The Line of Actions and Targets of Process Safety

Process Safety

An **Occupational Event** might result into an injury or a fatality at most BUT…

a **Process Safety Event** results into a CATASTROPHE with multiple casualties & massive asset damage

- The world has witnessed severe **process safety disasters** in the recent decade which have completely changed the dynamics of the business.
- Few Major Disasters to name
  - Macondo Blowout – April 20, 2010
  - Buncefield Fire Accident – December 11, 2005
  - BP's Texas City Refinery Explosion – March 23, 2005
  - Piper Alpha disaster – July 6, 1988
  - Bhopal Gas disaster - December 3, 1984

Process Safety is now identified as one of the Critical Areas for Business Sustainability.

Macondo Blowout

- **What happened?**
  - On April 20, 2010; the Deepwater Horizon Semi-submersible Mobile Offshore Drilling Unit (MODU), which was owned & operated by Transocean & drilling for BP in the Macondo Prospect Oil Field, exploded & subsequently resulted in a fire.
- **What were the Consequences?**
  - The Deepwater Horizon was burnt and sank, & a massive offshore oil spill started in the Gulf of Mexico.
  - This environmental disaster is the largest accidental marine oil spill in the history of the petroleum industry.
  - The explosion killed 11 workers & injured 16 others
- **What were the Causes?**
  - Systematic failures in the Safety Management System rendered the system ineffective in preventing or responding to the flow of hydrocarbon in the riser and the subsequent explosion & fire.

Buncefield Fire Accident

What happened?

- On December 11, 2005; a number of explosions occurred at Buncefield Oil Storage Depot, Hertfordshire.
- At least one of the initial explosions was of massive proportions & there was a large fire, which engulfed over 20 large fuel storage tanks over a high proportion of the site.

What were the Consequences?

- The fire burned for several days, damaging most of the commercial & residential properties in the vicinity and emitting large clouds of black smoke into the atmosphere, dispersing over southern England and beyond.
- The Buncefield accident has been described as the biggest fire in Europe since the Second World War.
- There were 43 reported injuries; 2 people were deemed to be seriously injured enough to be kept in hospital. There were no fatalities reported.

What were the Causes?

- Lack of Maintenance Regime & Equipment Functionality Understanding. This caused failure of both "Automatic Tank Gauging System" & "Independent High-level Switch" to operate when fuel level in tank increased.
- The switch failure should have triggered an alarm, but it too appears to have failed.
- This caused the overflow of estimated 300 tonnes of petrol and the formation of a rich fuel & air vapor mixture.

BP's Texas City Refinery Explosion

- **What happened?**
  - On March 23, 2005, a massive fire & explosion occurred at BP's Texas City Refinery in Texas City, Texas. The explosion occurred in an isomerization unit at the site.
- **What were the Consequences?**
  - Explosion & subsequent fire had resulted in 15 fatalities and 180 injuries.
  - All of the fatalities occurred in or near office trailers located close to the blowdown stack.
  - BP was charged with criminal violations of federal environmental laws, and has been subject to lawsuits from the victims' families.
- **What were the Causes?**
  - Level indicator could not identify liquid level in the stack above 3 meters range.
  - Office trailer was placed close to the blowdown stack believing that the trailer, where most of the deaths happened, was empty most of the year & so the risk was low.
  - Lack of reporting & learning culture.

Bhopal Gas disaster

- **Bhopal Gas disaster occurred** on 3rd Dec 1984 at Union Carbide pesticide plant in Bhopal, India.

Impacts

- 45 tons of MIC (Methyl-isocyanate) spread over 25 miles of the city.
- More than 200,000 people died within days.
- Further 15,000 died in the following years.
- Around 100,000 people are suffering chronic and debilitating illnesses.
- Company is no more exists in the World.
- Union Carbide paid an unprecedented large settlement to the Indian government and suffered other significant business and market losses in the years following 1984.
- Forced to sell of business after business in order to maintain its core operation, Union Carbide was eventually sold to The Dow Chemical Company in 1999, marking the sad end of a chemical industry pioneer.

