

PROCESS SAFETY MANAGEMENT

Fundamentals



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The World Steel Association (worldsteel) is one of the largest and most dynamic industry associations in the world, with members in every major steel-producing country. worldsteel represents steel producers, national and regional steel industry associations, and steel research institutes. Members represent around 85% of global steel production.

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“ Nothing is more important than the safety and health of the people who work in the steel industry.”

worldsteel Board of Directors

SIX SAFETY AND HEALTH PRINCIPLES FOR THE STEEL INDUSTRY

- All injuries and work-related illness can and must be prevented.
- Managers are responsible and accountable for safety and health performance.
- Employee engagement and training is essential.
- Working safely is a condition of employment.
- Excellence in safety and health drives excellent business results.
- Safety and health must be integrated into all business management processes.

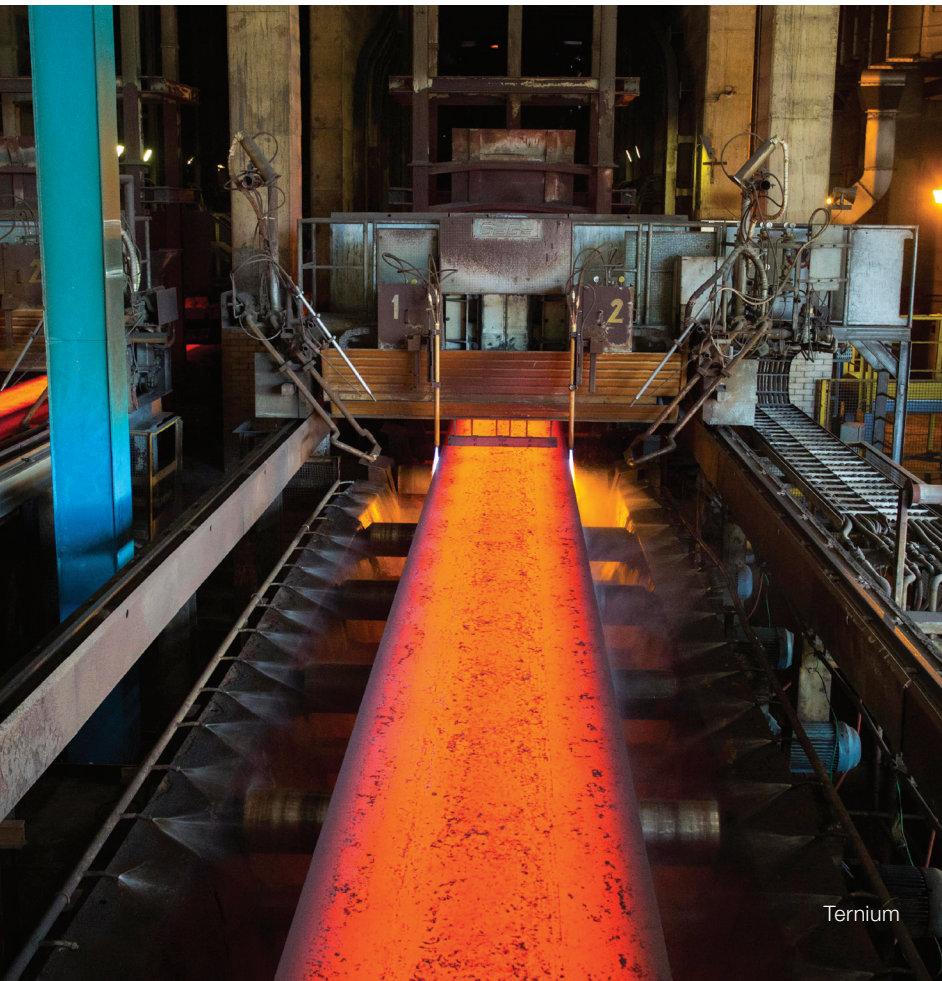
FOUR FOCUS AREAS

Safety Culture and Leadership

Occupational
Safety
Management

Occupational
Health
Management

Process
Safety
Management



Process Safety Management (PSM) is a blend of engineering, operations and management skills focused on preventing catastrophic accidents, particularly structural collapse, explosions, fires and toxic releases associated with loss of containment of energy or dangerous substances such as toxic gases, molten metal, chemicals and petroleum products.

The manufacturing of steel involves processes with intrinsic hazards that need careful management. The measures needed to control these hazards are often complex. The focus of process safety management is not limited to protecting the people within the company but also includes the environment, assets and surrounding community.

