Safety and health in the steel industry **Data report 2024**

A holistic approach towards safety and health is required to move performance to the next level

worldsteel ASSOCIATION

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For terminology definitions and calculations, please refer to the worldsteel publication Safety and health principles and definitions available at worldsteel.org

Foreword

Welcome to the World Steel Association's 2024 Safety and health in the steel industry data report. This report is based on data provided by our members and offers crucial insights into our industry's ongoing commitment to safety and the well-being of our workforce.

In 2023, worldsteel's members reported 61 fatalities globally, representing a global fatal frequency rate (FFR) of 0.017, the lowest on record. Additionally, our lost time injury frequency rate (LTIFR) has risen slightly to 0.76 from 0.65 last year, but it remains below historical levels.

While we must approach lagging metrics cautiously, acknowledging their retrospective nature, it's evident that our industry's safety trajectory is generally positive. Despite challenges, we're making strides in implementing next-generation safety approaches such as human and organisational performance (HOP) and maintaining a focus on process safety management (PSM).

It's crucial to recognise the importance of looking at safety holistically, considering not only traditional safety metrics but also broader issues such as health in all its facets. To move performance to the next level we need to adopt a comprehensive view, integrating physical health, mental well-being, and overall quality of life into our safety frameworks.

To this end, moving forward, it is important that we promote a culture of holistic well-being for every individual in the global steel industry. Together, let us continue to strive for excellence in safety and health, ensuring a safer and healthier future for all.

Andrew Purvis
Director, Sustainable Manufacturing

To move performance to the next level, we need to adopt a comprehensive view, integrating physical health, mental well-being, and overall quality of life into our safety frameworks.

worldsteel's position on lagging indicators

The most popular lagging indicators, such as lost time injury frequency rate (LTIFR) or total recordable injury frequency rate (TRIFR), will be kept within the worldsteel reporting framework and as a reference of the industry's general performance.

However, comparisons between organisations or local sites should not be made using LTIFR or TRIFR.

Below are the main reasons:

- These indicators correlate poorly with the severity of accidents and injuries and do not provide a valid or reliable measure of safety and health controls and initiatives.
- A smaller organisation's LTIFR or TRIFR is more significantly affected by a single incident but this doesn't necessarily indicate a more dangerous working environment.
- Although worldsteel has a definition for lost time injury (LTI) and total recordable injury (TRI), companies vary in their definition of what constitutes an LTI and TRI.

These two indicators should not be part of individual, team or organisation objectives, bonuses, or incentives as they can foster a negative attitude towards reporting, limiting the organisational ability to learn and improve.

Potential serious injuries and fatalities (PSIF)

A serious injury is a permanent impairment or life-altering state, or an injury that, if not immediately addressed, will lead to death or permanent or long-term impairment.

A potential serious injury or fatality is a near miss incident that could have resulted in a serious injury or fatality if not for specific barriers or countermeasures or if one factor around the event had been changed.

A precursor of PSIF is a high-risk situation in which control methods are absent, ineffective, or not complied with, and if allowed to continue, would potentially result in a fatality or serious injury.

In 2023, 95% of sites made use of a PSIF framework.

The number of individual sites reporting to worldsteel using the PSIF framework has increased in recent years. The figures below only represent the sites reporting PSIFs and combining contractors and employees.

Figure 1: Potential serious injuries and fatalities triangle 2023 for employees and contractors

	Total	PSIF	
Fatalities*	35		
Lost time injuries	2,173	581	26.74%
All other injuries**	21,035	497	2.36%
Near misses	142,120	5,570	3.92%
Precursors	3,249,061	166,420	5.12 %

* In 2023, there were 61 fatalities reported to worldsteel. In order to preserve the ratios within the PSIF section of this report, fatalities reported by organisations that were not able to provide PSIF information have been excluded from this analysis.

** All other injuries includes restricted work cases (RWC), medically treated injuries (MTI) and minor injuries (MI).

Stated injury statistics in this graphic are derived from companies that report PSIF information to worldsteel.