Piper Alpha disaster

- **Piper Alpha disaster was an explosion resulting into fire on 'Piper Alpha' North Sea platform on July 6 1988.**

Impacts

- **167 men were killed with only 59 survivors.**
- **Total insured loss was about (US$ 3.4 billion).**
- **Company has been told by Government to leave North Sea.**
- **Company is no more existent in North Sea.**

Causes

- Permit to work system was not followed properly, also cross-referencing of permits was missing.
- Platform Design Modifications without HAZOP/Process Safety Reviews.
- Poor Platform layout design as gas compression area was close to the control room etc.
- Delayed decision making for shut down of interacting platforms production.
- Emergency Evacuation system was poor as no instruction was given to the staff for their safely evacuation.
- Fire protection system was on manual as divers were working regardless of their position in the sea.
- Poor Communication as Shift-change meeting was not conducted properly

Process Safety

- Has come to the forefront of oil and gas industry concerns as a result of statements like this:
  - Company Management paid attention to, measured, and rewarded personal safety rather than process Safety.
  - To understand how this operated we must first make the distinction between occupational safety, sometimes called personal safety, on the one hand, and process safety on the other.

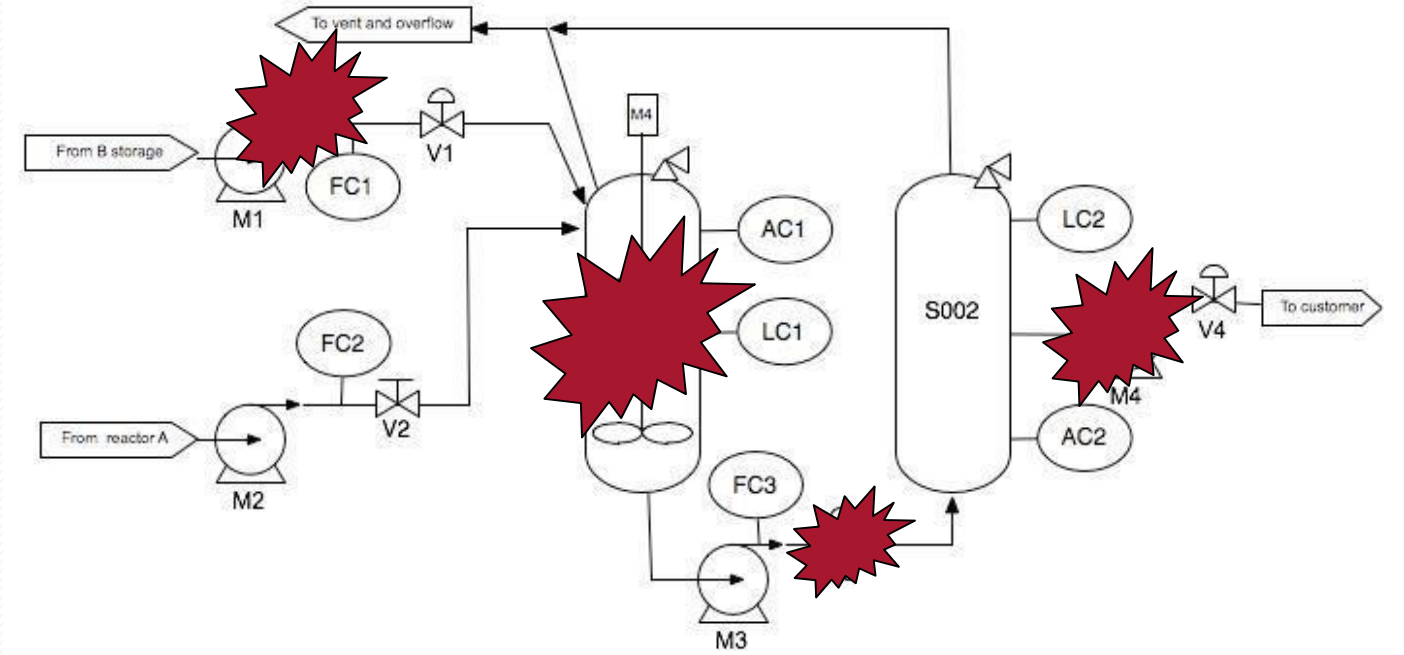
Process Safety vs. Personal Safety

If you're in charge of safety and you think of hazards like this…

You're probably doing "personal safety"

