



IOSH Webinars

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Process Safety Awareness

Beginner's Guide to Process Safety

IOSH Hazardous Industries and Offshore Groups Joint
Presentation

By Shailesh Purohit

What do you think led to this incident?

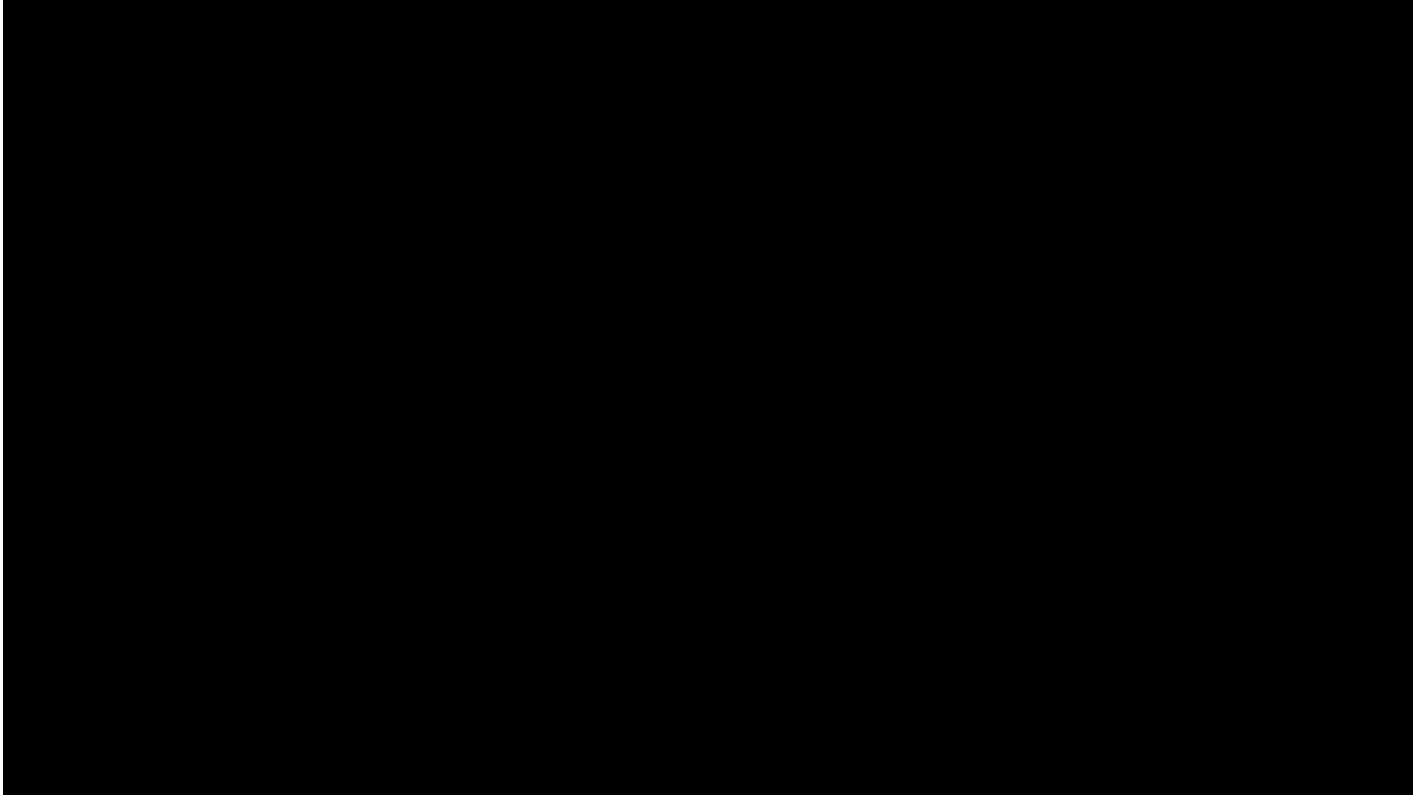


Now Watch this video: Filling blind

- This is an incident video of a manual operation for a typical Oil storage and Distribution facility using non-automated equipment and manual level Checks
- What are your thoughts?
- What if the level gauges did not read correct?