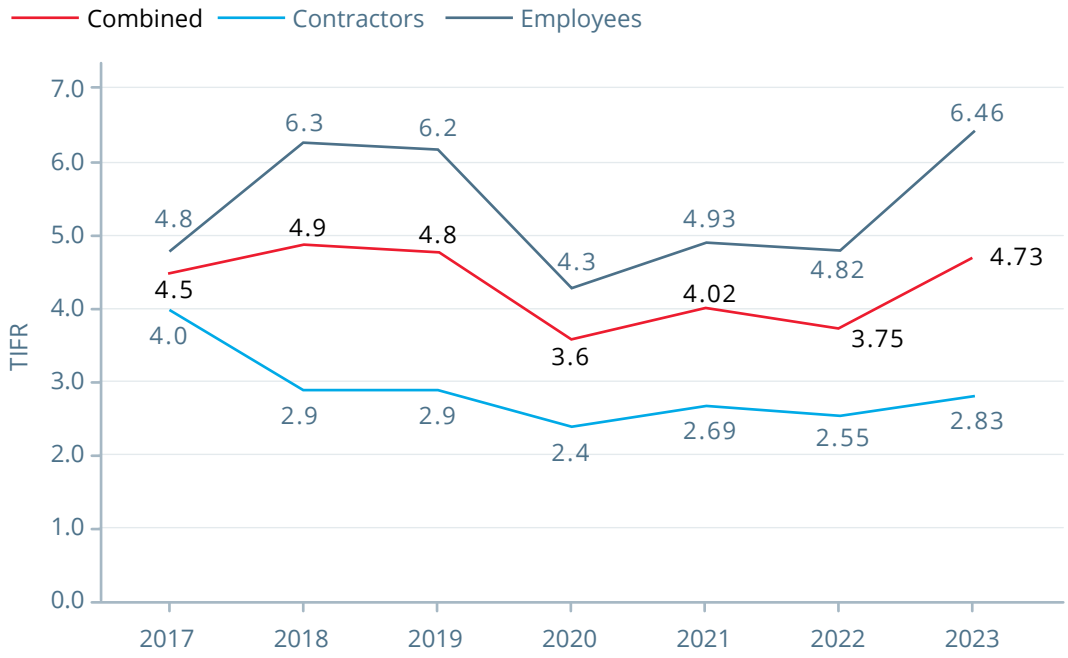
Typically around 20% of incidents have the potential to become serious injuries or fatalities.

To reduce serious harm, steelmakers should focus on better identifying, managing and reporting near misses and injuries with the potential to cause fatalities and serious injuries.

Total recordable injury frequency rate (TRIFR)

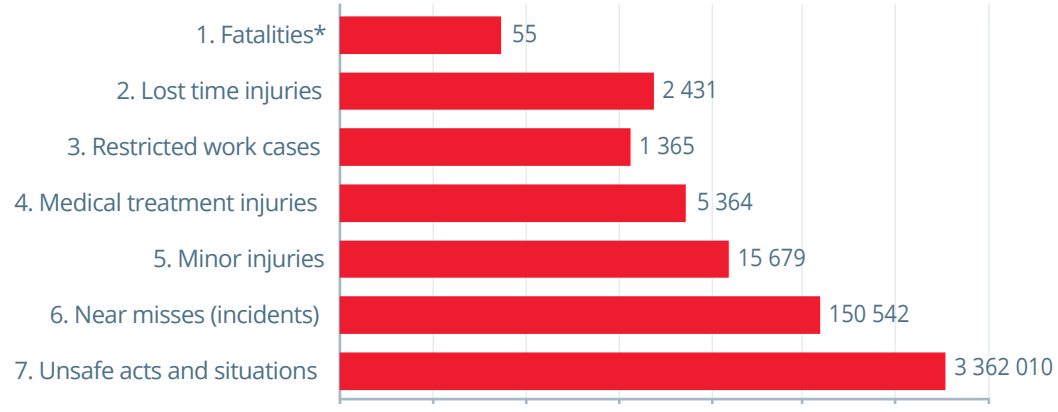
Total recordable incidents comprise fatalities, lost time injuries (LTIs), restricted work cases (RWCs) and medically treated injuries (MTIs). In the data survey, restricted work cases and MTIs are reported separately. Working hours are counted only on sites that have reported at least one RWC or MTI.

