



*Minimizing risk. Maximizing potential.™*

February 12, 2014 | East Hartford, Connecticut

AIHA/ASSE Meeting

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# **Process Safety Management**

## ***What the Industrial Hygienist Should Know*** **(including Proposed Changes to 29 CFR 1910.119)**

by  
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[Soderberg.m.nh@iomosaic.com](mailto:Soderberg.m.nh@iomosaic.com)



## Background and Experience

- Melody Soderberg, CFEI
  - Senior Consultant, ioMosaic Corporation
  - B.S. in Chemical Engineering
  - B.S. in Fire Protection Engineering
  - Certified Fire and Explosion Investigator
- Technical Expertise includes:
  - Process Safety Management
  - PSM Auditing
  - Process Hazard Analyses
  - Chemical Incident Investigation



## Contact Information

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Senior Consultant



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Soderberg.m.nh@iomosaic.com | [www.ioMosaic.com](http://www.ioMosaic.com)



## Agenda

- Introduction to Process Safety Management (PSM)
- Understanding Hazard and Risk Identification
- Overview OSHA PSM 29 CFR 1910.119
- In Dec 2013 - OSHA Proposed Changes to PSM
  - Third-Party Audits
- Learn From Experience
  - Process Safety Incident: DuPont – Phosgene Release

# Introduction to Process Safety Management







## What is process safety management?

- A management system that is focused on
  - prevention of,
  - preparedness for,
  - mitigation of,
  - response to, or
  - restoration from

catastrophic releases of chemicals or energy from a process associated with a facility.

- CCPS Guidelines for Risk-Based Process Safety



## What is process safety?



### Personnel Safety

*Slips Trips and Falls*



### Process Safety

*Catastrophic Process Incidents*



## What is a catastrophic process safety incident?

### Loss of Containment

- Flammables
  - Pool fires, jet fires, boiling liquid expanding vapor explosions (BLEVE)
  - Flash fires, vapor cloud explosions
  - Thermal radiation and overpressure
- Toxics
  - Vapor releases
  - Inhalation, ingestion, skin contact
- Reactives
  - Runaway reactions
- Combustible dusts
  - Explosions







## What is a catastrophic release?

- A **catastrophic release** is a major uncontrolled emission, fire or explosion, involving one or more highly hazardous chemicals (HHCs), that presents serious danger to employees in the workplace





## Process Safety Management is about Accident Prevention

### Commit to Process Safety

- A workforce that is convinced the organization fully supports safety as a core value will tend to do the right things, at the right times – even when no one else is looking

### Understand Hazards and Risk

- To allow the organization to allocate limited resources in the most effective manner

### Manage Risk

- With a goal to sustain long-term, accident-free, and profitable operations

### Learn from Experience

- Using mistakes to determine lessons learned as motivation for action

- CCPS Risk-Based Process Safety Guidelines

# Understanding Hazard and Risk Identification





## Understanding the Hazards of a Chemical Process

- What can go wrong?
- How likely is it?
- What are the impacts?
- Is the risk tolerable?



SuperChems



ioXpress



HAZOPTimizer



ioFIRST



ioLOGIC



ioVu



ioAuditor



**All of our existing and new software tools (client side) will be integrated under the Process Safety Office™ suite**



One Installer  
Components can be licensed individually  
One security key  
Limited activations for non-licensed components  
Integration with ioXpress  
Integration between Components





## Process Safety & Risk Management





## ioXpress™

ioXpress is a knowledge management software package

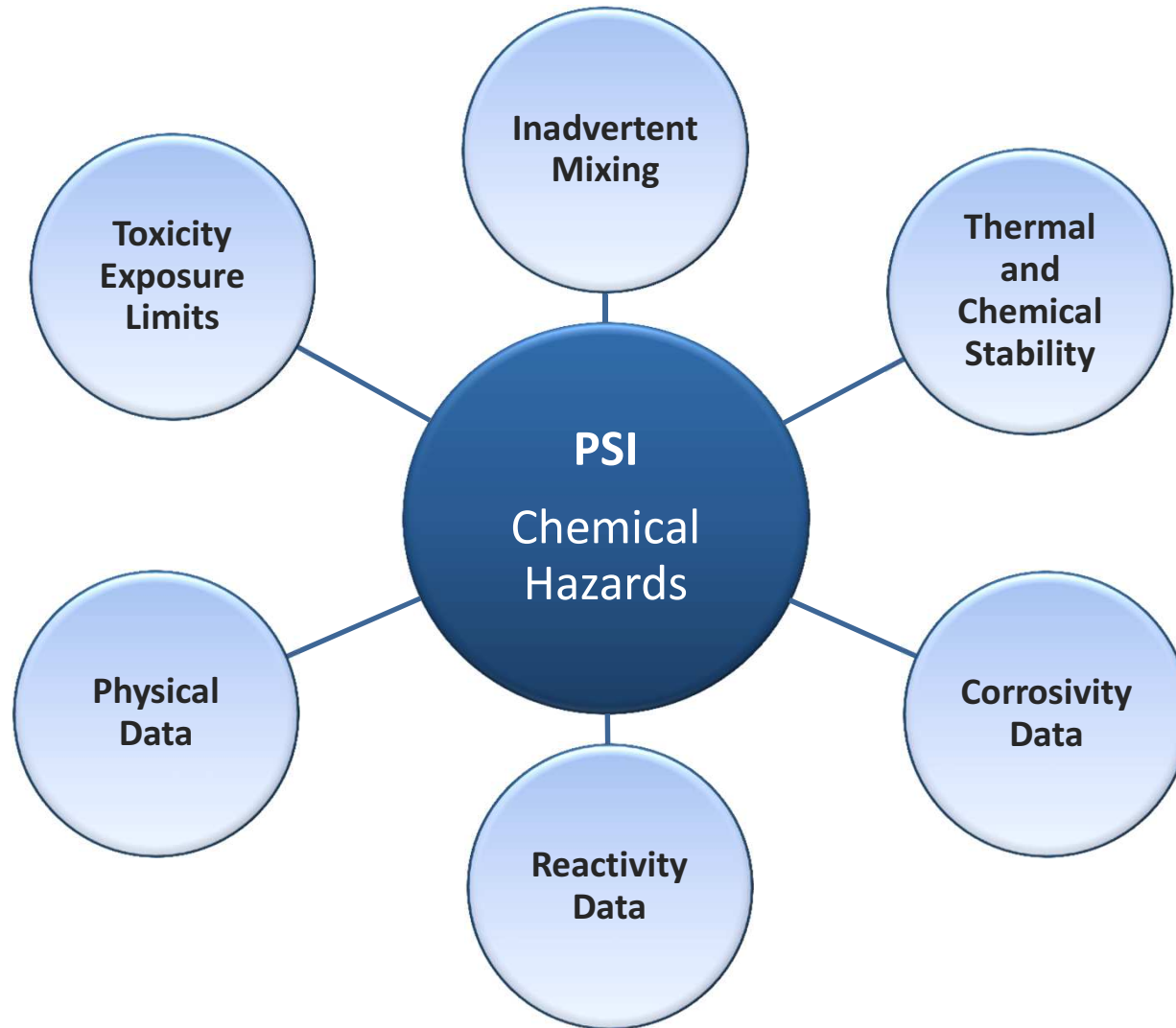
- Administer workflows
- Manage data and documents
- Enable knowledge sharing
- Enhance communication

The screenshot displays the ioXpress web application interface. At the top, there's a navigation bar with links like Libraries, Modules, Communication, Tasks, Reports, Tools, and Manager. Below this, a search bar and a 'Welcome to ioXpress' message are visible. The main content area is divided into several sections: 'News' with two recent updates, 'New Documents' with a table of files, and 'Action Items' with a list of tasks. The footer contains contact information and copyright details.

Option	Type	File Name	Last Modified
		0100ioM12112008OTH.ioMosaic Performance Review Form - Partner	12/23/2011
		105	12/23/2011
		summary	12/23/2011
		cvp	12/23/2011
		dan	12/22/2011
		ioAuditor test import	12/20/2011
		ioAuditor1	12/20/2011
		ioAuditor1	12/20/2011
		HAZOP test import Worksheet	12/20/2011
		Audit Management Solution	12/16/2011