Process Safety vs. Personal Safety

If you're in charge of safety and you think of hazards like this…



You're probably doing "process safety"

Process Safety vs. Personal Safety

- The classic distinction:

Personal / Occupational Safety  **Process Safety**

- In nearly every introduction to process safety, this distinction will be made as a way to define the domain of process safety

Process Safety vs. Personal Safety

Personal Safety

- …to all workplace scenarios, any industry

Process Safety

- …primarily to process industries, e.g.,
  - Chemical
  - Petrochemical
  - Energy/Utility

(Any industry dealing with materials with intrinsically hazardous properties and subject to major accident hazard)

Process Safety vs. Personal Safety

Some Associated Terms

Personal Safety

Slips, Trips, & Falls

On Site Hazard ID

Incident Reporting

JHA

Tailgate Safety Meeting

PPE

Unsafe Acts, Unsafe Conditions

Process Safety

PHA

Design for Safety

HAZOP

Asset Integrity

Human Factors

Material Verification

ALARP

Management of Change

Intrinsically Safe

LOPA

Equipment Maintenance

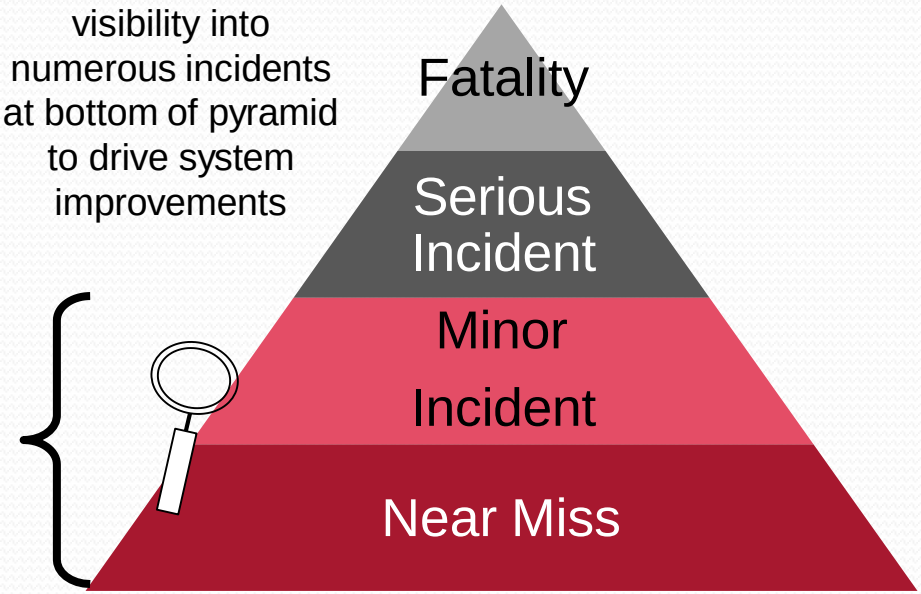
Process-Change Reporting

Major Hazard / Major Accident Hazard

Safety Pyramid

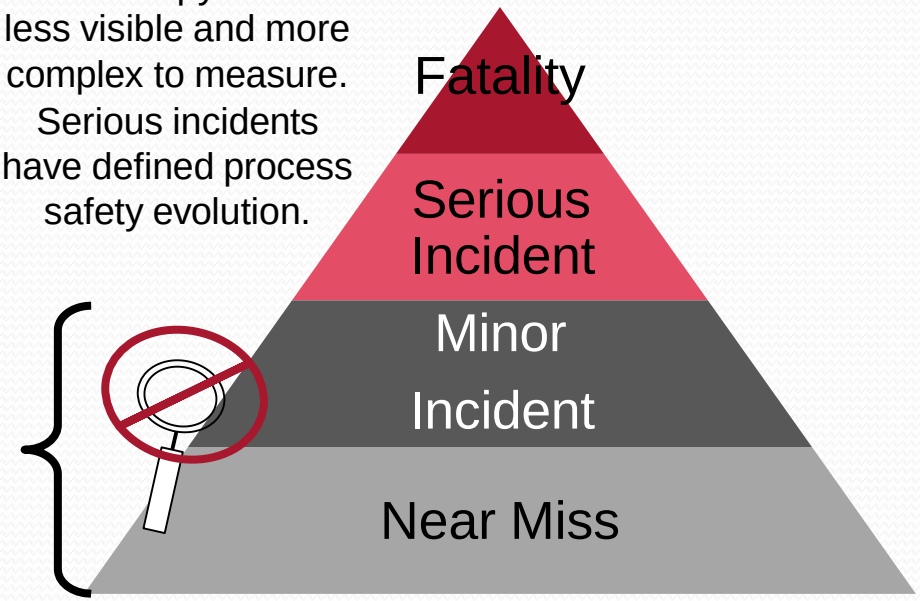
Personal Safety

Typically good visibility into numerous incidents at bottom of pyramid to drive system improvements



Process Safety

Bottom of pyramid is less visible and more complex to measure. Serious incidents have defined process safety evolution.



Hazard ID & Assessment

Personal Safety

- Lends itself to a wide range of participants
- May be conducted in some cases with minimal training
- Often managed entirely in-house

Process Safety

- Requires technical & often engineering expertise in processes and materials handled
- Frequently facilitated by external consultants

Hazard Control

Personal Safety

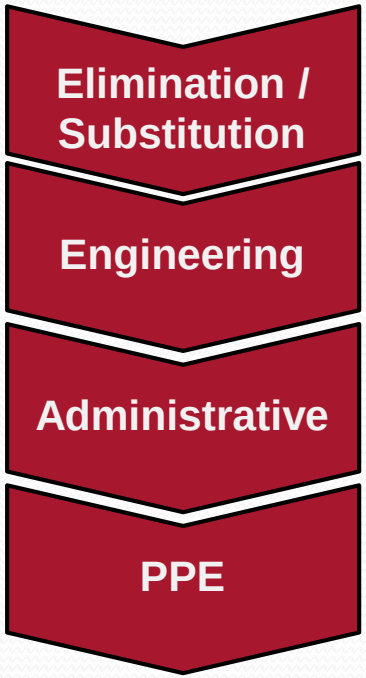
Process Safety

Hierarchy of Control

Should start here…

But frequently lands here…

Must start here



As such, responsibility for hazard controls is often in hands of ***front line workers*** and ***supervisors***

As such, responsibility for hazard controls is often in hands of ***senior management*** and ***engineers***

Safety Culture

Personal Safety

- Must especially be nurtured with:
