

Process Safety Management

• 29 CFR 1910.119



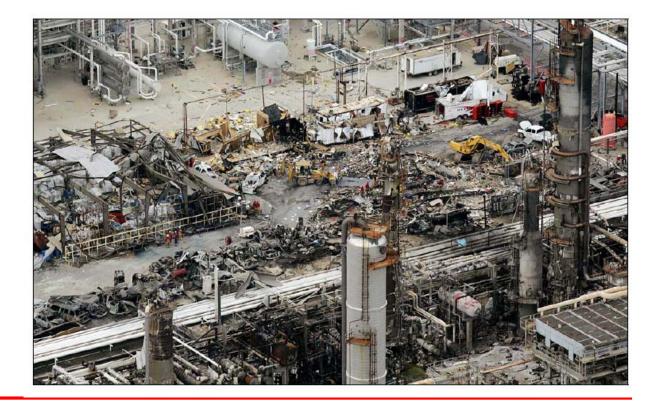
Objectives

- In this course, we will discuss the following:
 - Importance of Process Safety Management (PSM)
 - Elements of a PSM Program



Process Safety Management

• Prevent catastrophic releases of highly hazardous chemicals.



Events Leading to PSM Standard

- 1985: Institute, WV;
 135 injured
- 1989: Richmond, CA;
 9 injured

1988: Norco, LA;
7 dead/42 injured

- 1989: Pasadena, TX;
 23 dead/232 injured
- 1988: Henderson, NV;
 1990: Channelview, TX;
 2 dead/350 injured
 7 dead

Clean Air Act Amendments of 1990 -Section 304

- OSHA develops chemical safety standard
 - Standard to contain a list of chemicals
 - Standard to contain certain elements



Implementation of the PSM Standard

- Top management support
- Personnel and capital investments
- "Giving another hat"
- Outside consultants
- Company take ownership
- "Canned programs"
- Time intensive



Application

- Toxic or reactive process chemical(s) ≥ Threshold Quantity (TQ):
 - Chemicals covered in appendix A
 - Ammonia TQ = 10,000 Lbs.
 - Chlorine TQ = 1,500 Lbs.
 - Flammable liquids and gasses TQ =10,000 Lbs.
 » (except [A] and [B])



The Meer Decision

• Court decision implemented by directive

- Language in standard for flammable liquids "unconstitutionally vague"
 - RESULT: Flammable liquids in atmospheric storage tanks not counted in determining TQ



List of Hazardous Chemicals

Appendix A

CHEMICAL NAME	CAS*	TQ**
Aœtaldehyde	75-07-0	2500
Acrolein (2-Propenal)	107-02-8	150
Aaylyl Chloride	814-68-6	250
Allyl Chloride	107-05-1	1000
Allylamine	107-11-9	1000
Alkylaluminums	Varies	5000
Ammonia, Anhydrous	7684-41-7	10000
Ammonia solutions (> 44% ammonia by weight)	7684-41-7	15000
Ammonium Perchlorate	7790-98-9	7500
Ammonium Permanganate	7787-38-2	7500
Arsine (also called Arsenic Hydride)	7784-42-1	100
Bis (Chloromethyl) Ether	542-88-1	100
Boron Trichloride	10294-34-5	2500
Boron Trifluoride	7637-07-2	250
Bromine	7728-95-8	1500
Bromine Chloride	13863-41-7	1500
Bromine Pentafluoride	7789-30-2	2500
Bromine Trifluoride	7787-71-5	15000
3-Bromopropyne (also called Propargyl Bromide)	106-96-7	100

Definitions

1910.119(b)

- Catastrophic release
- Facilities
- Hot work
- Normally unoccupied remote facility

- Process
- Replacement in kind
- Trade secret
- Covered process



Employee Participation

- Consult with employees throughout development
- Develop written employee participation plan
- Provide employee access to all elements of process safety program