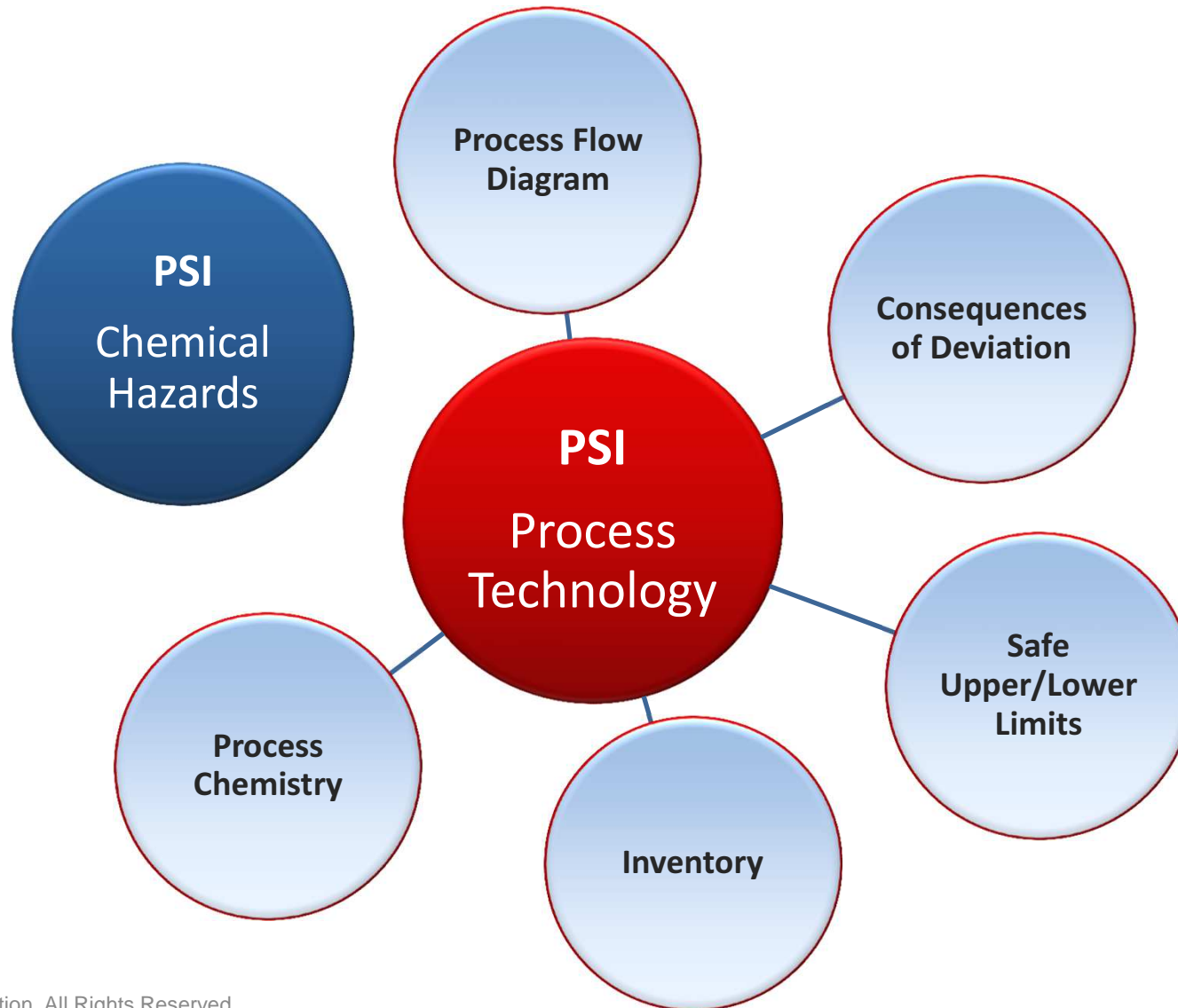


## Process safety information (PSI) – chemical hazards



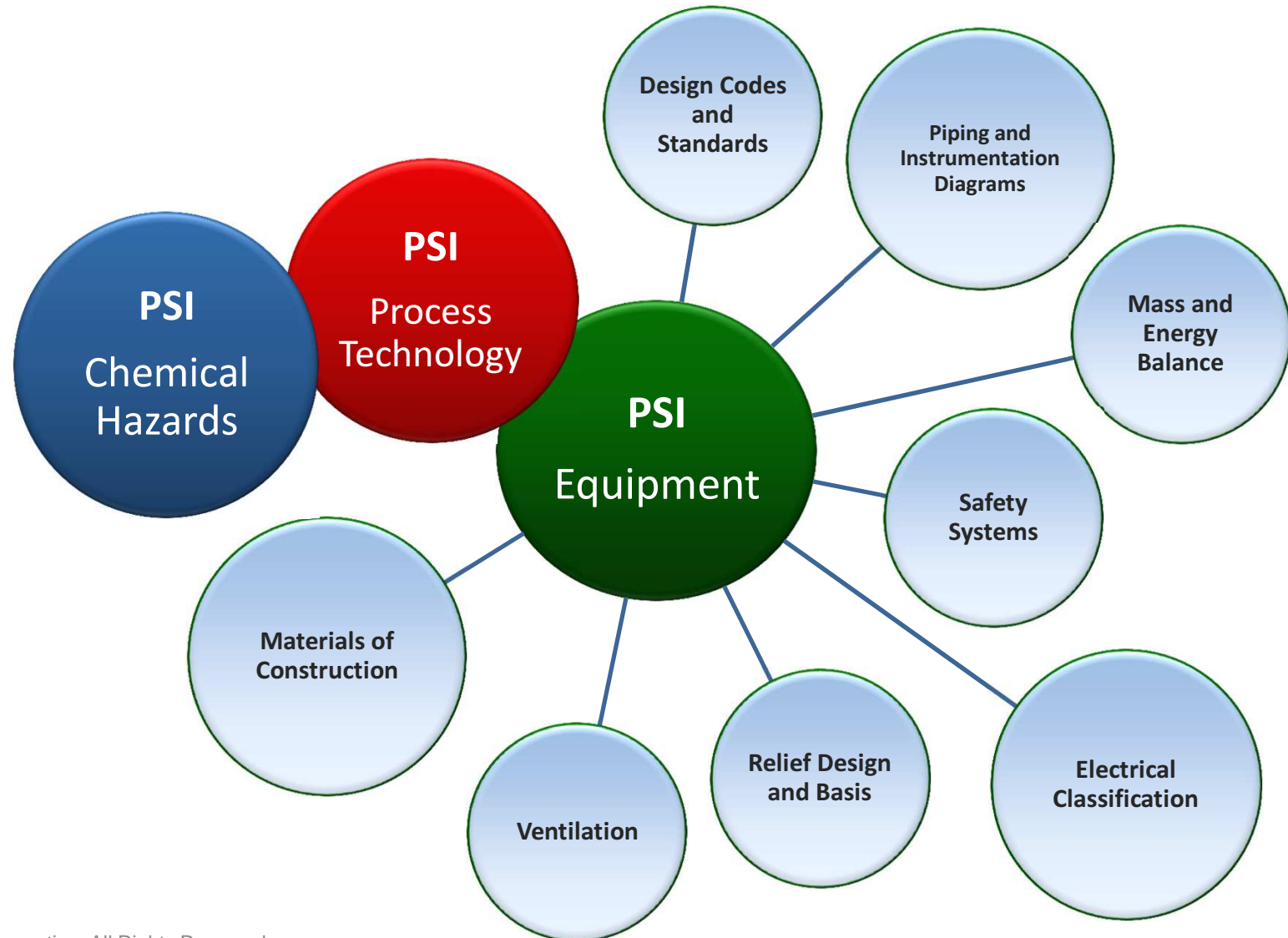


## Process safety information – process technology





## Process safety information – equipment







## ioXpress™ Features

- Manage information by PSM element
- Centralized PSI linked to PHAs, MOCs, IIs, Relief Systems,
- Manage documents and data
  - AutoCAD, databases, email, HTML, PDF, Microsoft Office products, etc.
- Action item tracking
- Enable knowledge sharing
- Fully integrated with full suite of ioMosaic software solutions



## ioXpress™ Features

### ➤ Action item tracking

ioXpress

Hello, Jaime | Logout | Profile | Help

Libraries Modules Communication Tasks Reports Tools Manager

Current Site: ioMosaic

Tasks List Tasks

★ Favorite | 🛒 Cart [0] | ? Help

Search for  GO

Advanced Search >>

Tasks

- Action Items Assigned to You
- Action Items Assigned by You
- Add a project action item
- Add a module action item
- Action Item in Calendar View

### ACTION ITEM

New General Action Item | New Module Action Item

Advanced Search (Select Action Item Type)

☐ Project ☐ Module ☐ Workflow GO

Goto Action Item  GO

[Edit Action Item]

#### Info

Action Item ID:	1845	Elapsed Time:	196 day(s)
Assigned By:	Jaime Romero	Date Entered:	3/28/2012 11:00:17 AM
Last Modified By:	Jaime Romero	Date Modified:	3/28/2012 11:00:17 AM

#### Details

Description:	demo		
Assigned to:	Jaime Romero	Module:	Relief Device:1544-ARV-3566
Status:	Open	Reference:	
Priority:	A-High		
Due Date:	3/29/2012		
Notify List:			
Rec./Findings:	demo		
Comments:			

#### Attachments

Attachment	Comment
<input type="text"/>	<input type="text"/>

#### Action Item Management

Completion Date:

#### Action Tracking History

Entered By:	Jaime Romero	Jaime Romero --> Jaime Romero	Open	3/28/2012 11:00:17 AM	+ -
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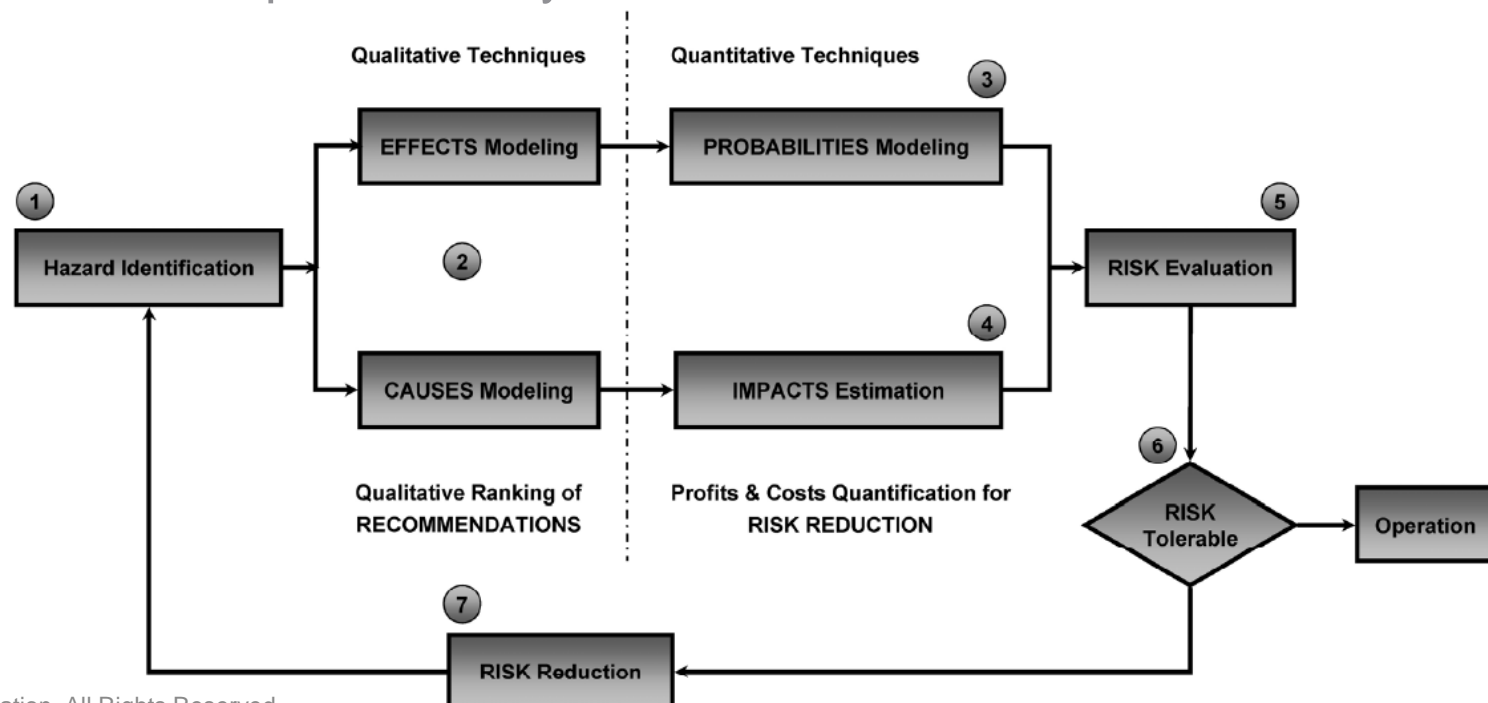
Contact | Legal | About ioIQ, LLC