(Courtesy: Chemical Safety Board, USA)

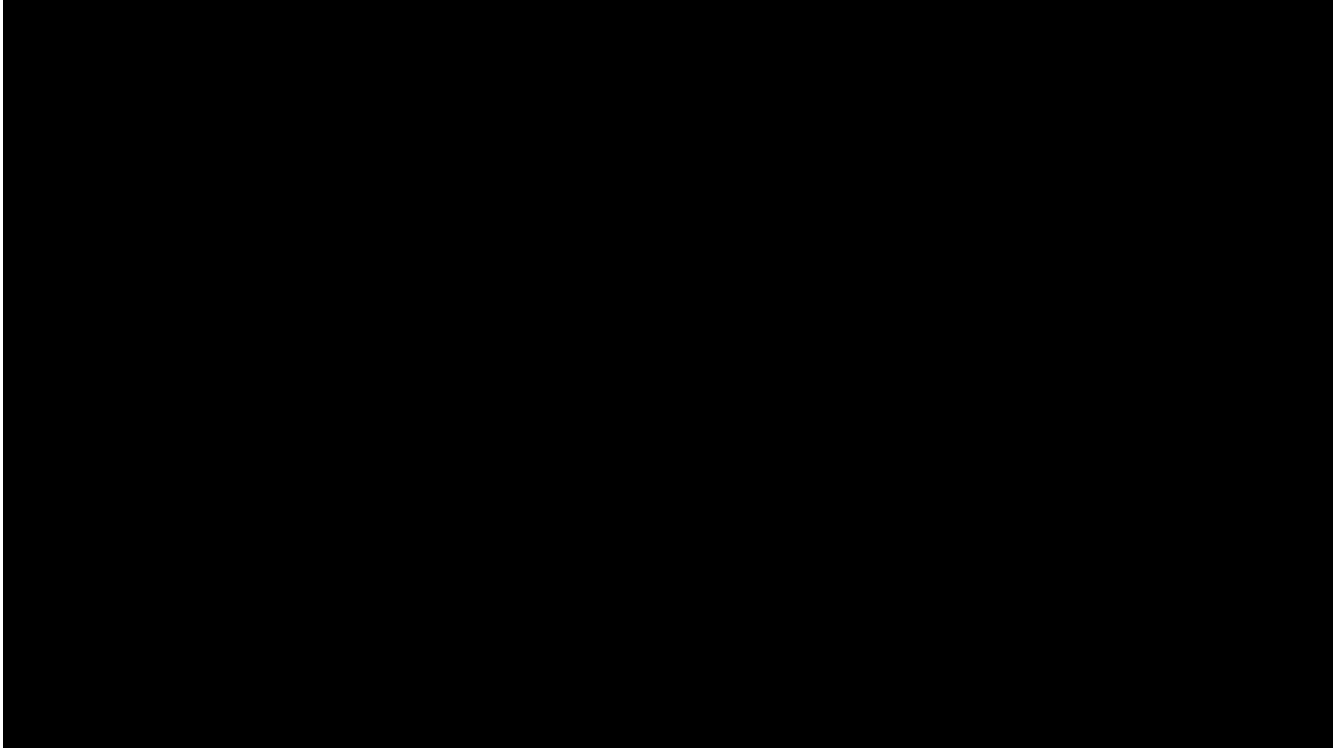
Filling Blind Animation: Courtesy: Chemical Safety Board US



Objectives of the PSM Awareness (Process Safety Management) Training)

- Define process safety
- Explain the difference between Occupational Safety and Process Safety
- Describe the Ten Pillars of Compliance elements of process safety as applicable to Oil Storage & Transfer operations
- Outline consequences of Process Safety failures
- Highlight the key part played by human factors (people) in achieving high Process Safety standards

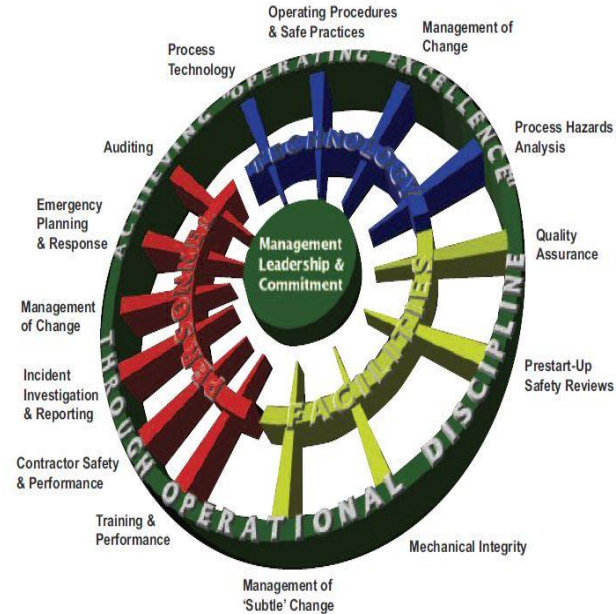
HSE Response to the Buncefield Disaster



Courtesy: ITN News

What is Process Safety?