Figure 2: Total recordable injury frequency rate 2017-2023



Total recordable injury frequency rate increased from 3.75 in 2022 to 4.75 in 2023.

Figure 3: Safety pyramid 2023

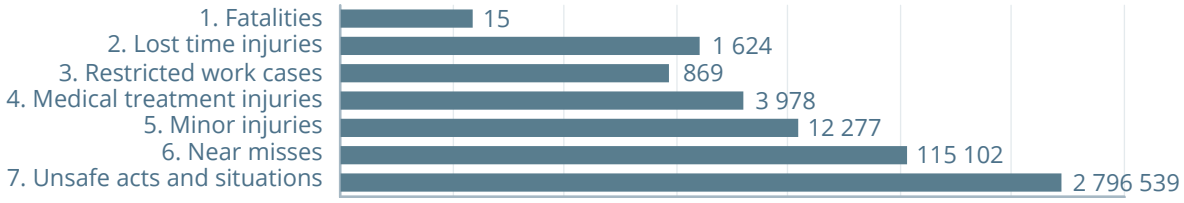


* In 2023, there were 61 fatalities reported to worldsteel. In order to preserve the ratios within the TRIFR section of this report, fatalities reported by organisations that were not able to provide TRIFR information have been excluded from this analysis.

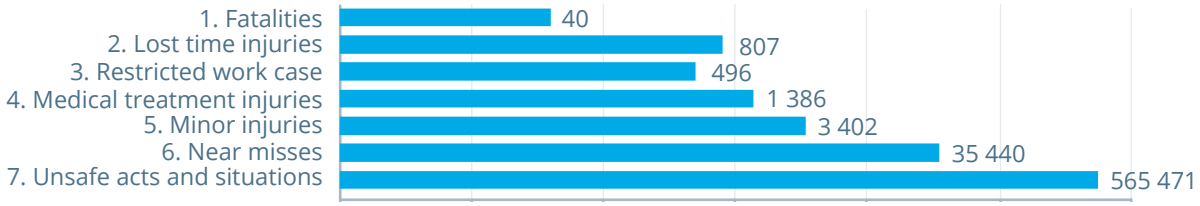
Safety pyramids can be used to compare the shape of a company's incident triangle. In case the company triangle is narrower, it could mean that not all incidents are reported, or that fatality prevention requires more attention. It should be noted that the average incident triangle is not necessarily optimal; it should probably be wider. Reducing the number of more minor incidents does not directly reduce the probability of severe incidents, but having those reported allows action to be taken to mitigate risks that might otherwise cause severe incidents.

Figure 4: Safety pyramids 2023 for employees and contractors

Employees:



Contractors:



More must be done to improve contractor management systems, to improve reporting and to better manage and reduce the risks contractors face. This is especially true of PSIF events (see page 4)

Table 1: Ratio lost time injuries (LTIs) vs fatalities 2004-2023

Cause	LTIs	Fatalities	Ratio LTIs per 1 fatality
Gassing and asphyxiation	236	138	1.71
Explosion	218	93	2.34
Rail	223	73	3.05
Fire	317	75	4.23
Electrical	435	80	5.44
Structural failure	342	57	6.00
Fall from height	1977	318	6.22
On site road vehicle	890	129	6.90
Forklift	316	34	9.29
Overhead crane	897	103	8.71
Moving machinery	3130	301	10.40
Hot metal	714	66	10.82
Falling object	2057	170	12.10
Other mobile equipment	818	54	15.15
Off site road vehicle	321	13	24.69
Hot substances	502	20	25.10
Product loading	665	17	39.12
Product handling storage	1947	38	51.24
Exposure to chemicals	170	3	56.67
Manual task tools	2623	8	327.88
Slip, trip and fall	3394	6	565.67

The ratio between lost time injuries (LTIs) and fatalities provides important insight into workplace safety. A small ratio suggests fewer LTIs per fatality, and while less common these type of incidents represent a higher risk of fatalities.

