss Prevention Principles issued
1976 - Minimum Requirements (First Edition)
1986 - Chemical Exposure Index (CEI)
1990 - Chemical Engineering Hazard Guidelines issued.
1991 - Guidelines for Management of Change
1994 - Process Risk Management Guidelines for Facilities and Distribution
1994 - Guidelines for Hazard and Operability Study
1997 - Process Safety Expertise Center established
1997 - Global Reactive Chemicals Global Standard issued
1998 - TDCC Business EH&S Risk Evaluation Work Process
1999 - Global Mechanical Integrity Standard issued
2000 - Introduction of Layers of Protection Analysis tool
Dow’s Process Safety History

And our “history” never stops growing. We continuously improve upon our existing programs….

Pre-1960 - Fire Protection Engineering
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Although we already had a rich tradition in Process Safety, with the integration of best practices from UCC’s Operational Safety program we’ve added to or enhanced several of our programs.

1991 - Guidelines for Management of Change
1994 - Process Risk Management Guidelines for Facilities and Distribution
1994 - Guidelines for Hazard and Operability Study
1997 - Process Safety Expertise Center established
1997 - Global Reactive Chemicals Global Standard issued
1998 - TDCC Business EH&S Risk Evaluation Work Process
1999 - Global Mechanical Integrity Standard issued
2000 - Introduction of Layers of Protection Analysis tool

2001 - Enhanced Process Risk Management Program
2002 - Enhanced Layers of Protection Analysis
2004 - Update to all Dow Loss Prevention Principles
2006 - Enhanced Building Overpressure Analysis

.... and many more.....
The Bow-Tie Diagram

HAZARD

THREAT

THREAT

THREAT

Undesired Event

Barriers

Mitigation & Emergency Preparedness Measures

CONSEQUENCE

ENGINNERING

MAINTENANCE

OPERATIONS

Courtesy of Robin Pitblado DNV
Work Processes and Guidelines

- **Corporate-wide work processes** and guidelines for implementation of Operating Discipline, Management of Change, Mechanical Integrity programs, Training, Project reviews and more

Dow corporate Operating Discipline Management System (ODMS)

Web based. Accessible to all employees world-wide
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State Based Control - Like pressing the “Easy” button
- Dow internally developed control system beginning in 1970’s
- Automated Operator Work Processes (Startup, Shutdown, Runs steps)
- Automated Process State Degradation Handling (Abnormal Situation Management)
- In 2001, Dow Standardized on the ABB 800xA

State Based Control:
- Plant-Wide Coordination of Startup and Degradation
- Automation of Frequent Operations
- Process Upsets Handled by Automation Program
- Alarms Only Enabled when Required
- Control Strategies are State Dependent

Benefits:
- Increased productivity
- Reduced variability
- Improved EH&S performance
- Fewer nuisance alarms
- Enforces operating discipline
Pyramid of Process Safety Performance

- Loss of Primary Containment (LOPC)
- Process Safety Near Misses
- LPP Compliance & Gap Closure
- Reactive Chemical incidents (including any unplanned fires)
- Overdue action items
- Compliance Plan status

Work Processes and Operating Discipline
Pyramid of Process Safety Performance

- Work Processes and Operating Discipline
- Metrics
- Culture
Culture – Ownership and Accountability at all levels

**Company and Business Leaders**

- Set Performance Vision
- Provide the resources
- Hold organization accountable
- Hold themselves accountable
  - Annual ratings, bonuses and career opportunities hinge on success
Plant Leaders
The most important player with respect to culture!

- Their pay and career movement must be dependent on safety performance
- Must be held responsible for results not just implementation
- Dow performs a “New Leader Review” within the first six months of any new Production Leader arriving to a new role. This NLR is intended to demonstrate knowledge/competency of the reactive chemical and process safety hazards present in the plant.
  - As the final reviewer of all MOCs, we want the Production Leader to be fully aware of the hazards and mitigations in place to prevent incidents in the plant prior to approving changes.
**Plant Operators**

- Where it all comes together; your front line of defense
- Employment must be contingent upon safety performance
- Plant Leader must hold employees accountable
- “Balance of Consequences” applied to behaviors
Process Engineers, Process Automation, Design

• Utilize Inherently Safer designs

• Incorporate Process Automation which will take a plant to a safe state even without operator intervention

• Follow recognized industry standards

• Emphasis the importance of Management of Change and Pre-Startup Safety Reviews whenever building or changing the process.
Pyramid of Process Safety Performance

Work Processes and Operating Discipline

Metrics

Culture

Personalization
Characteristics of Safety Performance Intangibles

- The entire organization must personalize process safety and what it means to them.
- Communication is constant, timely, and personal
- Make safety performance data relevant—go beyond the numbers
- The consequences of an incident are internalized, individually...from the operator level to the corporate leader level.
- Total ownership of performance across the entire organization
- Must be kept fresh, creativity is the key
Chemical Industry’s Reputation for Safety Grows
Thank You