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## Process Safety Steps

- 1. Process Hazard Analysis (PHA)
- 2. Risk Ranking
- 3. Frequency Analysis
- 4. Consequence Analysis
- 5. Risk Analysis
- 6. Risk Tolerability Criteria
- 7. Management of Change





## 1. Process Hazard Analysis

- HAZard & OPerability study (HAZOP)
- Checklist
- What-if
- Checklist-What-if
- Event Tree Analysis (ETA)
- Fault Tree Analysis (FTA)



## Preparing for the PHA – Team Members

### Expertise or Knowledge about

Specific PHA Methodology

- PHA Leader

Engineering and Process Operations

- Process Engineer
- Supervisor

Process Day-to-Day Operations

- Process Operators
- Contractor Operators

Mechanical Integrity Program

- Mechanical Maintenance (typically)

Instrumentation and Control

- E&I Maintenance (typically)

R&D Chemistry

- Process Engineer







## 2. Risk Ranking

- A risk matrix contains frequency and consequence ranges the combination of which provides a relative measure of risk

**Risk-ranking Matrix**

5	C	B	A	A		
4	D	C	B	A		
3	D	D	C	B		
2	D	D	D	C		
1	D	D	D	D		
0	O					
	0	1	2	3	4	
	<b>Consequence</b>					

**Likelihood**

Levels of likelihood = 5  
Levels of consequence = 4

Risk Level		Team Action
O	Operability	Operability issue
A	High Priority	Risk mitigation required to risk level "D"
B	Medium Priority	Risk mitigation required to risk level "D"
C	Low Priority	Risk mitigation required to risk level "D"
D	Very Low Priority	No further risk mitigation required





## Risk Matrix

- Consequence and Likelihood values are determined by the judgement of the PHA team to apply the risk matrix

Risk Ranking Consequence Ranges

Consequence Range	Safety Consequence Criteria	Environmental Consequence	Property Damage/ Business Interruption
1	First aid injury	Minor Environmental Release	PD & BI < \$50,000
2	Recordable Injury, minor fire	Reportable Chemical Release	PD & BI < \$250,000
3	LTI, major fire	off-site release with public consequences	PD & BI < \$1,000,000
4	One or more onsite or offsite fatalities	off-site release with public consequences	BI & PD > \$1,000,000
	Optional		

high <-- low

Risk Ranking Frequency Ranges

Likelihood Range	Event Frequency	Impact Frequency
1	$<10^{-4}$ (Once per 10000 years)	$<10^{-5}$
2	$10^{-3}$ to $10^{-4}$ /yr (Once per 1000 years)	$10^{-4}$ to $10^{-5}$ /yr
3	$10^{-2}$ to $10^{-3}$ /yr (Once per 100 years)	$10^{-3}$ to $10^{-4}$ /yr
4	$10^{-1}$ to $10^{-2}$ /yr (Once per 10 years)	$10^{-2}$ to $10^{-3}$ /yr
5	$>10^{-1}$ /yr (Once per year)	$>10^{-2}$ /yr

high <-- low





## HAZOPtimizer™

- HAZOPtimizer™ is a process hazard analysis (PHA) documentation software that simplifies recording of findings and tracking of action item follow-up from PHAs.
  - User-friendly Excel-based application, no special software needed
  - Assists in complying with codes and standards such as:
    - OSHA PSM
    - EPA RMP
    - NFPA 654 (Combustible Dust)



# HAZOptimizer™ HAZOP Worksheet

HAZOptimizer1 [Compatibility Mode] - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Add-Ins Load Test Team

HAZOptimizer ▾ |New Section| |Copy Section| |Remove Section| |Import Section| |Rename Section| |Lock| |UnLock| |Hide Header| |Show Header| |Summary| |Prep for Prt|  
|Data Entry| |Add Line| |Remove Line(s)| |New Cause| |New Consequence| |New Recommendation| |Renum Item No.| |Copy| |Paste| |Reset Attendance Sheet|  
|Go To Tab| |Convert Units| |Volume Calc.| |Comments|

Menu Commands Custom Toolbars

19 fx No recommendation

**Company:** ioMosaic Corp **Drawing Numbers:** PV11-PID 5  
**Facility:** Salem NH **Unit/Process:** Polymer 1122  
**Date:** 9-May-11 **Equipment and Lines:** PV11 and associated lines and receivers  
**Design Intention:** Section focused on PV11. Multi-purpose batch chemistry that involves EPI, DMA and EDC, as well as caustic and acids for PH adjustments.

Level A: 0 Level D: 0  
Level B: 0 Level : 0 # Entry for Likelihood (L#) or Consequence (C#) out of range  
Level C: 1 Operating Issue: 0

**Study:** HAZOP

Item No.	Deviation	Cause	Consequences	Engineering and Administrative Controls	L	C	R	Recommendations	Comments/Questions
1.01	High flow	Higher flow of steam than anticipated from control valve	loss of containment	High flow alarm	3	3	C	No recommendation	
1.02	No/low flow								
1.03	Misdirected Flow								
1.04	Reverse Flow								
1.05	Loss of containment								
1.06	High pressure								
1.07	Low Pressure								
1.08	Vacuum								
1.09	High temperature								
1.10	Low temperature								
1.11	Incomplete Reaction								
1.12	No Reaction								
1.13	Reactants added in wrong order								

Attendance Section 1 RiskRanking Reference DeviationMatrix Comments Options

Ready 100%



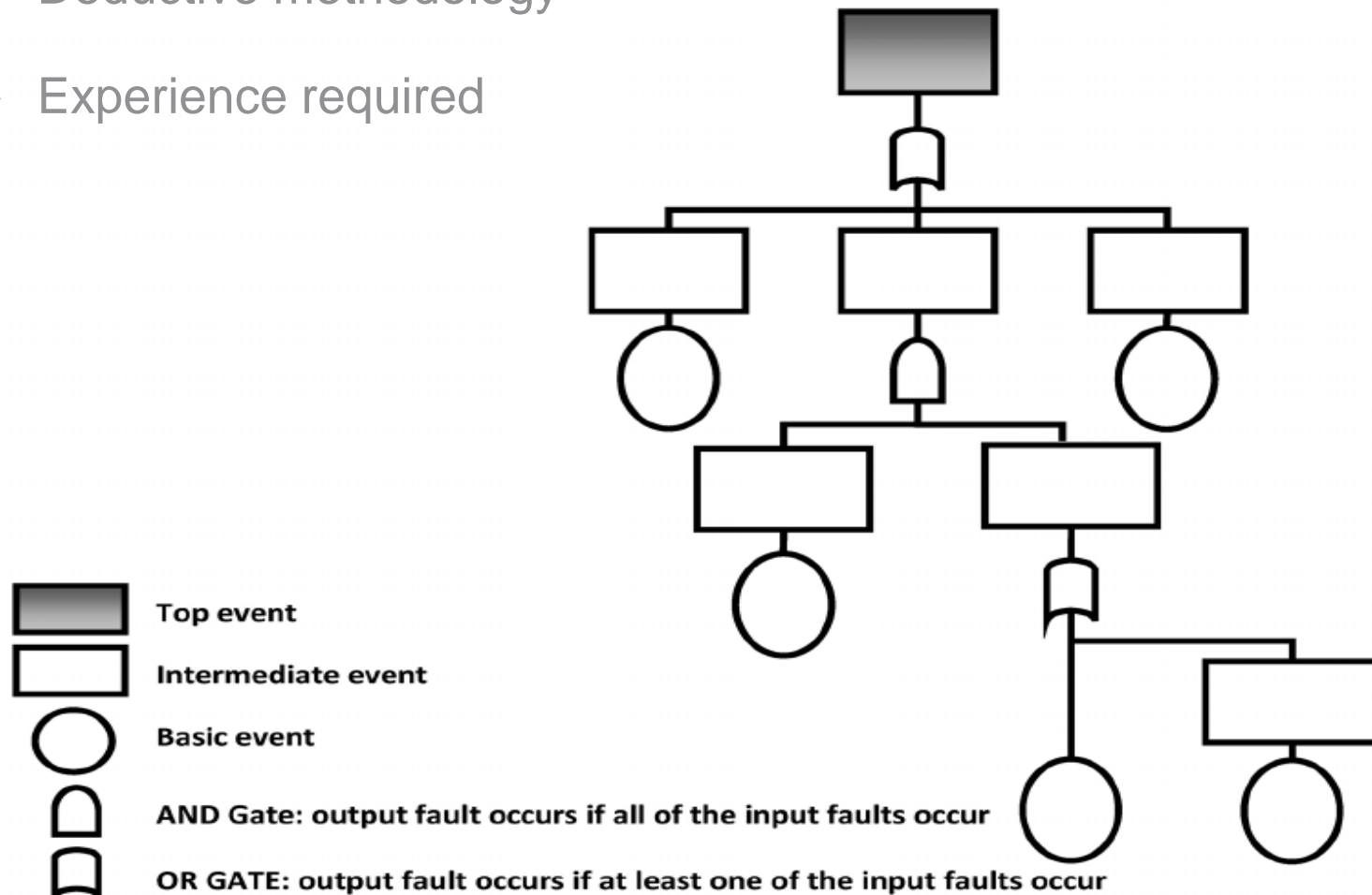
## HAZOPtimizer™ Features

- PHA methodologies include:
  - HAZOPs
  - LOPAs
  - What-if and Checklist
- Multiple pre-populated checklists for dust hazard PHAs, in accordance with NFPA 654
- Pre-start up safety review included as checklist option
- Fully adaptable for up to a 6x6 risk-ranking matrix
- Categorizes action items as pre-start up, or post start-up
- Easily import action items to ioXpress™