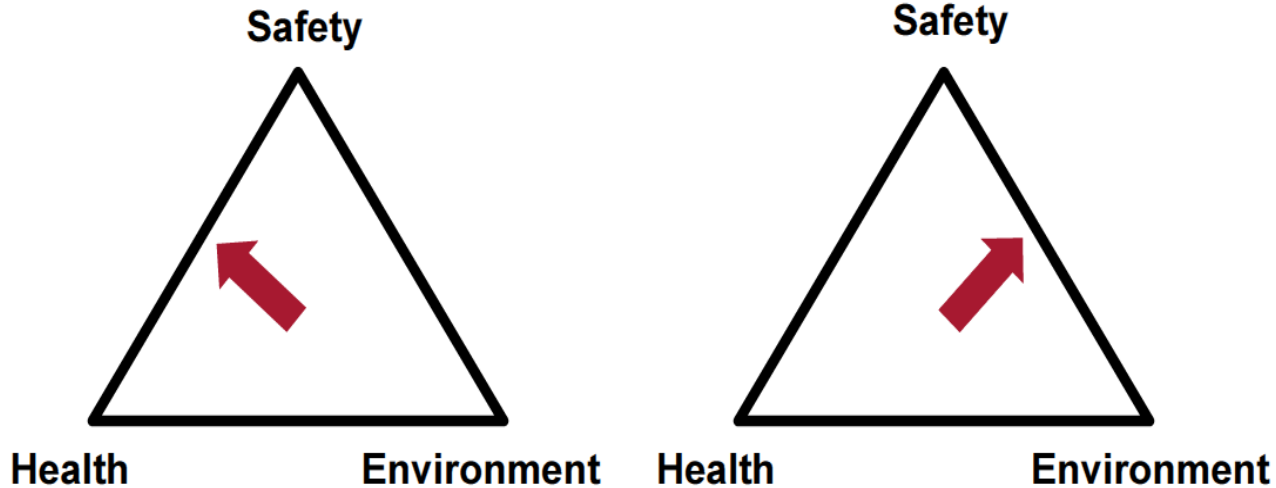
- Process Safety generally refers to the prevention of unintentional releases of chemicals, energy, or other potentially dangerous materials during the course of chemical processes that can have a serious effect on the plant and environment.
- Process safety involves, for example, the prevention of leaks, spills, equipment malfunction, over-pressures, over-temperatures, corrosion, metal fatigue and other similar conditions.
- Process safety programmes focus on design and engineering of facilities, maintenance of equipment, effective alarms, effective control points, procedures and training.
- It is sometimes useful to consider Process Safety as the *outcome* or *result* of a wide range of technical, management and operational disciplines coming together in an organised way.



Occupational Safety relates to personal safety of the employees/ contractors/ visitors however, **process safety** refers to the actual operational safety and prevention of long term harm to environment.

Personal Safety

Process Safety



Taken from ENFORM: The Safety Association for Canada's Upstream Oil & Gas Industry

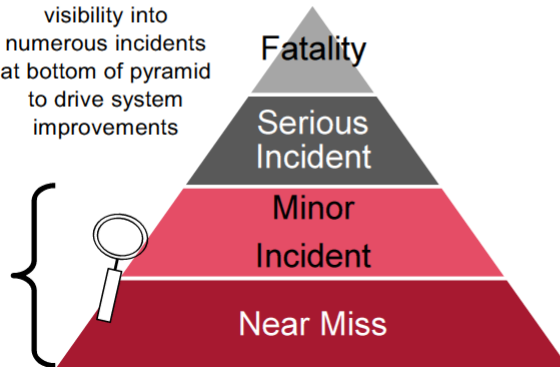
Injuries from poor manual handling or exposure of an employee to toxic vapours would be considered under occupational safety management.

Process safety management would refer to fire/ explosion/ toxic vapour releases that affect surrounding population.

“Safety Pyramid”