Chemical Information

- Toxicity information
- Permissible exposure limits (PEL)
- Physical data
- Reactivity data

- Corrosivity data
- Thermal and chemical stability data
- Hazardous effects of inadvertent mixing

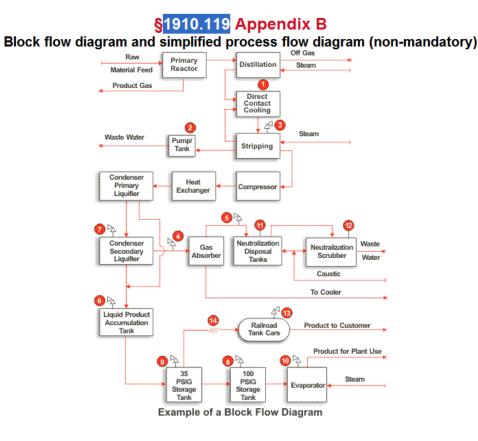
Technology information

- Process chemistry
- Maximum inventory
- Safe upper and lower limits
- Consequences of deviation

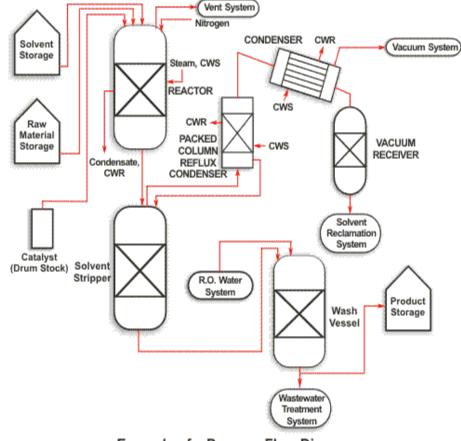


Flow Diagrams

Block or simplified process flow diagram



Process Flow Diagram



Example of a Process Flow Diagram

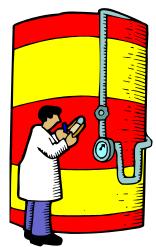
Equipment Information

- Materials of construction
- Piping and instrument diagrams (P & ID's)
- Electrical classification
- Relief system design and design basis



Equipment Information

- Ventilation systems design
- Design codes and standards employed
- Material and energy balances for processes
- Safety systems



 The equipment information must be compiled prior to process hazard analysis initiation.



- Process hazard analysis (PHA) cornerstone of PSM
 - Formal, systematic means of identifying, evaluating, and controlling process hazards
 - Must perform an initial process hazard analysis (hazard evaluation) on processes



Methodologies must be appropriate to complexity of process

- What-if analysis
- Checklist analysis
- What-if/checklist
- Fault tree analysis

- Hazard and operability study
 - (HAZOP)
- Failure modes and effects analysis
- Other



- Must address:
 - Process hazards
 - Identification of previous incidents
 - Engineering and administrative controls
 - Consequences of failures
 - Facility siting
 - Human factors
 - Qualitative evaluation of effects of failure of controls on employees



- Assemble team with:
 - Expertise in engineering and process operations
 - Experience and knowledge specific to the process being evaluated
 - Knowledgeable in the specific process hazard analysis methodology being used



- System to promptly address team's findings and recommendations
- PHA updated and revalidated every 5 years
- Retain records for life of process



Operating Procedures

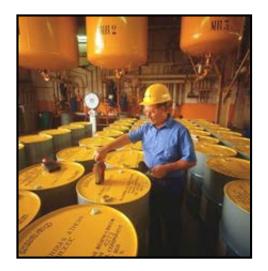
- Operating phases
- Operating limits
- Safety systems and their functions
- Safety and health considerations



Operating Procedures

- Quality control for raw materials and hazardous chemical inventory levels
- Special or unique hazards
- Safety systems and functions
- Accessible operating procedures

 Annual certification
- Safe work practices



1910.119(g)

Training

- Process overview
- Process hazards
- Operating procedures
- Emergency procedures