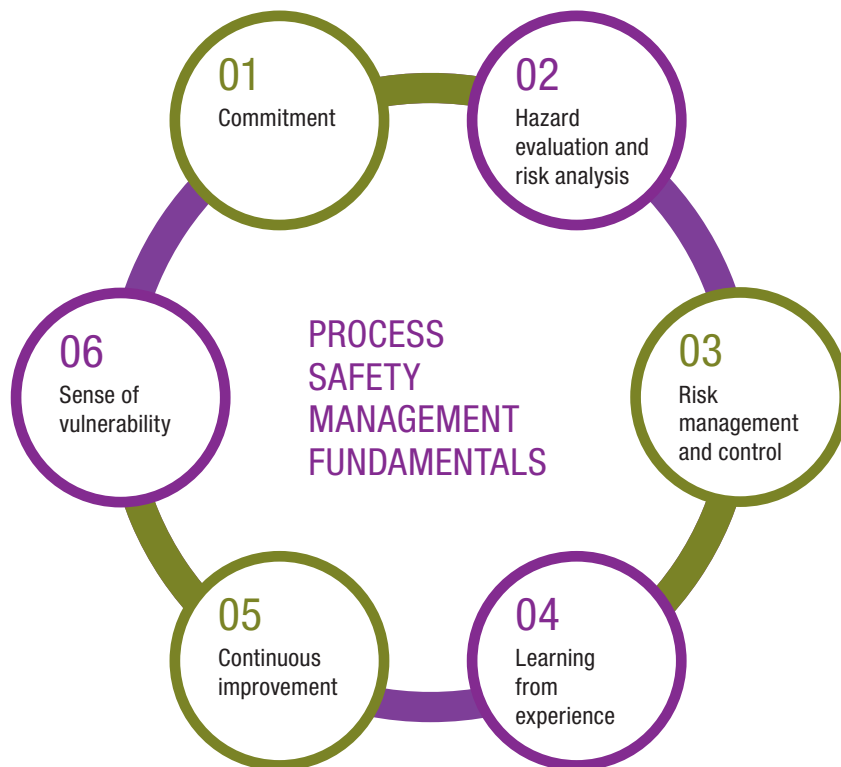
Our PSM fundamentals encourage steelmakers to take a risk-based, rather than compliance-based strategy to the prevention of PSM incidents and focus resources on high-risk activities.

SIX PROCESS SAFETY MANAGEMENT FUNDAMENTALS

1. Ensure there is a commitment to Process Safety Management.
2. Establish a hazard evaluation and risk analysis programme.
3. Implement and maintain a risk management and control system.
4. Strive to excellence in learning from experience.
5. Utilise continuous improvement to ensure Process Safety Management effectiveness.
6. Maintain a sense of vulnerability in Process Safety Management.

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1. Ensure there is a **commitment** to Process Safety Management.

The commitment to Process Safety Management is the foundation of process safety excellence and requires five elements:

1. Process safety culture in the workplace
2. Workforce involvement and participation
3. Stakeholder involvement
4. Workforce competencies
5. Performance based on standards.

> Is Process Management Safety a core value in your organisation?

2. Establish a **hazard evaluation and risk analysis** programme.

The understanding of process safety hazards and risks helps organisations to allocate resources effectively. This process comprises two elements:

1. Process and equipment knowledge
2. Hazard identification and risk analysis (HIRA process).

> Do you understand your hazards and risks?

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Tata Steel Limited

3. Implement and maintain a process safety **risk management and control** system.

Risk management and control helps organisations to operate and maintain processes with excellence, ensuring risk mitigation, management of change and keeping the risk tolerable. It also ensures that the workplace is prepared in the event of an emergency. This process requires six elements:

1. Good operational practices
2. Asset integrity and reliability
3. Management of contractors
4. Training and performance
5. Management of change
6. Emergency preparedness.

- > Do you manage your risks to keep them on a tolerable level?
- > Do you have emergency plans in all your units?