  - Field & Shop Managers
  - Supervisors
  - Front Line Supervisors
  - Workers

(Note: Personal safety hazard controls are typically managed within existing operational budgets)

Process Safety

- Must especially be nurtured with:
  - Senior Executives
  - Senior Management
  - Any Key Decision-Makers

(Note: Process safety hazard assessments and controls often carry a price tag that requires senior operational buy-in)

Process Safety Management

- Process safety management is an analytical tool focused on preventing releases of any substance defined as a "highly hazardous chemical" by the EPA or OSHA.

- Process Safety Management (PSM) refers to a set of interrelated approaches to managing hazards associated with the process industries and is intended to reduce the frequency and severity of incidents resulting from releases of chemicals and other energy sources (US OSHA 1993).

- These standards are composed of organizational and operational procedures, design guidance, audit programs, and a host of other methods.

- The OSHA Process Safety Management (PSM) standard (29 CFR 1910.119) was published in the Federal Register on Monday, February 24, 1992.

OSHA's Process Safety Management 14 Elements

• The process safety management program is divided into 14 elements. The U.S. Occupational Safety and Health Administration (OSHA) 1910.119 define all 14 elements of process safety management plan.

1. Process Safety Information
2. Process Hazard Analysis
3. Operating Procedures
4. Training
5. Contractors
6. Mechanical Integrity
7. Hot Work
8. Management of Change
9. Incident Investigation
10. Employee Participation
11. Pre-startup Safety Review
12. Emergency Planning and Response
13. Compliance Audits
14. Trade Secrets

OSHA's PSM 14 Elements

Elements of Process Safety Management

Specified minimum elements that the OSHA standard (29 CFR 1910.119) requires employers to do:

1. **Employee Participation -** Employers shall develop a written plan of action regarding the implementation of the employee participation…." The stated intent of this element is for employees, production, maintenance, and staff to be involved in all aspects of the PSM program at your site, and to have representation in the development, discussion, and eventual solution to issues around the process hazard analysis.