- Means to verify/document training
- Refresher training at least every three years

Employer Responsibilities

- Evaluate contractor 's safety performance before hire
- Inform of process hazards
- Explain emergency action plan
- Develop/implement safe work practices
- Ensure contractors fulfilling obligations
- Maintain contract employee injury and illness log

Contract Employer Responsibilities 1910.119(h)(3)

- Assure employees are trained
- Assure employees understand emergency action plan
- Document employee receipt and understanding
- Assure employees follow safe work practices
- Advise facility of unique hazards present or discovered



Pre-Startup Safety Review

- Construction and equipment meet design specifications
- Operating procedures in place and adequate
- New facilities; perform process hazard analysis
- Modified facilities; meets management of change
- Training before startup



Mechanical Integrity

- Establish list of equipment covered
- Establish and implement written procedures to maintain on-going integrity of equipment
- Training for maintenance activities



Inspection and Testing

- Inspect and test equipment
- Document inspection results
 - Frequency consistent with manufacturer's recommendations and good engineering practices
- Correct equipment deficiencies
- Establish quality assurance of equipment
 - Appropriate checks and inspections



1910.119(k)

Hot Work Permits

- Requires written permit
- Authorization for welding, cutting, brazing, flame or spark producing operations
 - On or near covered process
- Fire prevention and protection requirements
 - Requirements are in 29 CFR 1910.252(a)