### 3. Frequency Analysis

- Deductive methodology
- Experience required

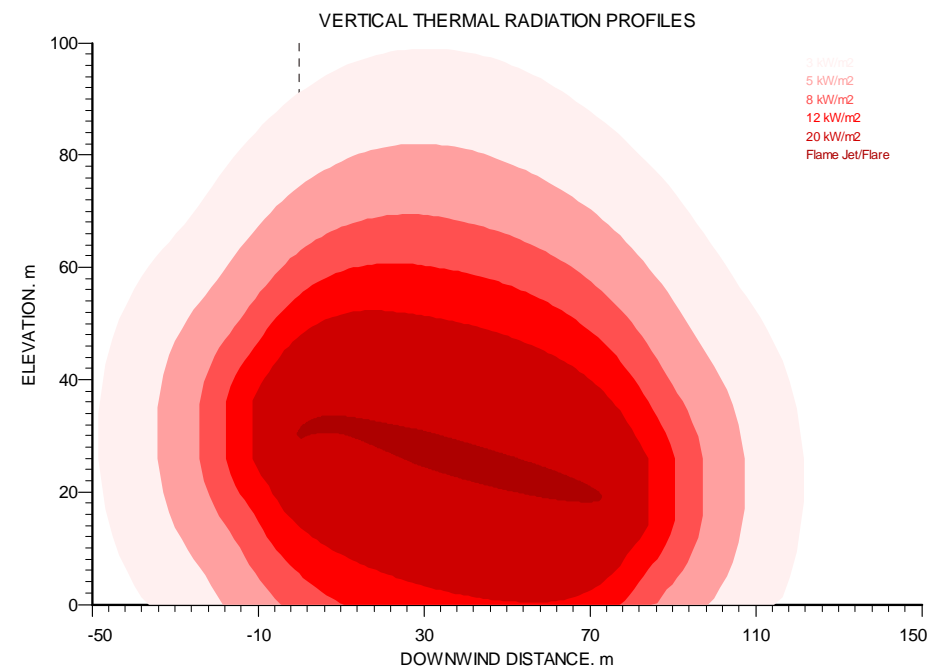






## 4. Consequence Analysis

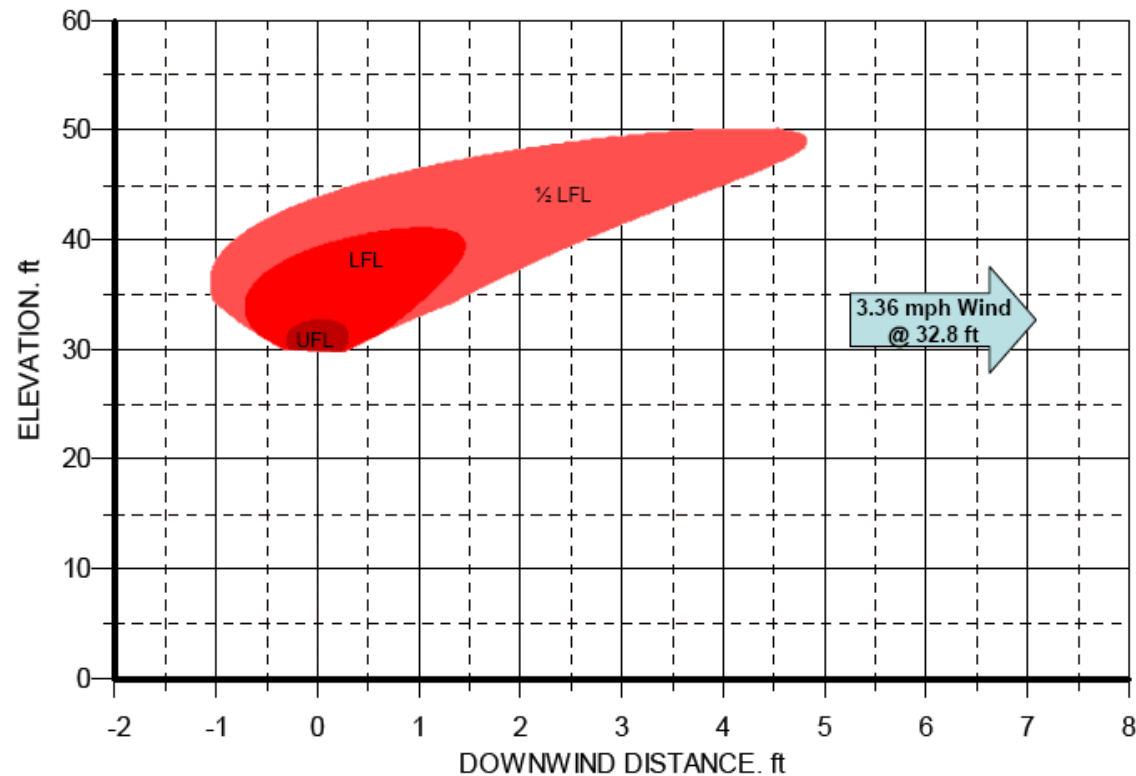
- Loss of Containment
  - Emergency Relief Systems (PRVs, RDs, EDPs,...)
  - Flare Systems
  - Failure of Mechanical Integrity
  - Runaway Reactions
  - Combustible dusts





## SuperChems™ Features

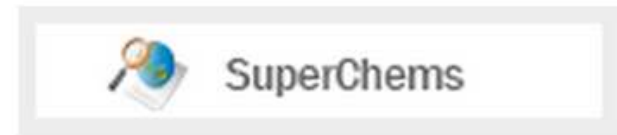
- Integrated and state-of-the-art dispersion models for single and multiphase systems using true multi-components. Can also handle mixture toxicity.