Many process safety issues fall into this category. It is therefore particularly important to conduct thorough incident investigations and implement preventive measures for incidents with low ratios.

The table shows the ratio between lost time injuries and fatalities by causes. Small ratios mean that per fatality, there are, on average, only a small amount of lost time injuries; a big ratio indicates there are many lost time injuries per fatality. If these were drawn as an incident triangle for each cause, the triangles for the small ratios would be very narrow.

These ratios show that to prevent fatalities, it is more important to undertake comprehensive and robust incident investigations and instigate preventive measures for those incidents with a low ratio. It is precisely these incidents that are most likely to lead to fatalities without effective prevention. These ratios also emphasise the usefulness of categorising potential serious injuries and fatalities among other incidents.

Lost time injury (LTI) analysis

Lost time injury. Any work-related injury resulting in the employee or contractor being unable to return to work for their next scheduled work period. Returning to work with work restrictions does not constitute a LTI status, no matter how minimal or severe the restrictions, provided it is at the employee's next scheduled shift. However, if an injury deteriorates and time is later lost, a LTI should be recorded. Lost time injury frequency rate (LTIFR) is calculated by combining fatalities and LTIs.

Figure 5: Number of lost time injuries (LTIs) 2014-2023

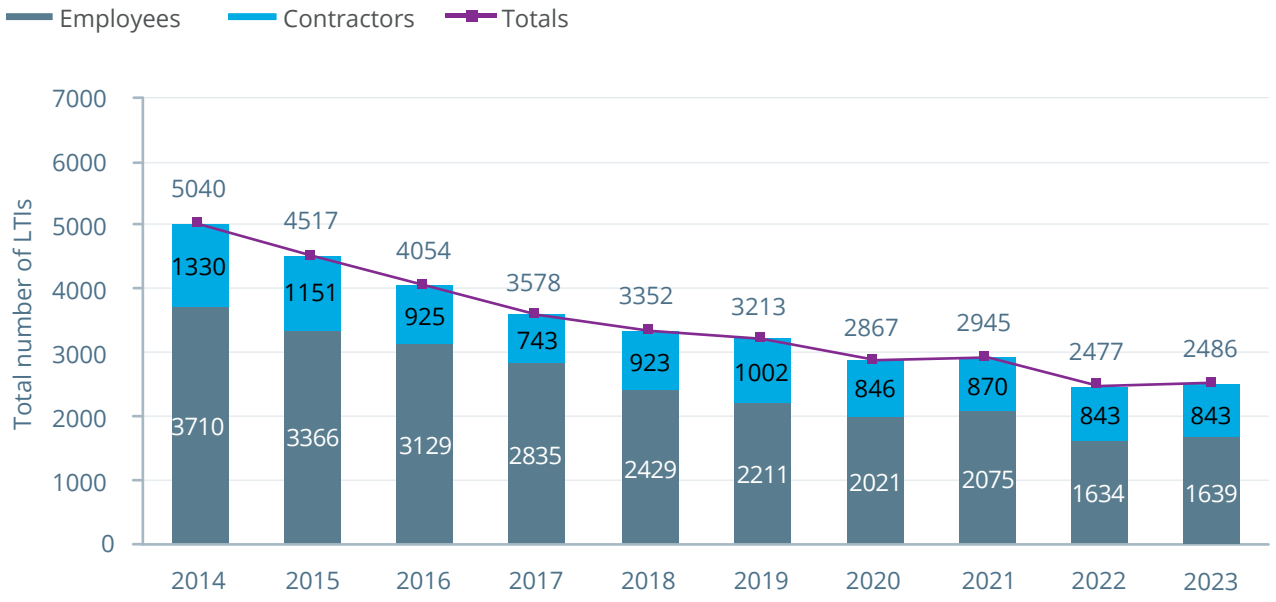
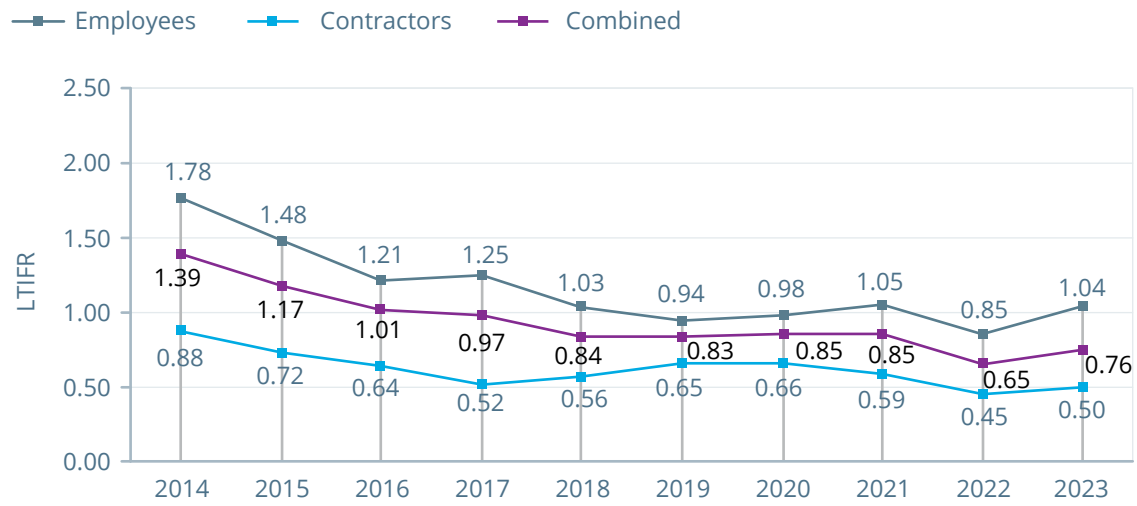