DUTENTIAL DEPENDENT DEPENDENT DEPENDENT DEPENDENT DE DEPE		(company mans)
 Bener Affreisen (1) Andreamy 1984. Bene Affreisen (1) Andreamy 1984. Bene Affreisen (1)		HOT WORK PERAIT
Sender Lateral (****). Sender	Date	T
10 10 11 Amount of a start o	Name of Person	(c) Performing Work
 Chara e vallage sensitiva i au nos la tele homa sub las chi. Chara e vallage sensitiva i au nos la chi dei tele nos sub las chi. Destructiva i tenni sub chi chi chi tele nos la chi chi chi chi chi chi chi chi chi chi	Specific Location	as of Work
 A standard for factor and a standard method of the stan	Yes No	
 Chang and a status for large status of any file based status insult suggests and the status of any file based status of the statu	Cut	ag or welding permitted in an area that has been made fire safe.
The result operating or public, there will not balance spaces of and add. The result operating or public, there will not balance spaces of an add. The result operating of the result operating operating of the result operating opera	AI •	avable fire hanneds in the vicinity have been taken to a safe place.
Presentation of the sector of the secto	<u>Gen</u>	Is used to contain the heat, sporks and sing if fire hazards cannot be removed.
Provide a new share the final size in the size of schedule shares and consolitation. The size of the schedule shares of the solar schedule schedule shares of the solar schedule schedu	<u>nee</u>	or wan openings or cracks, open occurritys and windows protected or closed.
The second	rue	stragester staute for ustait use.
Program of an attribution start for a solar of 27 The start of the start o	2.04	ANDER DE ARRES WERRER OTHER TEAL À ELEMENT ERR EMERGES ONVOLOP SUCCE AS APOULDE COLLORES DONE
Calculation from them has been served with them yield any protocol with the constant Whiteground the constant server was an advanced to manual the Works (protocol served and the server of the served of the served serv		
Biological de la construcción summaria la maria para de la construcción de la constr	Cem	builthis floors have been kept wet, covered with damp sand or protected by fire resistant
analysis of the specific mean state. It is specific the specific mean state is the specific mean		
The set of barries of the set of the se	wex	ing coming other only in meas autocated by interpreter. For we same coming in
Drug and ensempty traves. The adaptive synghts is direct antibulity provided in Controllers are used to experisive despense and the adaptive dataptive Controllers are used to experisive despense and the adaptive dataptive Controllers are used as a synthesis of the adaptive dataptive and the Controllers are used as a synthesis of the adaptive dataptive and the Controllers are used as a synthesis of the adaptive dataptive dataptive dataptive Controllers are used as a synthesis of the adaptive dataptive datap	- speak	tion of charges of sandday initially womands.
Analoss. In a source ou de portion of de poisent of de solution of the poise. Any ou de northwest of the poise of the solution of solution of de solution of de solution. The poise of the poise of the poise of the solution of the poise. The solution of the poise of the poise of the poise of the poise. The poise of the poise o		and converge of restary spanning and entry reachs to distant combustibles restarted or
Are non-sourcements that for family instantial of human which we have a set of human barrier of human barrie		
Be given the lowest Construction of the second se	Cuts	n'velder in trained in 12fe coentries of ecuipment and the 12fe use of the process.
Wolds or ontagementary Appropriate on constraints or observations downstread or blacked. PPD else on constraints or constraints downstread or blacked. PPD else on constraints or constraints. PPD else on constraintstread elsets. PPD else on con	Aay	on-site contractors advised about flammable material or hazardous conditions of which
Constraint through Jonasti and rowationd Approphile are constraints to constraint documents of tabled. Mapping and a constraints to constraint documents of tabled. Works are provided with the order of the stark. Mapping and a constraint provided are starked in 1990 146. Torona making in constraint provided in 1990 146. Torona making in constraint provided in 1990 146. Constraints the starked in 1991 1992 1992 1993 2993 2993 2993 2993	they	may not be aware.
Arp pay law or construction constants documented or balad. P20 cold a source law or container the constant of the law. P20 cold a source law or container the law. P20 cold a source law or container the law. P20 cold a source law or container the law. P20 cold a source law or container the law. P20 cold a source law or container the law. P20 cold a source law or container the law. Construction Source law or container the law. Construction Source law or container law or container law or container law or container law or container. Construction Source law or container law or container law or container law or container. Construction Source law or container law or container law or container.		
PPE tool a sould-e.g. experience, history provide the formation of the provide the source of th	Cest	aner thoroughly cleaned and ventilated;
Waring tap yound to ion the workin of the mult. Appropriate molecular provide Data working a normal program has been used to provide the provide equipment, but to Gaussi labory Standards 1910 146, 1910 252, 253, 254 and 272 Commution Standard 1956/950, 359, 357 and 359.	— — An	spe lines or connections to containers disconnected or blanked.
 Appropriate vacificities previded. When working is confided speecing a penalt has been insued as per 1990.146. Wapper working is confided speecing previded. Wapper working is confided speecing. Wapper working is confided speecing.<	m	ned in needed- e.g., eye protection, beinner, protective clothing, perpusitor, glover.
White working in confined spaces a permut his beam insula to per 1910-146. In specific sequiements refer to General Indexity Strandards 1900.146, 1910.252, 253, 254 and 272 al Construction Standards 1920.807, 358, 352 and 353.	was	ing tigs point to wait other women of not metal.
d Countraction Standard: 1926-800; 350; 352 and 353.		a working in confined spaces a permit has been israed as per 1920.146.
storiad Signiture - Superiour	or specific requi ad Construction	mments refer to General Industry Standards 1910.146; 1910.252; 253,, 254 and 272 Standards 1926.803; 350; 352 and 353.
dariad Signitae - Supervisor		
	interiori Sigurian	- Supervisor

Management of Change (MOC) 1910.119(1)

- Written procedures to manage changes to process chemicals, technology, equipment, procedures
 - Except "replacements in kind"
- Must address: technical basis, impact of change, modifications to operating procedures, and time period for change

Management of Change

- Authorization requirements for change
- Training for employees prior to start up
- Update process safety information after a change