4. Strive to excellence in **learning from experience**.

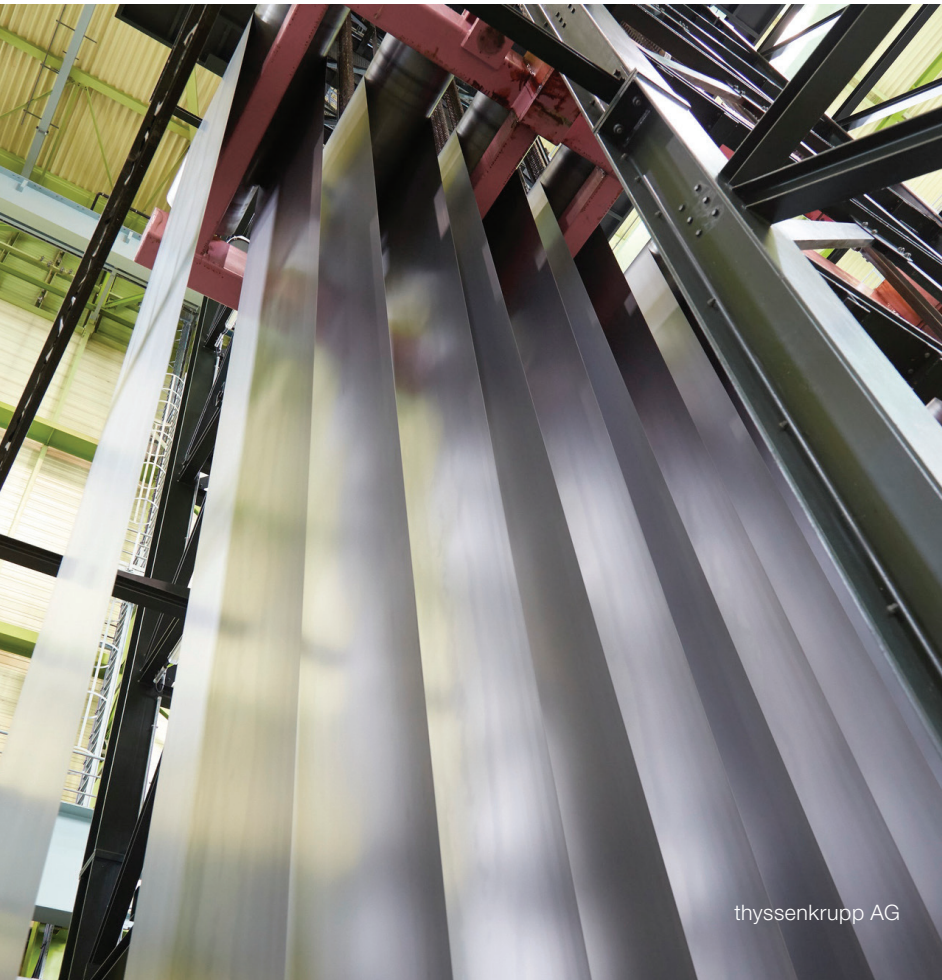
The learning from experience programme must maintain vigilance, utilise internal and external sources of information, take action and ensure effectiveness. This process comprises two elements:

1. Incident investigations
2. Measures and metrics.

- > Are you monitoring and acting on internal and external sources of information?

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5. Utilise **continuous improvement** to ensure Process Safety Management effectiveness.

Routinely reviewing the Process Safety Management system to stimulate continuous improvement will ensure effectiveness in the fundamentals of Process Safety Management. This process comprises two elements:

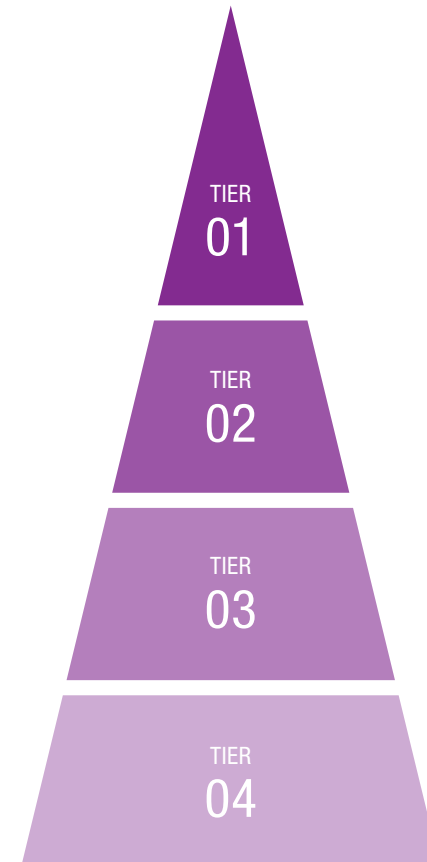
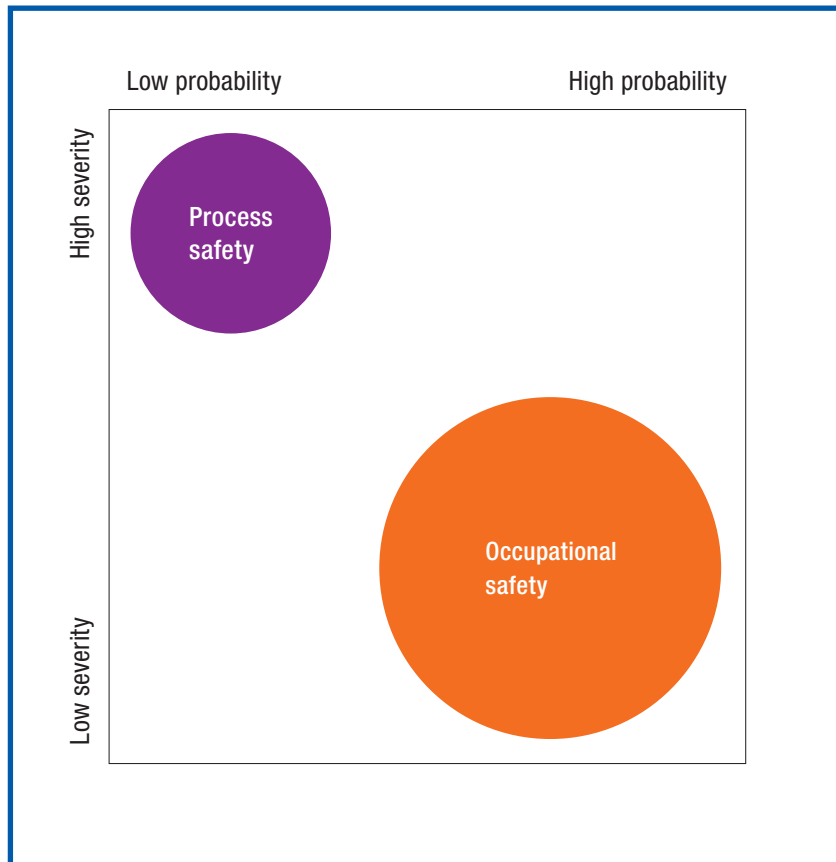
1. Auditing
2. Management review and governance.