2. **Process Hazard Analysis -** This element is extremely technical in nature and includes a comprehensive what-if evaluation. This process analysis will be conducted as a team and includes a review of the facility siting for possible hazards.

3. **Process Safety Information**-Requires compilation of written process safety information (PSI) including hazard information on HHC's, technology information and equipment information on covered processes.

PSM Elements

4. **Operating Procedures**-Must be in writing and provide clear instructions for safely conducting activities involving covered process consistent with PSI; must include steps for each operating phase, operating limits, safety and health considerations and safety systems and their functions; be readily accessible to employees who work on or maintain a covered process, and be reviewed as often as necessary to assure they reflect current operating practice; and must implement safe work practices to provide for special circumstances such as lockout/tagout and confined space entry.

5. **Training**-Employees operating a covered process must be trained in the overview of the process and in the operating procedures. This training must emphasize specific safety and health hazards, emergency operations and safe work practices.
6. **Contractors**-Identifies responsibilities of work site employer and contract employers with respect to contract employees involved in maintenance, repair, turnaround, major renovation or specialty work, on or near covered processes

7. **Pre-startup Safety** Review-Mandates a safety review for new facilities and significantly modified work sites to confirm that the construction and equipment of a process are in accordance with design specifications; to assure that adequate safety, operating, maintenance and emergency procedures are in place; and to assure process operator training has been completed.

PSM Elements

8. **Mechanical** Integrity-Requires the on-site employer to establish and implement written procedures for the ongoing integrity of process equipment particularly those components which contain and control a covered process.

9. **Hot Work**-Hot work permits must be issued for hot work operations conducted on or near a covered process**.**

10. **Management of Change** -The work site employer must establish and implement written procedures to manage changes to facilities that effect a covered process. The standard requires the work site employer and contract employers to inform and train their affected employees on the changes prior to start-up. Process safety information and operating procedures must be updated as necessary**.**

11. **Incident Investigation**-Requires employers to investigate as soon as possible (but no later than 48 hours after) incidents which did result or could reasonably have resulted in catastrophic releases of covered chemicals. The standard calls for an investigation team.

12. **Emergency Planning and Response**-Requires employers to develop and implement an emergency action plan. The emergency action plan must include procedures for handling small releases.

PSM Elements

13. **Compliance Audits**-Calls for employers to certify that they have evaluated compliance with process safety requirements at least every three years. Prompt response to audit findings and documentation that deficiencies are corrected is required. Employers must retain the two most recent audit reports.

14. **Trade Secrets**-Sets requirements similar to trade secret provisions of the 1910.1200 Hazard Communication standard requiring information required by the PSM standard to be available to employees (and employees representatives). Employers may enter into confidentiality agreement with employees to prevent disclosure of trade secrets.

Process Safety Competence Framework (OSHA / CCPS & DuPont based)

PSM Framework Purpose

PSM framework is developed to :

- Identify company staff having PSM critical roles
- Define levels of PSM proficiency
- Develop process safety competency matrix
- Identify gaps in PSM competencies
- Develop action plan to increase PSM competence

Terms and Definitions

Term	Definition
Competency	Ability / skills to perform a tasks or jobs to a specific standard.
Process Safety	A disciplined framework for managing the integrity of hazardous operating systems and processes by applying good design principles, engineering, and operating and maintenance practices
Process Safety Experience	The amount of time that an individual has worked with Process Safety Management (PSM) systems, particularly those applying to the PSM Elements which are most important in their current job assignment. Work in units with similar PSM systems, either at this unit or another, may be included.
Risk	The combination of the expected likelihood and consequence of a single accident or a group of accidents
PSM Critical Tasks	PSM critical tasks are those tasks where substandard performance could contribute to a major accident hazard.