Section 1: Request for Change 5 Originator:		ompleted by	Originatio	change	1
	Process:				
Proposed Date of Change: Description of proposed change an			OR 🛛 Tempora		
any potential health and safety impac change start and end dates.	ts from the pro	posed change	 If the change is: 	tenipot	nry, indicate the proposed
Section 2: Authorization to Procee					
Review/Approved by: Maintenance		Signature:			Date:
Review/Approved by: Safety		Signature:			Date:
Review/Approved by: Plant Enginee		Signature:			Date:
Review/Approved by: Plant Manage	er 👘	Signature:			Date:
Section 3: Program with Change	Section to be c	ompleted foll	owing implementa	tion of	change but prior to the
startup of the change.					
Review Question			Check Answer	Ca	mpletion Date (if yes)
Have affected personnel (i.e. operatio contract) been informed of and traine	ons, maintenand	e or	□ Yes □ No		
Are SOP's or maintenance procedure			□ Ves □ No	+	
Are SOP's or maintenance procedure a result of this change?	is required to b	e updated as	🗆 res 🗆 No		
If yes, have affected personnel been t	trained in the m	wlated	Ves O No	+	
procedures?	a survey as the up		140		
Does the change affect overall proces	ss safety or the	results of a	Ves O No	-	
previously conducted JHA or Process					
If yes, has a JHA or Process Hazard			□ Yes □ No	-	
and all recommendations addressed?					
Is Process Safety Information require of this change?	ed to be updated	i as a result	🗆 Yes 🗆 No		
If yes, has the Process Safety Inform	ation been unda	ted and	□ Yes □ No		
distributed to appropriate personnel?					
Section 4: Authorization for Start	up .				
Authorized by: Maintenance Supervi	sion Signatu	te:			thorized artup Date:
Automzed by: Maintenance Supervi		10. C			thorized
Authorized by: Safety	Signatu	ie.		Sta	rtup Date:

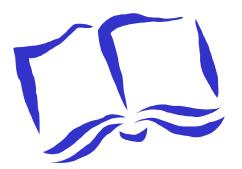
* Attach documentation to this form, which substantistes completion of the applicable requirements (e.g. meeting minutes, sign-ins, training records, etc.)

Distribute completed forms to the following personne
 PSM Coordinator/Plant Engineer

- PSM Coordinator/Plant Engin
 Safety Coordinator
- Maintenance Supervisio
 HR Department
- Plant Manager

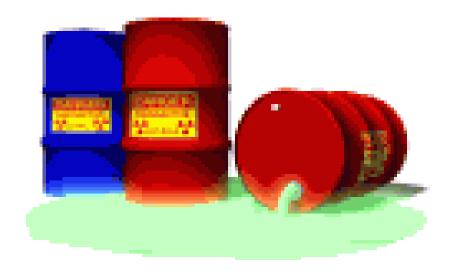
Incident Investigation

- Incidents which did or could result in catastrophic release of hazardous chemicals
 - Investigation initiated within 48 hours
- Report and recommendations
- System to address recommendations
- Review with affected personnel
- Retained 5 years



Emergency Planning and Response 1910.119(n)

- Implementing emergency action plan
 - Handling of small releases



Compliance Audits

- Certify program in compliance
 - Every 3 years
- Ensure at least one person knowledgeable in process
- Develop report and recommendations
 - Document response and correction of deficiencies
- Retain 2 most current audits

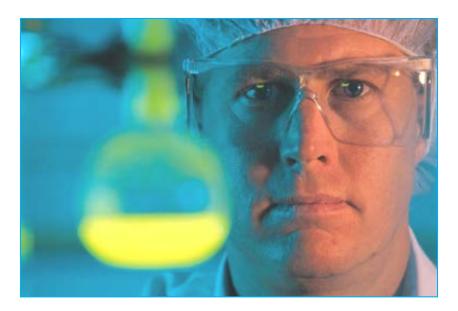




Trade Secrets

1910.119(p)

- Protection of process trade secrets
- Confidentiality agreements (if needed)
- Information available to affected employees





Summary

- In this course, we discussed:
 - Importance of Process Safety Management (PSM)
 - Elements of a PSM Program



Thank You For Attending!

Final Questions?