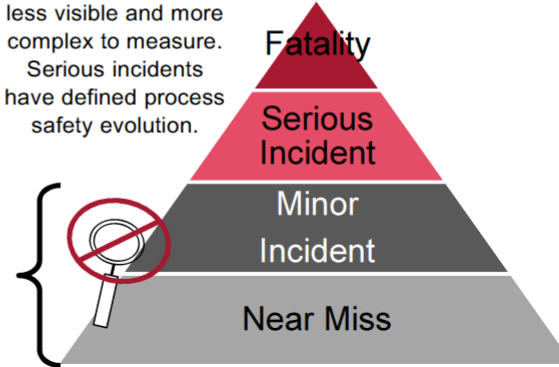
Personal Safety

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



Process Safety

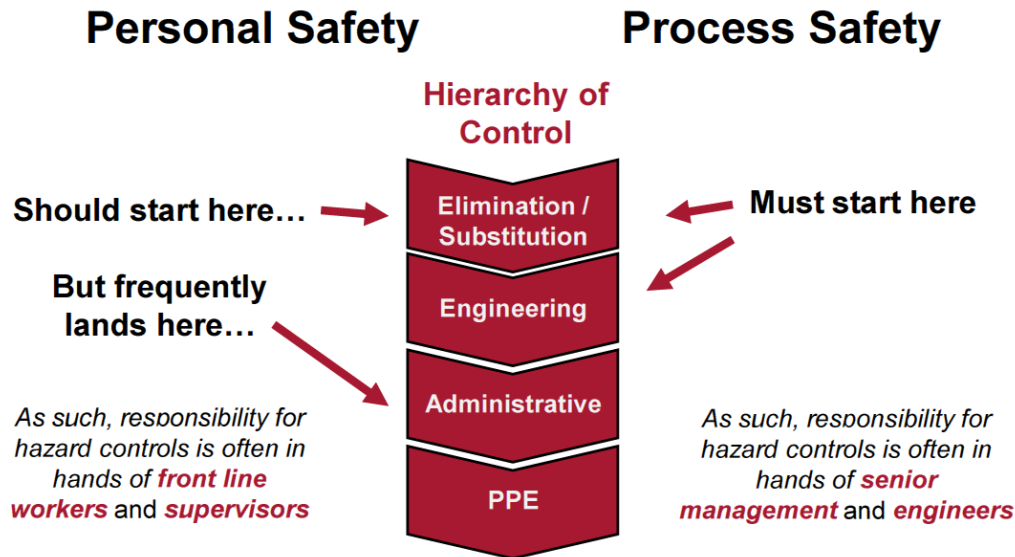
Bottom of pyramid is less visible and more complex to measure. Serious incidents have defined process safety evolution.



Taken from ENFORM: The Safety Association for Canada’s Upstream Oil & Gas Industry

Process safety incident results in a catastrophic event including long term pollution. Occupational safety incident would affect personal safety of an employee or a few of the colleagues.

Hazard Control



There is no dividing line between the two types of safety and a consequence could be attributed to both types.

Taken from ENFORM: The Safety Association for Canada's Upstream Oil & Gas Industry

Ten Pillars of Compliance Approach to Process Safety

- What are the **Ten Pillars of Compliance** and how do they relate to **Process Safety**?
- List of Ten Pillars of Compliance as followed by Competent Authority (HSE + EA)
 1. PILLAR 1 - **Safety Management System**
 2. PILLAR 2 - **Ageing Plant**
 3. PILLAR 3 - **Competence**
 4. PILLAR 4 - **Safety Instrumented Systems**
 5. PILLAR 5: **Overfill**
 6. PILLAR 6 - **Secondary and Tertiary Containment**
 7. PILLAR 7 - **Internal Emergency Plans**
 8. PILLAR 8 - **External Emergency Plans**
 9. PILLAR 9 - **Process Safety Performance Indicators**
 10. PILLAR 10 - **Safety Leadership**



**This
Happened
In UK**



Clips taken from "An Engineer's View of Human Error- I ChemE - Adventures of Joe Soap"

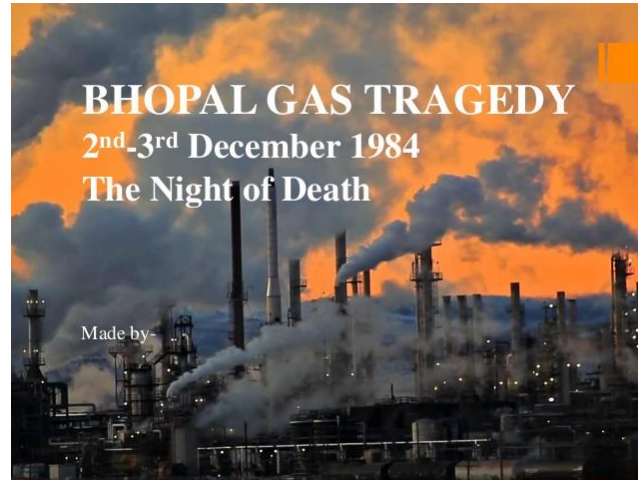
Ten Pillars of Compliance Rating as per Competent Authority