Process Safety Competence Levels

Levels of Competency	EXPLANATION
Awareness (Level-1)	Has knowledge of theory and displays conceptual understanding. Actively participates in discussions regarding the skill. Performs routine tasks with significant supervision. Learns how to do things.
Basic Knowledge (Level-2)	Has general working knowledge of the topic. Has basic training required to carry out general tasks related to their role. Performs fundamental and routine tasks. Requires occasional supervision. Increases functional expertise and ability. Works with others.
Proficient (Level-3)	Independent contributor. Integrates work with other disciplines. Can execute specific tasks within the topic with minimal direction. Has the experience levels to complete assigned tasks.
Expert (Level-4)	Is a recognized expert with extensive knowledge and skills. Has specialized training or certification which may be required for certain tasks. Advanced experience in the particular skill. Applies creative solutions to complex problems. Recognized as subject matter expert.
NA	Not applicable or no role requirement.

Process Safety Competence Matrix

S#	Competency Element	SENIOR MANAGEMENT					HEAD OFFICE MANAGEMENT															SITE / LOCATION MANAGEMENT														SUPPORT				
		Managing Director	Deputy Managing Director - AO	Deputy Managing Director - TS	Deputy Managing Director - EBD	Deputy Managing Director - CFO	GM Asset (SA; KA; Adhi; H/GS/M)	GM Projects	GM Partner Operations	GM Production Technology	GM Procurement	GM Legal	GM Human Resources	SM Training & Development	SM Asset (Operations; Plants; Field)	SM Projects	SM Constructions	SM Drilling Operations	SM Asset Subsurface	SM Engineering & Design	SM QHSE	SM Medical Services	Field Incharge	Production Incharge	Shift Engineer	Maintenance Incharge	Mechanical Engineer	Inspection Engineer	Electrical Engineer	Instrument Engineer	Stores Officer	Mechanical Technician	Control Room Operator	Shift Operator	Electrical Technician	Instrument Technician	Drilling Engineer	Process Engineer	Project Engineer	Field QHSE Engineer	QHSE Engineer (HO)
1	Safety Culture & Leadership	3	3	3	3	1	2	2	1	1	1	1	1	1	2	2	2	2	2	2	4	1	3	2	2	2	2	2	2	2	1	1	1	1	1	1	2	2	2	3	3
2	Process Safety Fundamentals	2	2	2	2	1	2	2	1	1	1	1	1	1	2	2	2	2	2	2	4	NA	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	3	2	3	3
3	Hazard Identification & Risk Assessment	2	2	2	2	1	1	1	1	1	1	NA	NA	NA	2	2	2	2	2	2	4	1	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	3	3
4	Asset Integrity & Reliability	2	2	2	1	NA	1	1	1	1	1	NA	NA	NA	2	2	2	2	2	2	2	NA	2	2	2	4	3	3	2	2	NA	1	1	1	1	1	1	1	2	2	2
5	Management of Safety Critical Equipments (SCE)	1	2	1	1	NA	1	1	1	1	1	NA	NA	NA	1	1	1	1	1	1	2	NA	3	3	3	4	3	2	3	3	2	2	2	2	2	2	2	1	1	1	1
6	Management of Change (MOC)	2	2	2	1	NA	1	1	1	1	1	NA	NA	NA	2	2	1	2	2	2	2	NA	4	3	3	3	2	2	2	2	1	1	1	1	1	1	2	3	2	3	3
7	Pre Startup Safety Review (PSSR)	2	2	2	1	NA	1	1	1	1	1	NA	NA	NA	2	2	2	1	2	2	2	NA	4	3	3	3	2	2	2	2	1	1	1	1	1	1	2	2	4	3	3
8	Standard Operating Procedures	2	2	2	1	NA	1	1	1	1	1	NA	NA	NA	2	2	NA	1	1	2	2	1	3	4	3	4	3	3	3	3	1	2	2	2	2	2	2	2	2	2	2
9	Operational Discipline	2	3	2	1	NA	1	1	1	1	1	NA	NA	NA	1	NA	NA	1	1	1	1	NA	2	3	4	3	2	2	2	2	NA	2	2	2	2	2	2	1	1	1	1
10	Contractor Safety Management	2	2	2	2	1	1	2	1	1	1	NA	NA	NA	2	3	2	1	2	1	4	NA	2	1	2	2	2	2	2	2	1	1	1	1	1	1	3	1	4	1	1
11	Incident Reporting & Investigation	2	2	2	2	1	1	1	1	1	1	1	NA	NA	2	2	2	2	2	2	4	1	3	3	3	3	3	2	2	2	1	1	1	1	1	1	3	3	3	3	3
12	Emergency Response Plannig	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	1	3	3	3	3	3	2	2	2	1	1	1	1	1	1	2	2	3	3	3
13	Training	2	2	2	2	1	1	1	1	1	1	NA	1	1	1	1	1	1	1	1	2	1	3	3	3	3	3	2	2	2	1	1	1	1	1	1	2	2	3	4	4
14	Safety in Engineering Design	1	2	1	1	NA	1	1	1	1	1	1	NA	NA	1	1	1	1	1	2	2	NA	1	1	1	1	1	1	1	1	NA	1	1	1	1	1	1	4	1	2	2
15	Regulatory Framework	1	2	1	1	NA	1	1	1	1	1	2	NA	NA	1	1	1	1	1	1	2	NA	2	2	2	2	1	1	1	1	NA	1	1	1	1	1	1	2	2	4	4
16	PSM Auditing	1	1	1	1	NA	1	1	1	1	1	1	NA	NA	1	1	1	1	1	1	2	NA	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	2	4	4