## 5. Risk Analysis

- Quantitative Risk Analysis (QRA)
  - Land-use Planning and Facility Siting

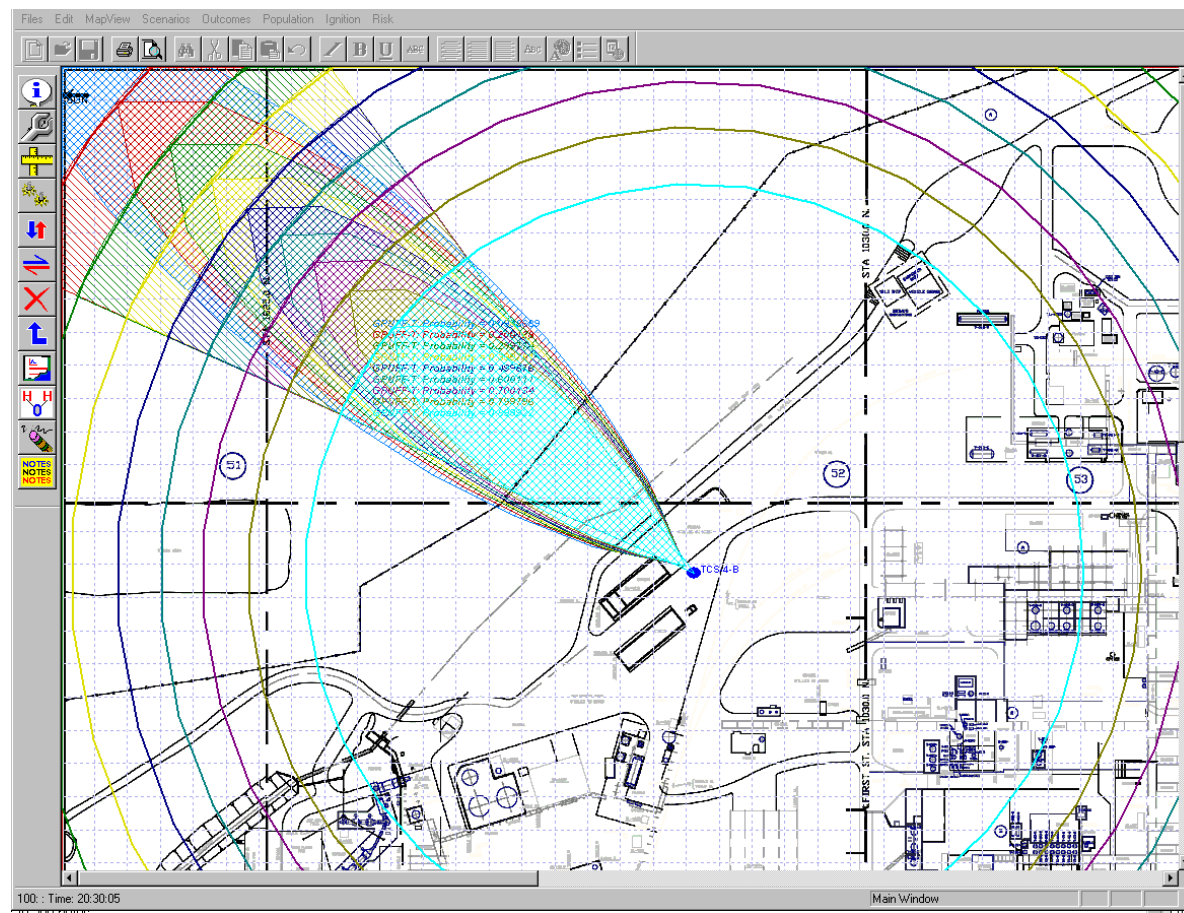






## SuperChems™ Features

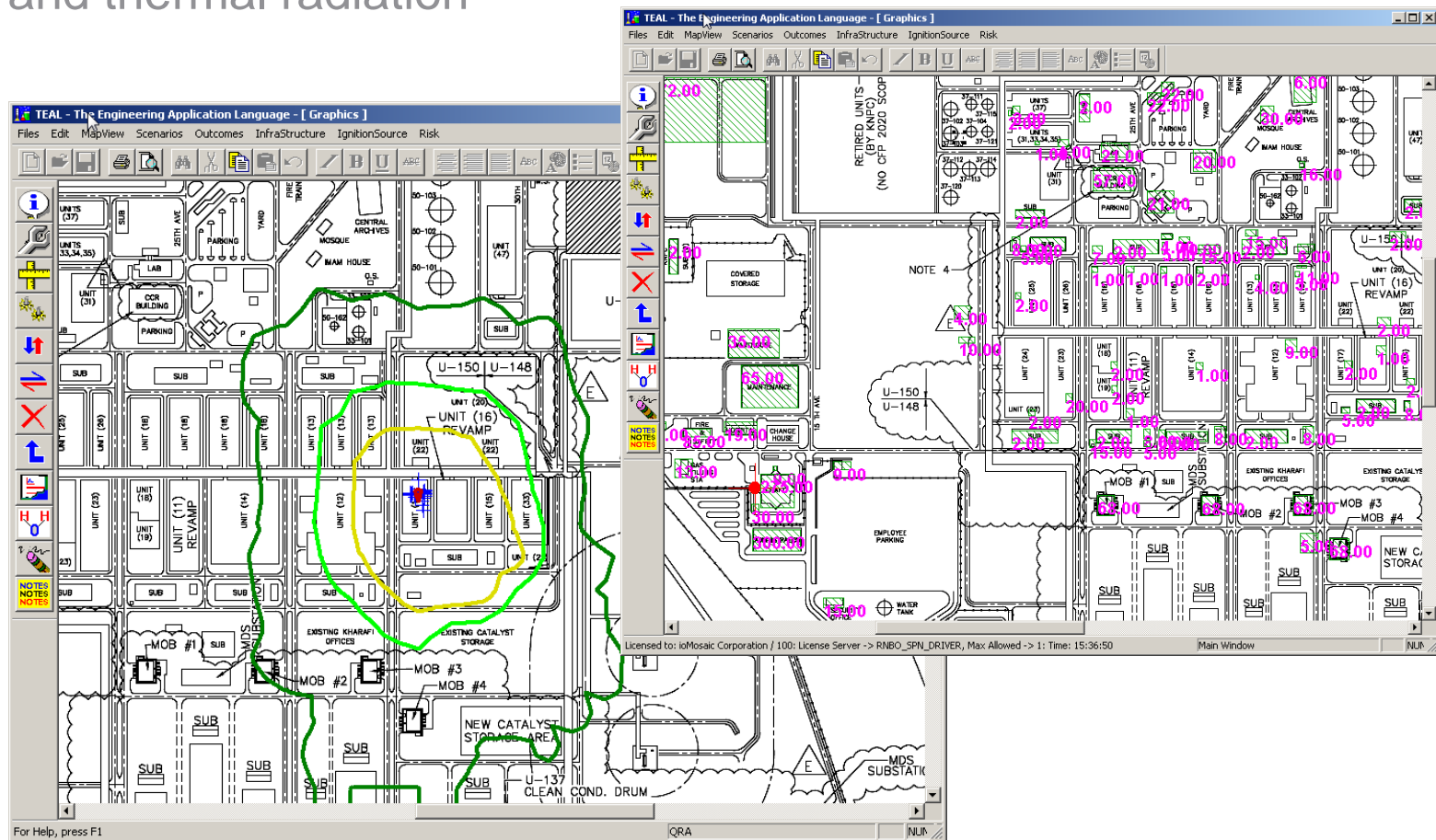
- User-defined maps for consequence and risk analysis





## SuperChems™ Features

- Advanced facility siting modules for overpressure, toxicity, and thermal radiation

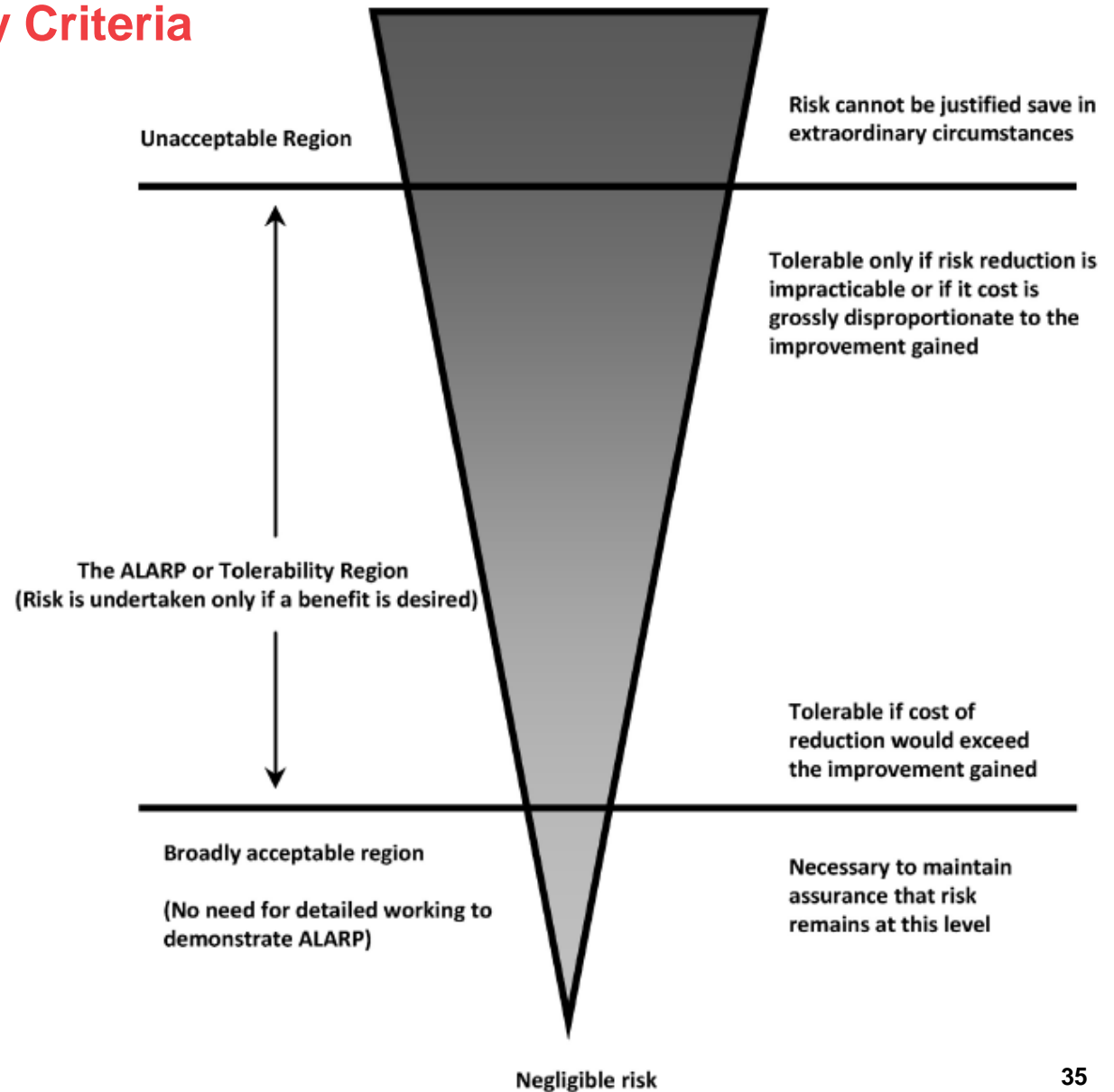




## 6. Risk Tolerability Criteria

### ➤ ALARP

➤ “As Low As Reasonably Practicable”







## 7. Management Of Change

- Implementation of prevention, control and/or mitigation strategies for risk reduction
- A PHA will be conducted
  - To ensure that hazards are reduced
  - To ensure that no new hazardous scenarios are being introduced.