Situation	Unacceptable Red Stop Dangerous &/or Illegal Situation	Very Poor Performance	Poor Standard	Broadly Compliant Good Standard / Performance	Excellent level of Compliance, Standard & Performance	Exemplary Best Practice
Action Required	<p>Cease activity and rectify before recommencing.</p> <p>Action Plan for improvement required within 3 days, signed-off by CE and relevant Line Manager.</p>	<p>Improvement needed within a very short timescale – Action plan within 1 week, signed-off by relevant Senior Manager and Line Manager.</p>	<p>Action Plan required to be in place and being worked on prior to next inspection, signed-off by the relevant Line Manager.</p>	<p>Attention to detail required.</p> <p>Review with site lead how best to improve the issues and drive forward CIP projects.</p>	<p>Site has adopted many areas of best practice.</p> <p>Provide positive feedback.</p>	<p>Site has adopted best practices in all areas with total adherence to the SMS.</p> <p>Letter providing positive feedback issued to all site employees signed by the CE.</p>
Performance Description – 10 Strategic Pillars	<p>None of success criteria met.</p>	<p>Majority of success criteria not met or not fully met.</p>	<p>Many success criteria not met or not fully met.</p>	<p>Some success criteria not fully met. May not preclude close out depending on scope of improvements required and operator attitude.</p>	<p>Good practice in most respects. Most success criteria met.</p>	<p>Good practice or above in all respects. All success criteria fully met.</p>
Performance Description – H&S Terms	<p>Very high risk of serious injury or fatality.</p> <p>Serious or imminent risk of MATTE</p> <p>Clear breach of legal requirements / no evidence of systems or management controls of any kind.</p> <p>Systems and / or management controls not being utilised or adhered to.</p>	<p>High risk of fatality or serious injury.</p> <p>Possible risk of MATTE.</p> <p>Breach of legal requirements / no evidence of systems being used in general.</p>	<p>Risk of serious injury.</p> <p>Possible environmental LoC</p> <p>Some breach of legal requirements systems not being used on this occasion.</p>	<p>Performance / systems need further improvement to ensure effective management controls in place and being adhered to.</p> <p>Elements of the SMS are not being adhered to but the site or elements of the works, which is being scored are legally compliant.</p>	<p>The performance noted on the site is well beyond system compliance but it not deemed innovation i.e. Standard industry best practice.</p>	<p>Innovation being adopted across the business</p> <p>Industry best practice in place.</p>
Score	60	50	40	30	20	10

PILLAR 1 - Safety Management System

- Evidence of PTW (permit to work) , Operation & Maintenance Procedures, Management of Change, Hazard Recognition & Reduction, Safety Reports, Bow Tie Reports, HAZOPs, etc.
- Which of the following disasters were a result of poor or total lack of management of change?
- Flixborough 1974 – 28 dead
- Piper Alpha 1988 – 167 dead
- Bhopal Toxic Gas Tragedy 1984 – Estimated 8000 immediately and up to 20,000 later on and still affecting new-born

- Do you think your Organisation is good at managing change? Why?



PILLAR 2 - Ageing Plant

- “Ageing is not about how old your equipment is; it’s about what you know about its condition, and how that’s changing over time”.
- There are well known corrosion mechanisms that Engineering Departments deal with daily and take actions to prevent/ minimise these so as to prevent loss of containment.
- In case you are wondering what causes plant to age, the following are all reasons: Corrosion, stress, erosion, fatigue, embrittlement, physical damage, spalling (degraded concrete), subsidence, weathering, expansion/contraction due to thermal changes, instrument drift, dry joints and detector poisoning.
- These ageing mechanisms can affect primary containment such as tanks and pipelines as well as supporting structures such as pipe bridges and supports, electrical, control and instrumentation systems and safeguard systems.



Tank has been decommissioned

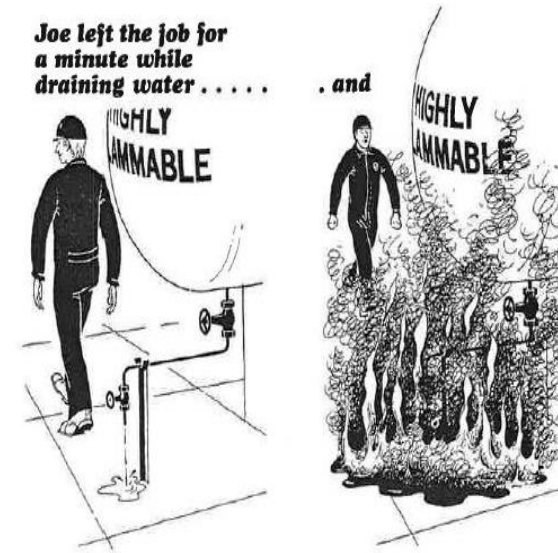
PILLAR 3 – Competence

- What is your understanding of “Competence”
- Is it training and experience – ability to do a task according to standard procedures? Would you call ability to respond under pressure competence?
- Competency aspect of operating a COMAH Site includes many other aspects such as Recruitment, Performance Management. All these and much more.
- The ability to carry out safety critical tasks correctly every time is a key process safety requirement. So, which of the following do you think is a “safety critical task”

Option 1: Safety induction of visitors

Option 2: Line breaking for maintenance

Option 3: Wearing correct personal protective equipment



Clips taken from “An Engineer’s View of Human Error- I ChemE - Adventures of Joe Soap”