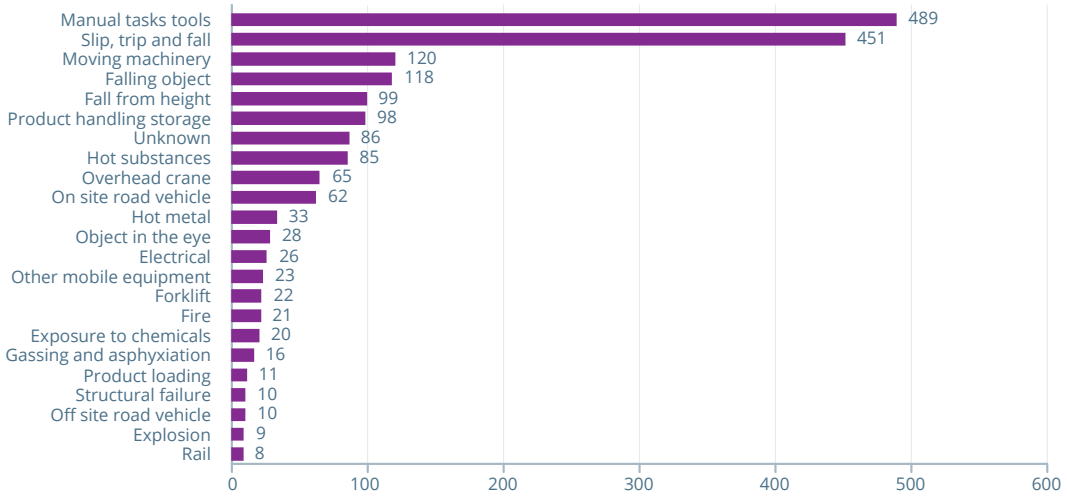
Figure 6: Lost time injury frequency rate (LTIFR) 2014-2023