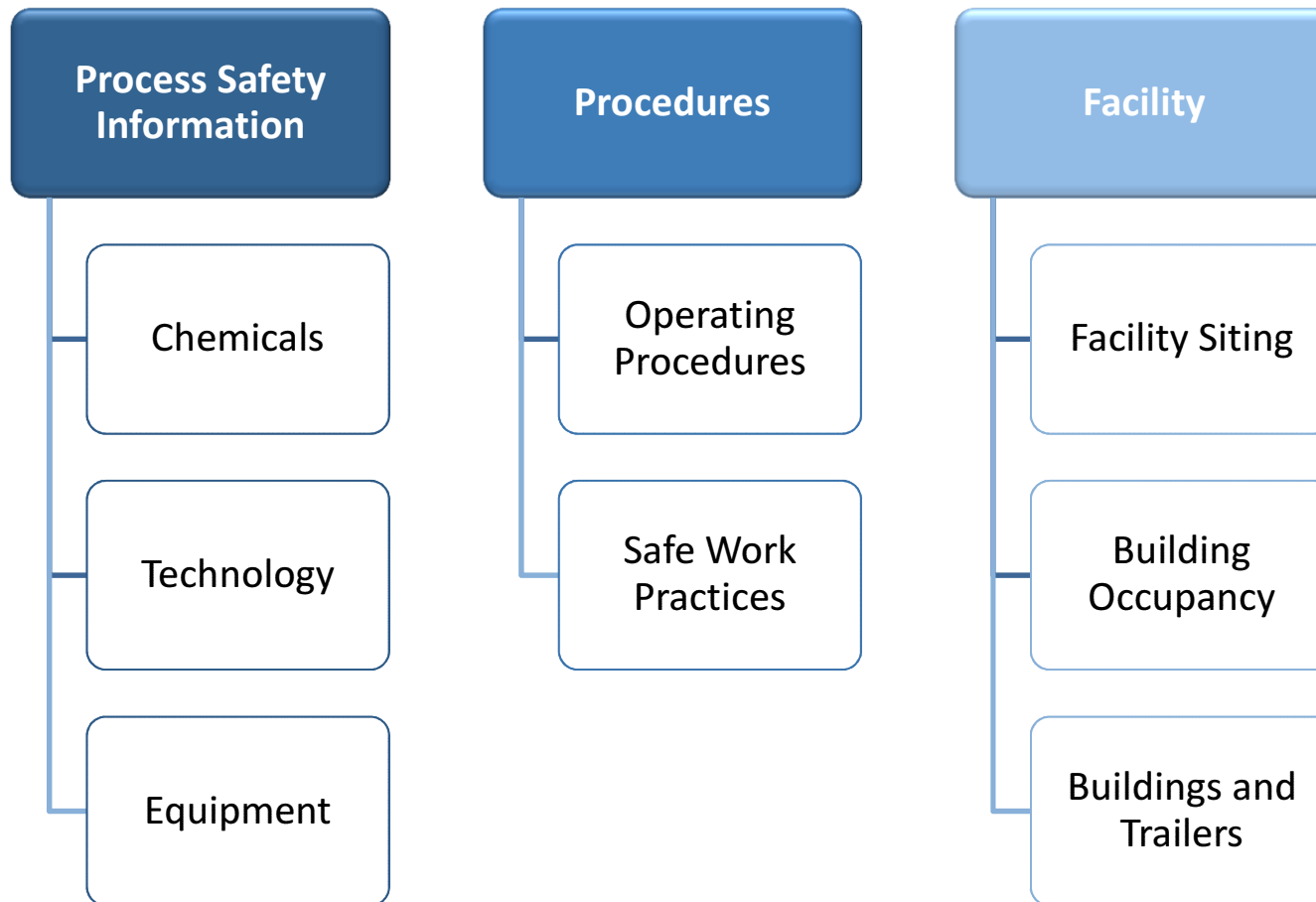


ioXpress



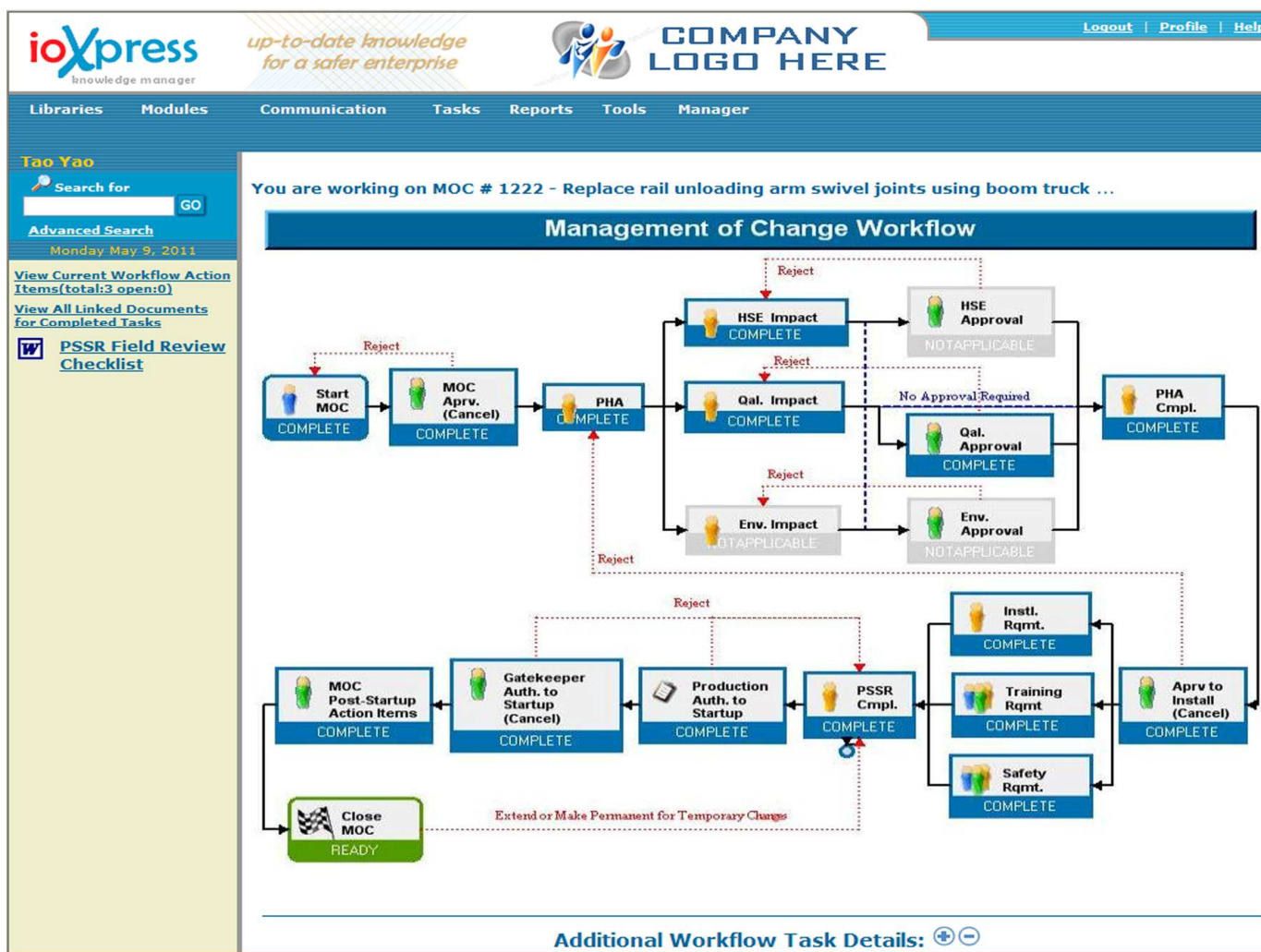
## Management of change

### ➤ System to manage changes





## ioXpress™ with MOC Workflow





## ioXpress™ with Workflow

### ➤ MOC / Process Change Request

ioXpress

Hello, Jaime | Logout | Profile | Help

Libraries Modules Communication Tasks Reports Tools Manager

Current Site: ioMosaic

Search for [ ] GO

Advanced Search >>

Modules

- Add a new I - MOC
- Show all I - MOC
- Search for a I - MOC
- Add a new action item
- Current Workflow Action Items