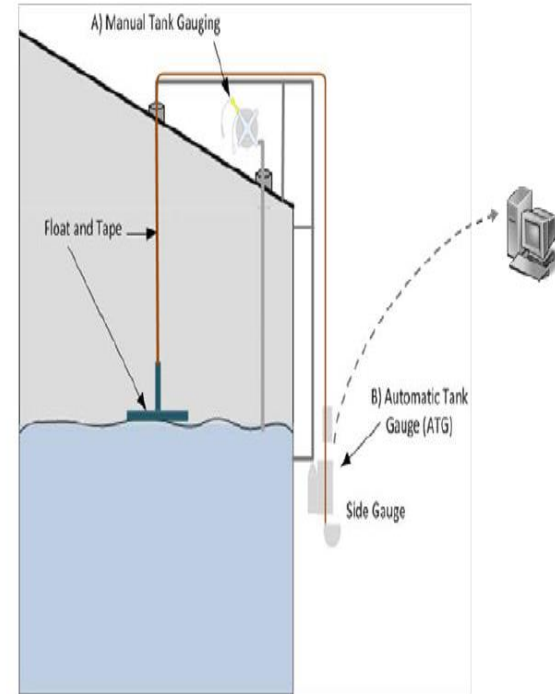
PILLAR 4 - Safety Instrumented Systems



- Prevention of loss of containment and fire/explosion is based on reliability of Safety Instrumented Systems (SIS)
- An example of such equipment is shown here. This is a level gauge which alarms when pre-set levels are reached and also may take executive action by closing inlet valves to prevent overfilling.
- Another example is Interceptor Pollution Probe which alarms upon detecting oil and in some cases- also shuts the final valve leading to public water courses.

PILLAR 5: Overfill

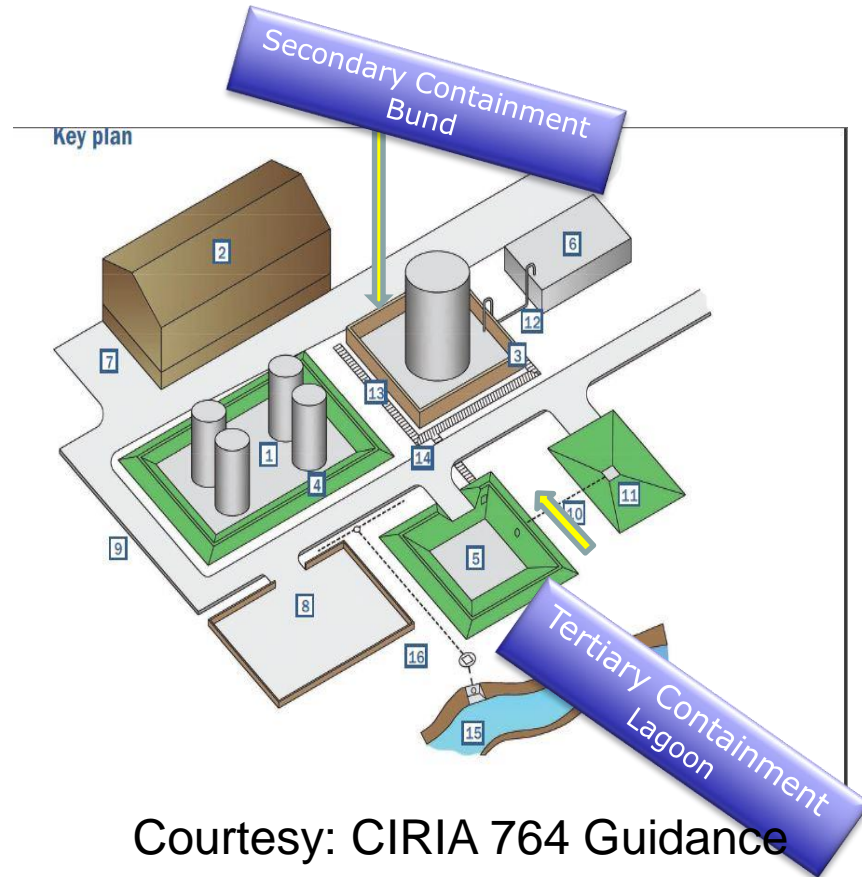
- Overfill of the tanks is one of the most common process safety events that may lead to fire/ explosion or severe environmental contamination.
- Factors that we must get right are:
- People – competent and following route cards every single time
- Use of Maintenance Systems to inspect/ proof test all safety critical plant and equipment
- Use of Containment Policy Score Cards to identify improvement areas & Site Improvement Plans



Reproduced from CSB Incident Report on COPECO

PILLAR 6: Secondary & Tertiary Containment

- Secondary Containment refers to Bunds that would catch any loss of containment from primary containment such as steel tanks. Concrete Jackets surrounding the tanks do not meet the criteria for secondary containment.
- Tertiary Containment refers to containment of product that has overtopped secondary containment and usually could be shown as dams/ pools/ lagoons on site