Process Safety Critical Roles

Critical Job roles which have direct or indirect interaction in managing process safety are:

1. Field Incharge
2. Production Incharge
3. Shift Incharge
4. Maintenance Incharge
5. Mechanical Engineer
6. Inspection Engineer
7. Instrument Engineer
8. Electrical Engineer
9. Stores Officer
10. Mechanical Technician
11. Control Room Operator
12. Shift Operator
13. Electrical Technician
14. Instrument Technician
15. Drilling Engineer
16. Process Engineer
17. Field QHSE Engineer
18. Project Engineer

Process Safety Competency Elements

The following 16 Competency Elements have been selected from international best practices (OSHA,CCPS,DuPont)PSM program.

1. Safety Culture & Leadership
2. Process Safety Fundamentals
3. Hazard Identification & Risk Assessment
4. Asset Integrity & Reliability
5. Management of Safety Critical Elements (SCE)
6. Management of Change (MOC)
7. Pre start-up Safety Review (PSSR)
8. Standard Operating Procedures
9. Operational Discipline
10. Contractor Safety Management
11. Incident Reporting & Investigation
12. Emergency Response Planning
13. Training
14. Safety in Engineering Design
15. Regulatory Framework
16. PSM Auditing

PS Competency Element - 1

Competency Element-1: Safety Culture & Leadership	
Levels of Competency	**Key Areas / Explanation**
Awareness (Level-1)	• Aware of the importance of visible safety leadership. • Aware of and participates in the company safety programmes. • Demonstrates knowledge of workplace safety culture. • Engaged and owns safety responsibilities and accountabilities. • Reports safety incidents and understands the importance of accurate reporting.

Basic Knowledge (Level-2)	• Understands the importance of visible safety leadership.
	• Has the communication skills necessary to hold an effective safety intervention.
	• Understands the concept of process safety.
	• Participates in safety related conversations and suggests improvements.
	• Able to communicate:
	  ○ why safety is important to the individual and the company.
	  ○ what behaviours the individual is expected to consistently adopt.

Proficient (Level-3)	• Sends clear and consistent messages about the importance of process safety. • Ensures that their communication and behaviour consistently sends a message that safety is embedded as a core value. • Identifies and publicly recognises individuals who display the desired safety behaviours and attitudes. • Identifies and privately discusses undesired behaviours and attitudes. • Identifies and implements safety improvements. • Holds regular in-field safety conversations with front-line workers. • Undertakes regular in-field verification of controls and lessons learned from significant incidents. • Engages in meaningful safety discussions with all team/work group members. • Understands and applies resourcing requirements to manage process safety. • Able to recognise change and implement it effectively.
Expert (Level-4)	• Exhibits leadership behaviours in HSE matters. • Acts to motivate and inspire others to work towards achieving a particular goal or outcome by sending clear and consistent messages about the importance of process safety. • Ensures leadership team is aware and committed to the provision of adequate levels of staffing and supervision to ensure an effective safety culture – financial / human resources to support safety. • Monitors HSE metrics to review effectiveness of process safety programs.
NA	• Not applicable or no role requirement.