EDIT DATA

Back to Workflow

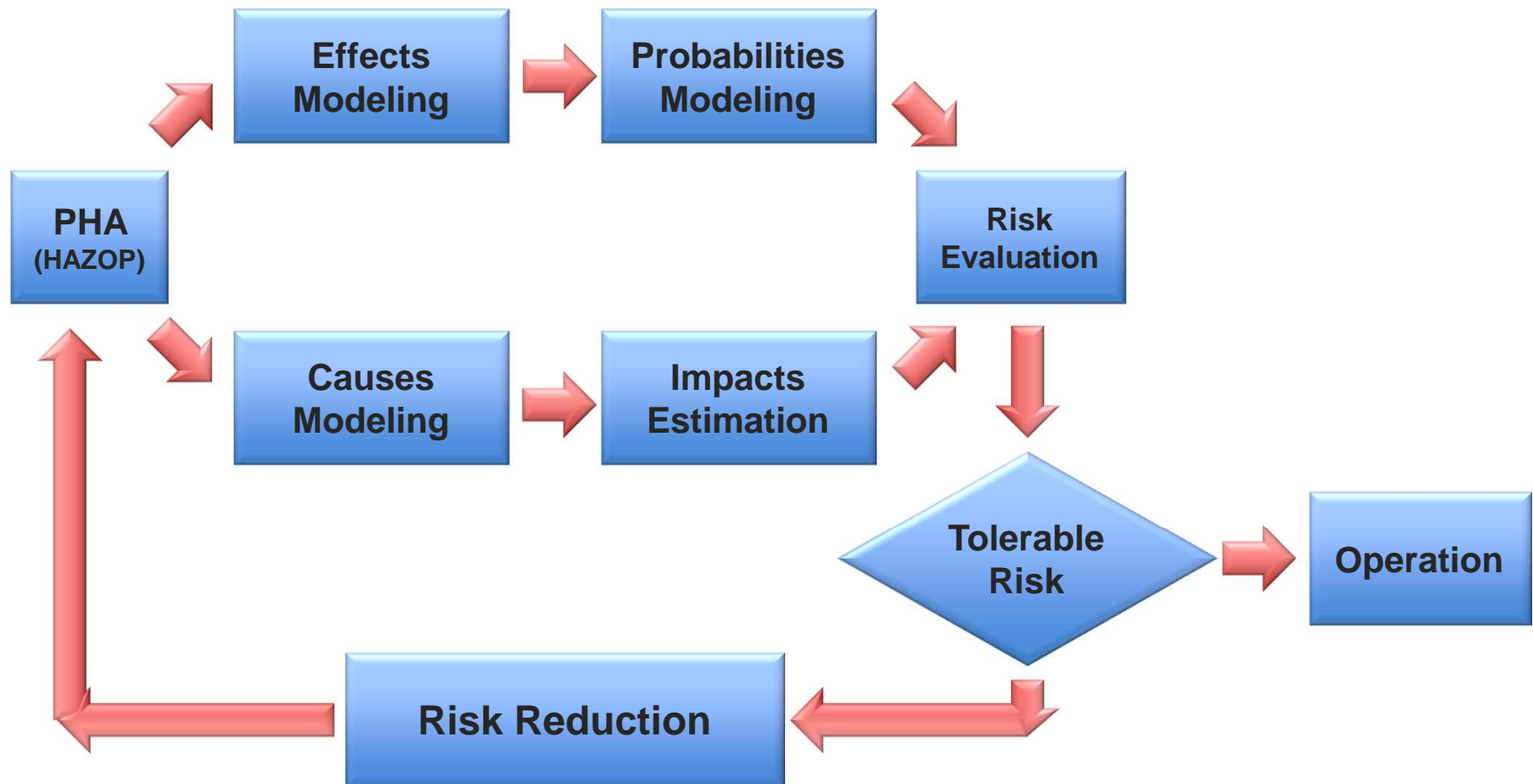
MOC DEMO1 # 1416 - change a pump

MOC Request Workflow Note Data History

*MOC Number	1416	* Identifier Field
*Date	2/10/2012	
*Title of Change	change a pump	
*Requester	Tao Yao	
*Affected Process	Crude Plant	
*Type of Change	permanent	
Temporary Change Duration (days)		
*Unit/Process Status	unit off	
*Nature of Change	<input checked="" type="radio"/> SOP, control logic, set point, operating limit, operational, unloading [Operations Manager] <input type="radio"/> equipment, maintenance, mechanical integrity program, adjacent activity [Maintenance Manager]	
*Gatekeeper	Tao Yao	
Equipment/Component	test	
*Description & Purpose	test	
*Technical Basis		



## Understanding Hazards and Risk Identification



# OSHA PSM 29 CFR 1910.119







## The OSHA PSM Standard was promulgated in 1992

- United States Occupational Safety and Health Administration  
*Process Safety Management Standard 29 CFR 1910.119*
  - Preventing or minimizing the consequences of a **catastrophic release** of toxic, reactive, flammable, or explosive chemicals
  - Focused on threat to onsite employees and contractors
  - Requires a PSM system with 14 elements





## ***Process Safety Management Standard 29 CFR 1910.119***

- Contains a list of applicable chemicals
- Threshold quantities (TQs) for inventory in a single process
  - Includes general TQs of 10,000 lbs. of flammable chemicals
  - Includes specific TQs for toxic and reactive chemicals
  - All explosive chemicals are covered





## The list of Highly Hazardous Chemicals (HHC), Toxics and Reactives (Mandatory) is located in Appendix A

← → ↻ www.oshaweb/owadis.show\_document?p\_table=STANDARDS&p\_id=9761 ☆

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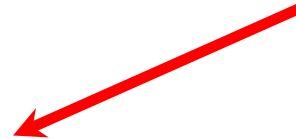
Home Workers Regulations Enforcement Data & Statistics Training Publications Newsroom Small Business **OSHA**

← Regulations (Standards - 29 CFR) - Table of Contents

- **Part Number:** 1910
- **Part Title:** Occupational Safety and Health Standards
- **Subpart:** H
- **Subpart Title:** Hazardous Materials
- **Standard Number:** 1910.119 App A
- **Title:** List of Highly Hazardous Chemicals, Toxics and Reactives (Mandatory).

This Appendix contains a listing of toxic and reactive highly hazardous chemicals which present a potential for a catastrophic event at or above the threshold quantity.

CHEMICAL NAME	CAS*	TQ**
Acetaldehyde	75-07-0	2500
Acrolein (2-Popenal)	107-02-8	150
Acrylyl Chlorde	814-68-6	250
Allyl Chlorid	107-05-1	1000
Allylamine	107-11-9	1000
Alkylaluminum	Varies	5000
Ammonia, Anhydrous	7664-41-7	10000
Ammonia solutions (greater than 44% ammonia by weight)	7664-41-7	15000





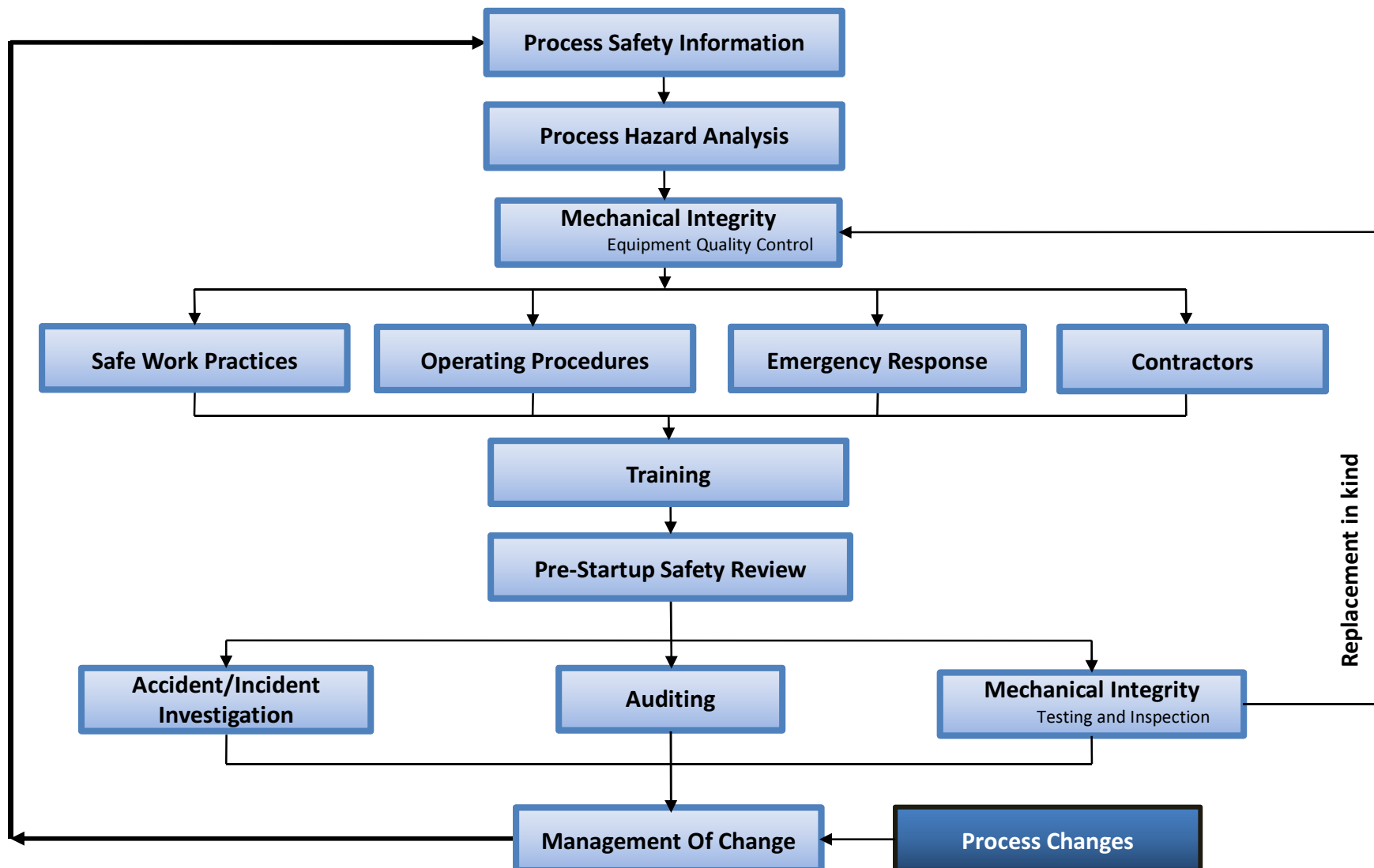
## The OSHA Process Safety Management Standard has 14 elements

### ➤ PSM Elements

- Employee Participation
- Process Safety Information
- Process Hazard Analysis
- Operating Procedures
- Operator Training
- Contractors
- Compliance Audits
- Pre-Start Up Safety Review
- Mechanical Integrity
- Hot Work Permit
- Management of Change
- Incident Investigation
- Emergency Planning and Response
- Trade Secrets



## All PSM elements work together





## Center for Chemical Process Safety - Risk Based Process Safety has 22 Elements

- Commit to Process Safety
  - **Process Safety Culture**
  - **Compliance with Standards**
  - **Process Safety Competency**
  - Workforce Involvement (Employee Participation)
  - **Stakeholder Outreach**
- Understand Hazards and Risks
  - Process Knowledge Management (Process Safety Information)
  - Hazard Identification and Risk Analysis (Process Hazard Analysis)





## Center for Chemical Process Safety - Risk Based Process Safety

- Manage Risk
  - Operating Procedures
  - Safe Work Practices (incl. Hot Work Permit)
  - Asset Integrity and Reliability (Mechanical Integrity)
  - Contractor Management
  - Training and Performance Assurance
  - Management of Change
  - Operational Readiness (Pre-Startup Safety Review)
  - **Conduct of Operations**
  - Emergency Management



## Center for Chemical Process Safety - Risk Based Process Safety

- Learn from Experience
  - Incident Investigation
  - **Measurement and Metrics**
  - Auditing
  - **Management Review and Continuous Improvement**



## After promulgation, PSM established NEPs

- National Emphasis Programs (NEPs)
  - 2007 – Petroleum Refinery PSM NEP
    - Directive CPL 03-00-004*
    - In depth audit with static question list
    - Covered all refineries
    - Superseded in 2009 by CPL 03-00-010
  - 2009 – PSM-Covered Chemical Facilities NEP
    - Directive CPL 03-00-010*
    - Pilot program focused on ammonia and chlorine processes
    - Regions I, VII, and X
  - 2011 – PSM-Covered Chemical Facilities NEP
    - Directive CPL 03-00-014*
    - Expanded to all OSHA Regions
    - Focused on ammonia refrigeration and all other HHC facilities