PILLAR 7 - Internal Emergency Plans



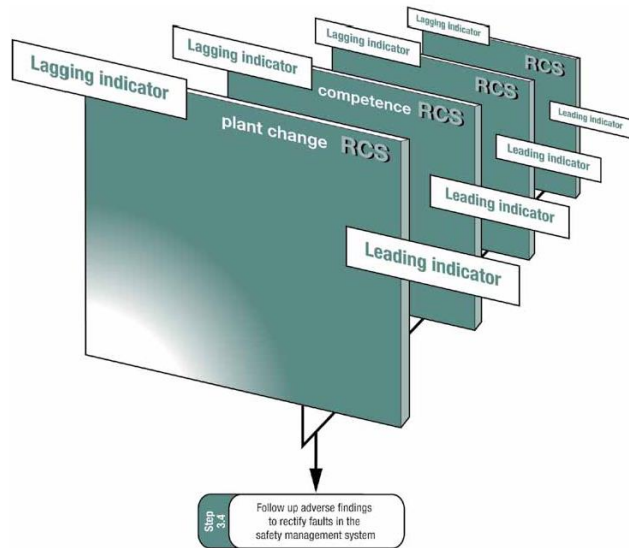
- MAPP: This is Major Accident Prevention Policy and sets out the framework and commitment of the Company to prevent Major Accidents.
- PIZ: Public Information Zones are established by the Competent Authority based on Safety Report reviews to provide area surrounding sites where the public must be provided key emergency information about our site and what to do in case of a COMAH alarm sounding
- Exercises: Invite local fire authorities to the site regularly to conduct annual on-site table top or physical exercises to keep them updated and also comply with the Regulatory Expectations
- Emergency Procedures are continuously reviewed and updated as new changes to the site are made.

PILLAR 8 – External Emergency Plans:

- The External Emergency plans are prepared by the Local Authority and has input from all emergency responders such as the Fire Brigade, Police, Ambulance, Public Health England, HSE, Environment Agency, Highways Authority, Water Authority and so on
- Liaison Meetings are held regularly with the Local Council to plan for and execute External Emergency exercises.
- These exercises are a legal requirement and must be done every 3 years.
- At a recent External Emergency Plan exercise, over 110 participants in various roles such as players, observers and umpires at strategic and operational levels were present. There was a hot and cold debrief after the conclusion of the successful exercise.
- The aim of these exercises is to validate the External Emergency Plan and continuously improve observed deficiencies.



PILLAR 9 - Process Safety Performance Indicators



From HSG 254: Developing Process Safety Performance Indicators

- Process Safety Performance Indicators (PSPI) provide assurance to the stakeholders that process safety issues are being managed to prevent catastrophic incidents. Typically, these are risk control barriers such as Operator Competence, Operational Procedures, Management of Change and Permit to Work and so on. These can be pro-active which indicate good practice such as planned preventive maintenance tasks or reactive which could be number of loss incidents. They are both useful in terms of continuous improvement in process safety on sites.
- Can you think of what else would be a good process safety indicator?

PILLAR 10 - Safety Leadership

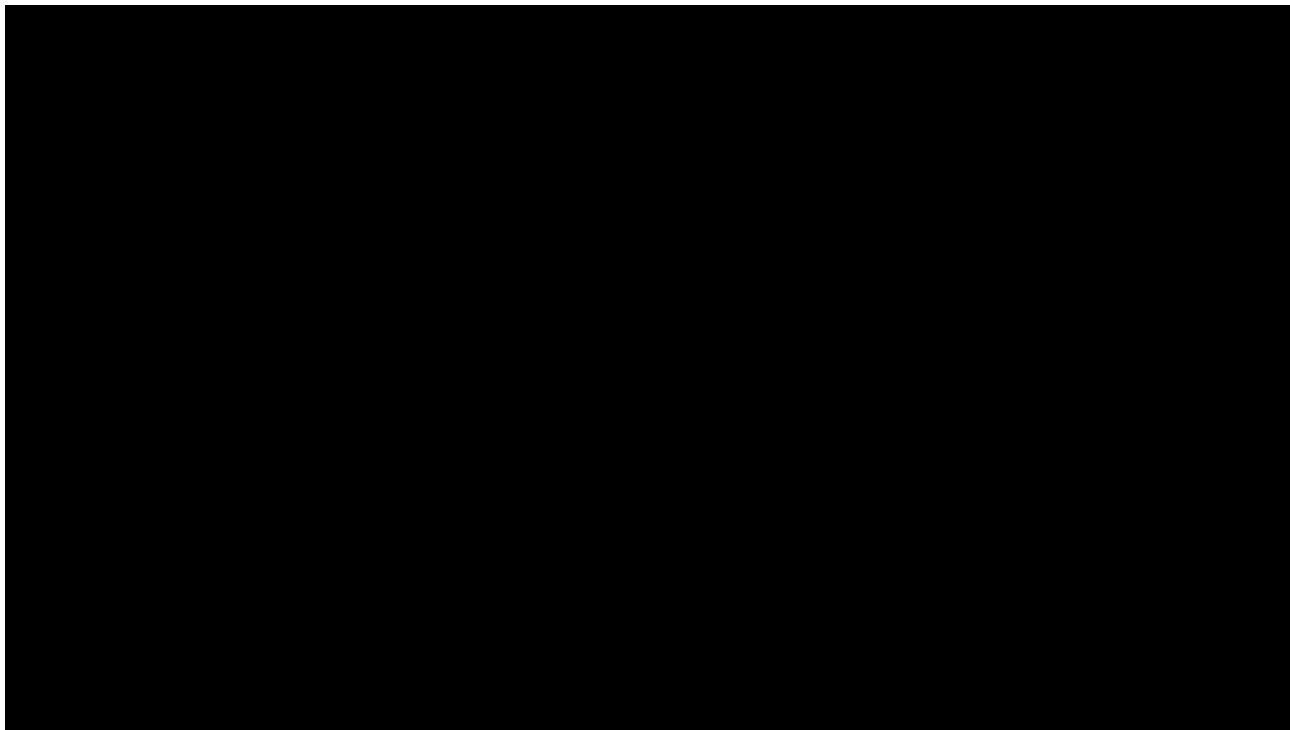
- Behaviour & Culture: Process Safety leadership is a must for any successful Organisation and Senior Leadership Team (SLT) sets the standard by personal commitment
- O & M Team Engagement: Senior Leadership Team (SLT) site visits to engage with local staff, carry out two way conversations to understand their concerns and promote Process Safety Issues on sites.