PS Competency Element - 2

Competency Element-2: Process Safety Concepts	
Levels of Competency	**Key Areas / Explanation**
Awareness (Level-1)	• Aware of process safety concepts. • Aware of the similarities and differences between process safety, personal safety and their hazards.
Basic Knowledge (Level-2)	• Applies process safety concepts into daily work activities.
Proficient (Level-3)	• Mentors others in process safety. • Communicates process safety concepts with target audiences and stakeholders. • Identifies learnings from past process safety events.
Expert (Level-4)	• Process safety subject matter expert. • Designs process safety awareness sessions for various levels within company. • Communicates process safety issues and programmes with leadership/ management team and gains their support.
NA	• Not applicable or no role requirement.

PS Competency Element - 3

Competency Element-3: Hazard Identification and Risk Assessment	
Levels of Competency	**Key Areas / Explanation**
Awareness (Level-1)	• Aware of basic hazard identification processes (eg Step Back 5x5, JHA, etc) and where these are used. • Aware of where to locate HSE risk registers. • Aware of the terms, Hazard, Risk, Control, As Low As Reasonably Practicable (ALARP). • Aware of the Safe Systems of Work (SSoW) tools – PTW, isolations, safe work method statements.
Basic Knowledge (Level-2)	• Participates in risk assessment processes. • Understands the way process safety hazards are controlled, and what those controls are and how effective they are. • Understands the terms Safety Case, Loss of Containment (LOC), Hazard Identification (HAZID), Hazard and Operability study (HAZOP) and Layers of Protection (LOPA), Safety Integrity Level (SIL), etc. • Implements Safe Systems of Work including PTW, isolation procedures and safe work method statements into every day work activities.
Proficient (Level-3)	• Mentors other in conducting risk assessments. • Identifies who needs to be involved in the development of hazard identification processes • Facilitates risk assessment processes such as HAZID, HAZOP, QRA, LOPA, bow tie, fault tree and event tree. • Facilitates the development of safe systems of work. • Applies the pros and cons of each assessment method in selecting the correct method. • Able to demonstrate understanding and application of reducing public risk as it applies to process safety.
Expert (Level-4)	• Subject matter expert for hazard identification and risk control. • Identifies where Safe Systems of Work need to be developed. • Engages with leadership team to provide resources for identification and assessment. • Develops risk criteria. • Manages the risk assessment process, including HAZID, HAZOP, QRA, etc. • Develops control strategies (e.g. from inherently safer design through to emergency response)
NA	• Not applicable or no role requirement.

PS Competency Element - 4

Competency Element-4: Asset Integrity & Reliability	
Levels of Competency	**Key Areas / Explanation**
Awareness (Level-1)	• Aware that assets require inspection and maintenance to ensure integrity. • Aware of scope of asset integrity element (i.e. what process and equipment are included) • Supports condition monitoring regimes.
Basic Knowledge (Level-2)	• Able to develop written program for managing asset integrity. • Able to track and report performance criteria, and when assets are not meeting criteria. • Understands importance of design standards (e.g. quality flange management, small-bore tubing requirements etc). • Stay abreast of changes or additions to RAGAGEPs associated with mangging asset integrity. • Performs routine maintenance on plant and equipment (where qualified). • Ensures that inspections which require certification are only done by certified inspectors. • Ensures that inspections, tests, and preventive maintenance activiteis are properly documented.
Proficient (Level-3)	• Establish a standard for each type of equipment which outlines the applicable design, test and inspection requirements. • Able to schedule & supervise maintenance and inspection activities. • Reviews maintenance and inspection results and trends. • Conduct periodic reviews of asset performance and risk levels. • Ensures that new assets are properly documented and inspected, and preventive maintenance programs are established prior to putting the asset into service. • Esblish a system to address required changes or exceptions to maintenance, inspection and test procedures.
Expert (Level-4)	• Promotes asset integrity. • Identifies risks to asset integrity. • Defines maintenance and inspection regime. • Defines specific maintenance and inspection procedures and specifications. • Interprets maintenance and inspection data and makes decision based on it (e.g. corrosion, fixed equipment, rotating equipment). • Subject matter experts in asset integrity & reliability field. • Authorises life extensions or changes to inspection programmes.
NA	• Not applicable or no role requirement.