Process safety management fundamentals

A six-step approach to address process safety management

worldsteel ASSOCIATION

NLMK

Contents

> "Nothing is more important than the safety and health of the people who work in the steel industry."
>
> worldsteel Board of Members

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.

Scope

Six safety and health principles for the steel industry

1. All injuries and work-related illness can and must be prevented.
2. Managers are responsible and accountable for safety and health performance.
3. Employee engagement and training is essential.
4. Working safely is a condition of employment.
5. Excellence in safety and health drives excellent business results.
6. 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

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.

01 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?

02 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?

03 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?

04 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?

05 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

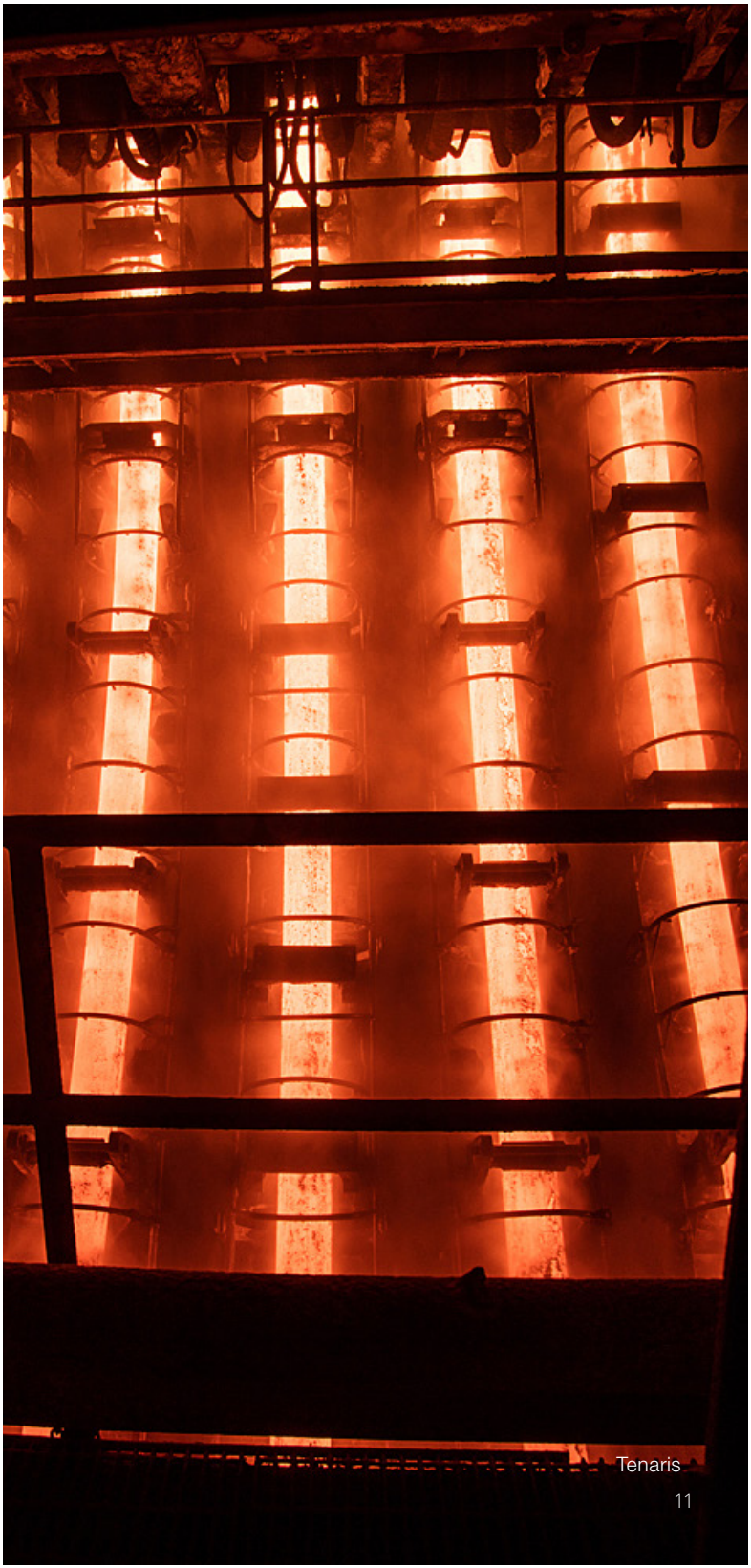
> Are you performing reviews and auditing your process safety management system?