Summary

- To recap, Process Safety is different as compared to Occupational Safety.
- Process Safety relates to safe operation of the plant to minimise the potential for fire/ explosion and/ or severe environmental contamination.
- Process safety management involves a lot of different aspects where competency of the operators, understanding of control measures, understanding what to do in abnormal process conditions, safety critical maintenance are some of the key issues that must be managed by all employees and management to ensure safe operation of the plant.

I could have saved a life today – but I chose to look the other way



Final Thoughts: I CHOSE TO LOOK THE OTHER WAY **A poem by Don Merrill**

I could have saved a life that day,
But I chose to look the other way.
It wasn't I didn't care;
I had the time, and I was there.

But I didn't want to seem a fool;
Or argue over a safety rule.
I knew he'd done the job before;
If I spoke he might get sore.

The chances didn't seem that bad;
I'd done the same, he knew I had.
So I shook my head and walked on by;
He knew the risks as well as I.

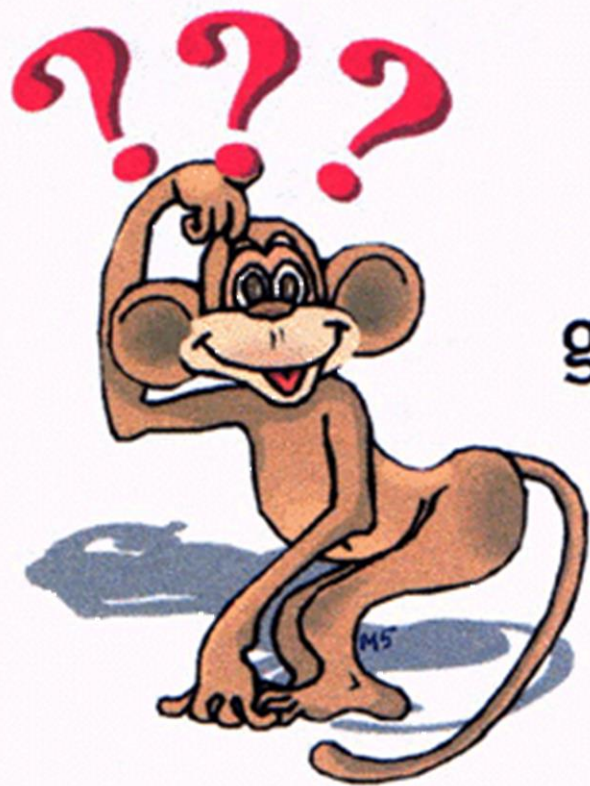
He took the chance, I closed an eye;
And with the act, I let him die.
I could have saved a life that day,
But I chose to look the other way.

Now every time I see his wife,
I know I should have saved his life.
That guilt is something I must bear;

But it isn't something you need share.
If you see a risk that others take,
That puts their health or life at stake,
The question asked or thing you say;
Could help them live another day.

If you see a risk and walk away,
Then hope you never have to say,
"I could have saved a life that day,
But I chose to look the other way"

Written after an actual event



Questions
are
guaranteed in
life;
Answers
aren't.