# Proposed Changes PSM





## OSHA has proposed changes to the PSM Regulation

- On August 1, 2013 President Obama signed Executive Order 13650 which requires OSHA to publish within 90 days a Request for Information regarding changes to the PSM and related regulations:
  - Explosives and Blasting Agents
  - Flammable Liquids
  - Spray Finishing.
- On December 3, 2013 OSHA published a RFI on 17 specific areas they are proposing to change
- Comments must be submitted to OSHA by March 10, 2014
- Based on these comments OSHA expects to publish a Notice of Proposed Rulemaking



## OSHA has listed 17 topics for proposed changes/additions

1. Clarifying the exemption for atmospheric storage tanks
2. Oil and gas well drilling and servicing
3. Oil and gas production facilities
4. Expanding PSM coverage and requirements for reactivity hazards
5. Updating the list of highly hazardous chemicals in Appendix A
6. Revising the PSM standard to require additional management system elements



## OSHA has listed 17 topics for proposed changes/additions

7. Amending paragraph (d) to require evaluation of updates to applicable recognized and generally accepted good engineering practices (RAGAGEP)
8. Adding a definition of RAGAGEP
9. Require mechanical integrity for any safety-critical equipment
10. Require management of organizational changes
11. Require coordination of emergency planning with local emergency response authorities
12. Require third-party audits





## Recognized and generally accepted good engineering practices (RAGAGEP)

Topic	RAGAGEP
Unfired Pressure Vessels	ASME VIII
Fired Vessel	ASME I
Pressure Relief	ASME VIII, API 520, API 521, API 2000, NFPA 30
Tanks	API 650, API 12
Piping	B31.3
Burner Management Systems	NFPA 85/86, API 556
Electrical Classification	API 500, NFPA 70, NEMA
Ventilation	NFPA 496, API 500
P&IDs	Process Industry Practices PIC001
Safety Instrumented Systems	ISA S84.01

# Third-Party Auditing





## Benefits of using PSM Consultant Auditing Services

- We bring fresh eyes
- We have seen PSM at other companies
  - What works well
  - What doesn't work
- We aren't full-time auditors
- We work with PSM on many levels
- We will always find an opportunity for improvement
- We will let you know what you are doing right
- We are the nice guys



## ioMosaic offers Auditing services

- PSM, RMP, NEP/RAGAGEP, CCPS RBPS, API 751 (HF)
- ioAuditor™ Software with our own protocols and audit guidance
  - Protocols for each Process Safety Element
  - Categorized and sorts findings by regulatory, local emphasis, RAGAGEPs or fully compliant
    - Compliance Audits
    - Gap Analyses and Management System Assessments
  - Findings can be readily imported and tracked in ioXpress™
  - A Windows® Excel application



ioAuditor1 [Compatibility Mode] - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Add-Ins

ioAuditor1 ▾ |Add Element| |Copy Element| |Remove Element| |Import Element(s)| |Renumber Element| |Lock| |unLock| |Sort by Element| |Summary| |Delete Reports| |Prep for Prt|  
 |Data Entry| |Renumber| |Add Line| |Additional Finding| |Remove Line(s)| |Insert Comment| |Hide Comments| |Show Comments| |Hide Header| |Show Header| |Copy| |Paste|  
 |Go To Tab| |Common Phrases|

Menu Commands Custom Toolbars

P1		fx									
A	B	C	D	E	F	G	H	I	J	K	
1	Company:	XYC Company	Audit Start Date:	1-Jan-14							
2	Facility:	ABC Facility	Audit End Date:	5-Jan-14							
3	Unit/Name of Process:	DEF Unit	Name and Company of Auditors:	LMNOP Corporation: John Smith and Jane Martin							
4			Period under Review:	1/1/2011 - 1/1/2014							
5	Regulatory:	0	Local Attention:	0							
6	GMP:	0	Compliant:	0							
7	Item No.	Ref	Element	OSHA 1910.119 Requirements (RMP requirements same except as noted in RMP (ref) below.	Auditor guidance	Emphasis	Findings	Category	Action	Responsible	Due Date
8				OSHA "Off Script" items from Refinery NEP violations (OPTIONAL SUPPLEMENT TO PSM/RMP AUDIT)							
9	1.001	1910.120 – (l) 2 & (q) 2	HAZWOPER	Elements of an emergency response plan. The employer shall develop an emergency response plan for emergencies which shall address, as a minimum, the following: Pre-emergency planning, Personnel roles, lines of authority, training, and communication, Emergency recognition and prevention, Safe distances and places of refuge, Site security and control, evacuation routes and procedures, Decontamination procedures which are not covered by the site safety and health plan, emergency medical treatment and first aid, emergency alerting and response procedures, Critique of response and follow-up, and PPE and emergency equipment.	Validate the written emergency response plan has each item required by HAZWOPER	NEP					
10	1.002	1910.120 – (q) 8	HAZWOPER	Those employees who are trained in accordance with paragraph (q)(6) of this section shall receive annual refresher training of sufficient content and duration to maintain their competencies, or shall demonstrate competency in those areas at least yearly.	Validate emergency response training for chemical response emergencies has occurred in last year for all responders and employees that may activate a response. Competency of training must be demonstrated.	NEP					
	1.003	1910.132 (d) 1	PPE	The employer shall assess the workplace to determine if hazards are	Ensure a document PPE assessment exists.	NEP					

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## OSHA has listed 17 topics for proposed changes/additions

- 13. Revise 1910.109 to cover dismantling and disposal of explosives, blasting agents and pyrotechnics
- 14. Updating 1910.106/107 based on the latest applicable consensus standards
- 15. Include storage, handling and management of ammonium nitrate
- 16. Change enforcement policy of the PSM exemption for retail facilities
- 17. Change enforcement policy for highly hazardous chemicals listed in Appendix A without specific concentrations



# Learn From Experience

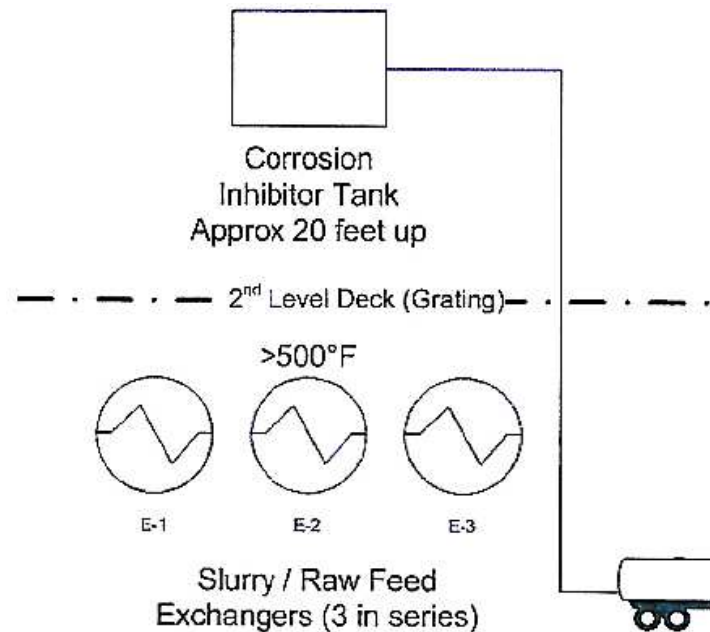




## Corrosion inhibitor tank overflow and fire

### ➤ Tank overfill and overflow

- 1,500 gal delivered from tanker truck
- 1,000 gal tank overfilled
- Corrosion inhibitor overflowed and contacted three heat exchangers
- Liquid ignited and fire resulted
- Fire was extinguished 17 minutes after igniting
- Contract worker received first and second degree burns from fire
- Worker was monitoring tank level during unloading process





## Corrosion inhibitor tank overflow and fire

- The isolated process is **not covered** under PSM or RMP
  - Corrosion inhibitor flash point: 120°F
- Likely connected to a PSM-covered Process
- The **process safety elements** would help to prevent this incident
  - Contractors
  - Process Safety Information
  - Process Hazard Analysis
  - Operating Procedures and Safe Work Practices
  - Management of Change
  - Mechanical Integrity



## DuPont, Belle, WV – September 23, 2010

- **Incident:** Phosgene Release
- **Consequence**
  - 1 Fatality
  - 1 Confirmed Exposure
  - 1 Possible Exposure
- **Key Issues**
  - Mechanical Integrity
  - Alarm Management





## DuPont, Belle, WV – September 23, 2010

- Hose Failure
  - Permeable PTFE Membrane
  - Change frequency not followed – SAP was manually altered
  - Recommendation to switch to Monel
  - Near miss not investigated
- Alarm Ignored: Nuisance Alarm
- PPE: Phosgene Indicator Badge
- Control of Entrance
  - Recommendations for enclosure



Figure 13. SafeAir Phosgene Dosimeter Badge<sup>37</sup>



## Discussion Topics

- What is our incident experience over the past five years?
- How do we know that incidents and near misses are being reported?
- Are incidents and near misses being promptly investigated and mitigated?





## About ioMosaic Corporation

Through innovation and dedication to continual improvement, ioMosaic has become a leading provider of integrated process safety and risk management solutions. ioMosaic has expertise in a wide variety of areas, including pressure relief systems design, process safety management, expert litigation support, laboratory services, training, and software development.

ioMosaic is an integrated process safety and risk management consulting firm focused on helping you manage and reduce episodic risk. Because when safety, efficiency, and compliance are improved, you can sleep better at night. Our over 40 years of industry expertise allow us the flexibility, resources and capabilities to determine what you need to reduce and manage episodic risk, maintain compliance and prevent injuries and catastrophic incidents.

Our mission is to help you protect your people, your plant, your profits, and our planet.

For more information on ioMosaic, please visit: [www.ioMosaic.com](http://www.ioMosaic.com)