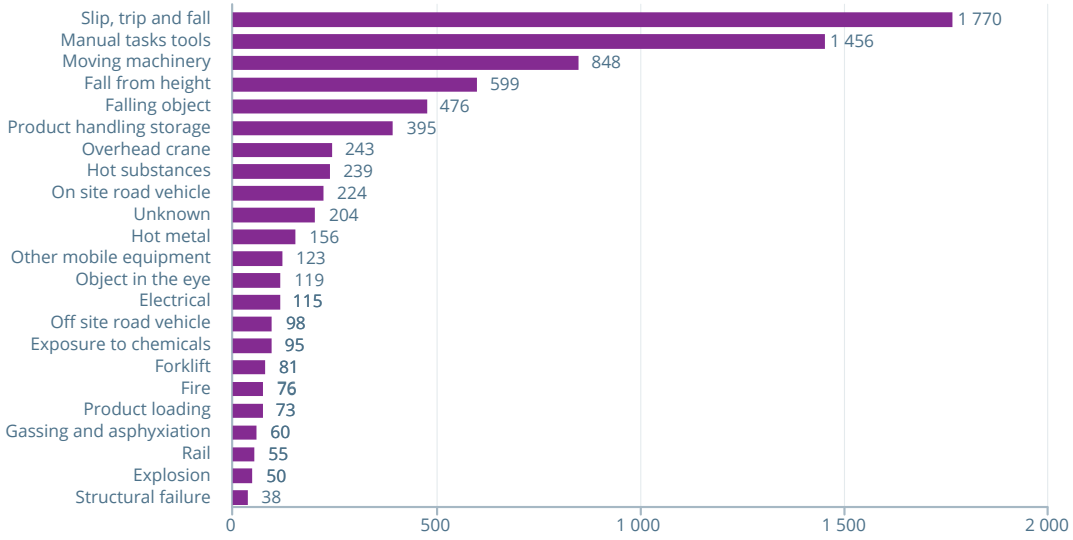
Lost time injury frequency rate increased from 0.65 in 2022 to 0.76 in 2023.

Figure 7: Causes of lost time injuries 2014-2023 for employees and contractors combined

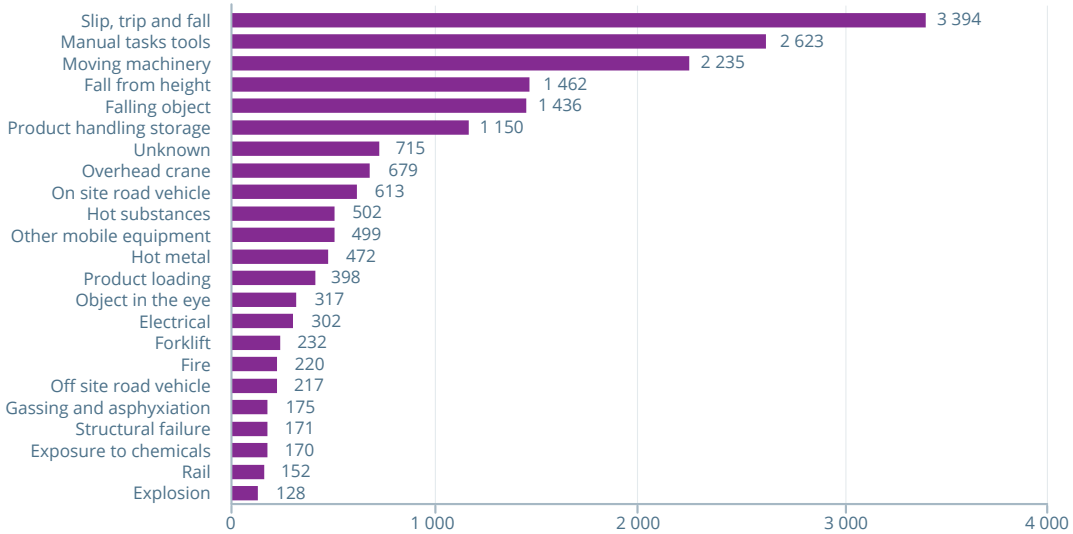
Causes of lost time injuries 2023



Causes of lost time injuries last 5 years (2019-2023)