> Are you performing reviews and auditing your Process Safety Management system?

6. Maintain a **sense of vulnerability** in Process Safety Management.

Developing a sense of vulnerability drives organisations to seek and maintain a clear understanding of risk and the means to control it.

> Are you promoting the sense of vulnerability in your organisation?



Tier 1 – Is a loss of primary containment (LOPC) with the greatest consequences, e.g. fires and explosions causing lost time injuries, one or multiple fatalities or significant financial impact (greater than organisational tolerance levels) or serious environmental impact or harm to the community or substantial reputation impact.

Tier 2 – LOPC with the lesser consequences, e.g. fires and explosions causing a recordable injury or financial impact (within organisational tolerance levels) or environmental impact or low harm to the community or reputation impact.

Tier 3 – Typically represents a challenge to the barrier system and near misses, e.g. deviations in safety operational limits, potential LOPC.

Tier 4 – Typically represents performance of individual components of the barrier system and are comprised of operating discipline and management system performance (e.g. KPI of PSM).

Clear definitions and calculation methodologies ensure the industry is applying a common standard and metric.

Containment, primary

A tank, vessel, pipe, truck, rail car, or other equipment designed to keep material within it - typically for the purposes of storage, separation, processing, or transfer of material.

Containment, secondary

An impermeable physical barrier specifically designed to mitigate the impact of materials that have breached primary containment. Secondary containment systems include, but are not limited to tank dikes, curbing around process equipment, drainage collection systems, the outer wall of open top double walled tanks, etc.

Explosion

A release of energy that causes a pressure discontinuity or blast wave (e.g. detonations, deflagrations, and rapid releases of high pressure caused by rupture of equipment or piping).

Fire

Any combustion resulting from a LOPC, regardless of the presence of flame. This includes smouldering, charring, smoking, singeing, scorching, carbonizing, or the evidence that any of these have occurred.

Loss of primary containment (LOPC)

An unplanned or uncontrolled release of any material from primary containment, including non-toxic and non-flammable materials (e.g. steam, hot water, nitrogen, compressed CO₂, or compressed air).

Molten metal

During the manufacture of steel and its co-products, different types of molten metals are used, such as zinc, iron and the steel itself.

Process

Production, distribution, storage, utilities, or pilot plant facilities used in the manufacture of steel products and co-products. This includes process equipment (e.g. reactors, vessels, piping, electric arc furnaces, blast furnaces, coke ovens, boilers, pumps, compressors, exchangers, cooling

towers, refrigeration systems, etc.), storage tanks, ancillary support areas (e.g. boiler houses and waste water treatment plants), on-site remediation facilities, and distribution piping under control of the company.

Note: All definitions are reproduced from API ANSI RP 754 except for: Molten metal and Process.

Process Safety Events Rates (PSER) are calculated as:

Total TIER 1 PSER * 1,000,000 / hours worked

Total TIER 2 PSER * 1,000,000 / hours worked

TIER 3 and 4 are leading indicators. They should be managed and be compliant with the PSM system.

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