06 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.

1. Incident investigations
2. Measures and metrics

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



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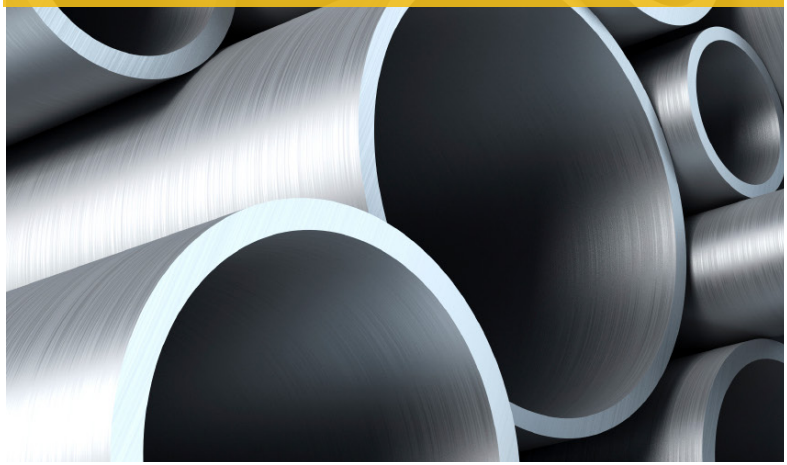
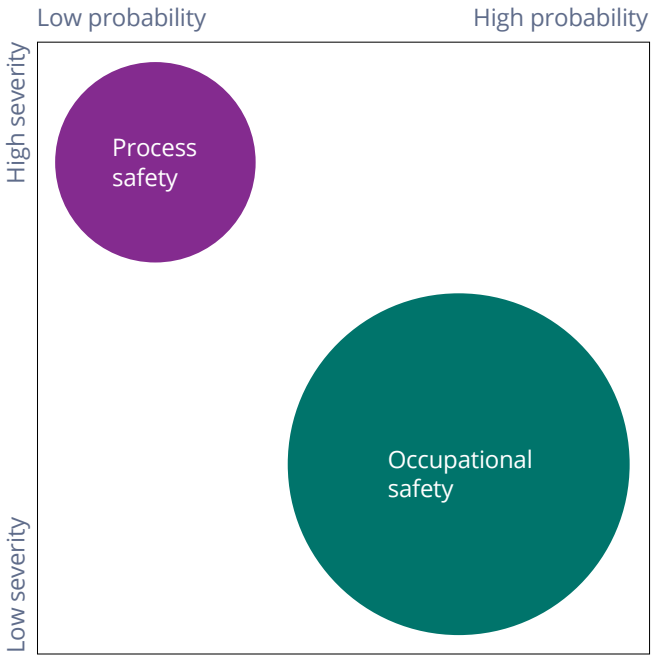
Tier framework for process safety





TIER 01

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 02

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 03

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

TIER 04

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).

Definitions and calculations

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 CO_2, 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.

Tier Frequency Rates are calculated as:

Tier 1 Frequency rate: Total Tier 1 Count * 1,000,000 / Hours worked (production activities)

Tier 2 Frequency rate: Total Tier 2 Count * 1,000,000 / Hours worked (production activities)

The Tier framework helps to improve process safety performance as we shift the focus from managing Lost Time Injury Frequency Rates and other conventional lagging indicators to properly identifying and investigating incidents and precursors for major events.

Tier 1 and Tier 2 are standardised definitions and support the industry benchmark. Threshold quantity values should be considered depending on the substance/material/energy release to classify as Tier 1 or Tier 2.

Tier 3 and 4 are company defined.

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