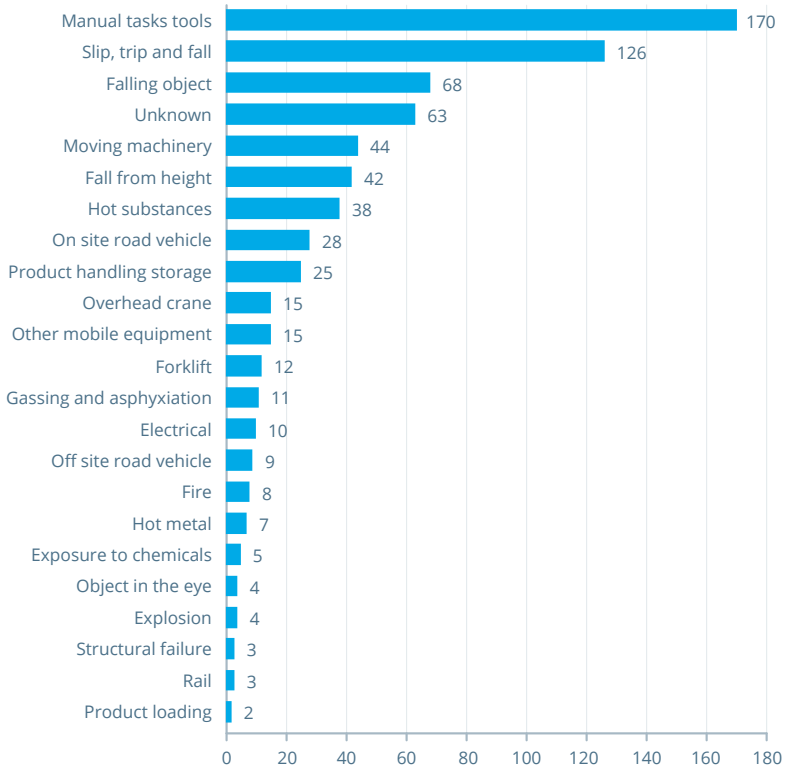
Causes of lost time injuries last 10 years (2014-2023)



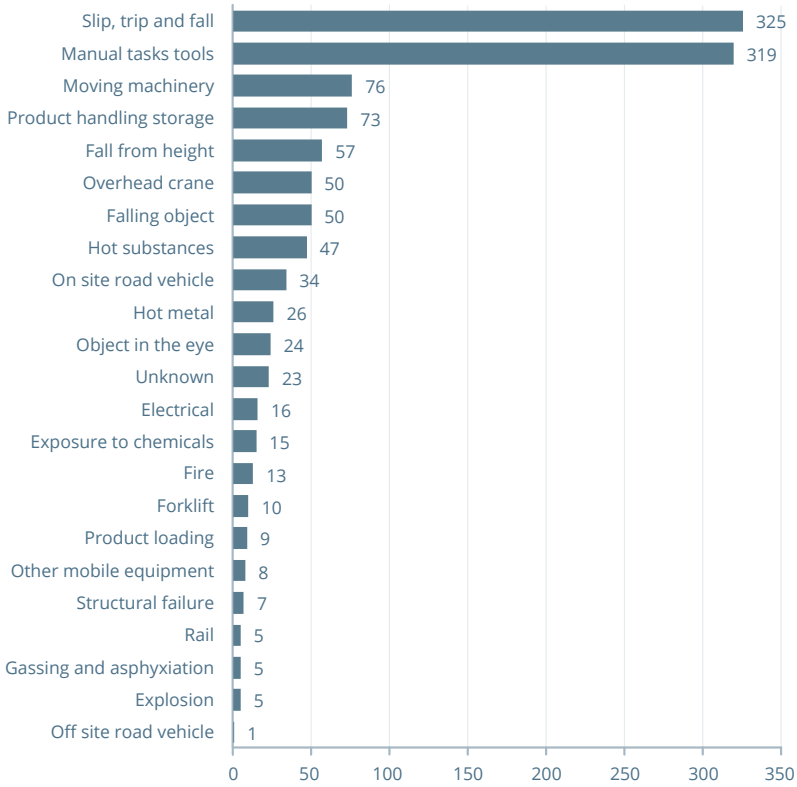
The following graphs show the distribution of causes separated by employees and contractors.

Figure 8: Causes of lost time injuries in 2023 for employees and contractors

Causes of lost time injuries - contractors 2023



Causes of lost time injuries - employees 2023

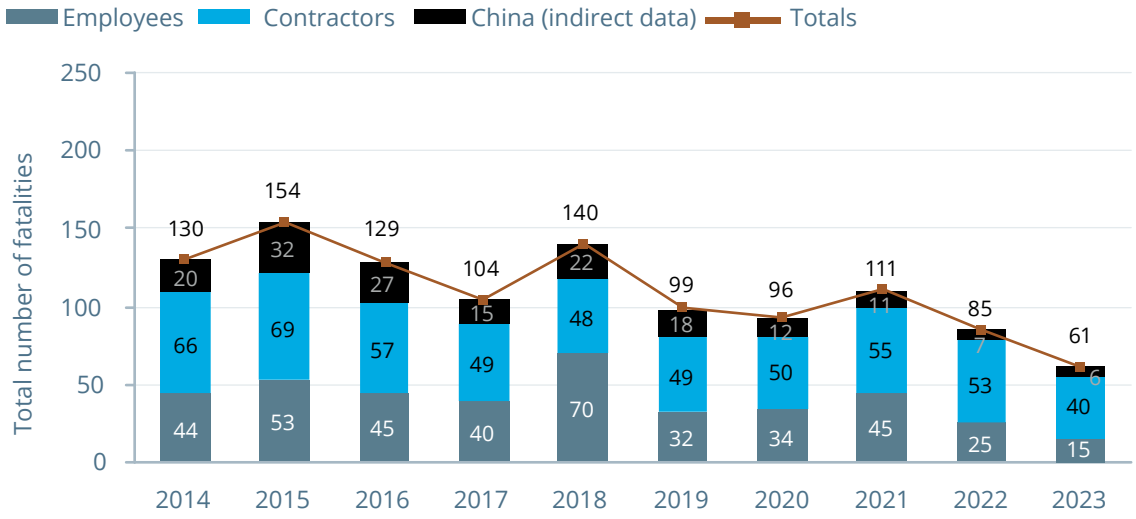


The top five causes of lost time injury in 2023 for employees and contractors combined were: use of manual tools, slipping, moving machinery, falling objects and falling from height.

Fatality analysis

Death from a work-related injury, certified by a medical professional. Fatality frequency rate (FFR) is calculated on the number of fatalities per million hours worked.

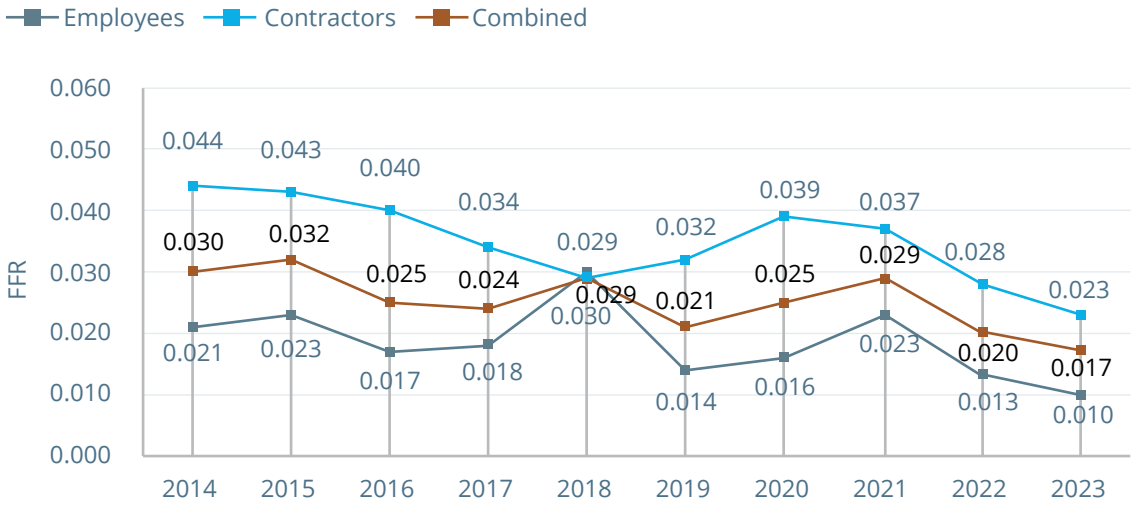
Figure 9: Number of fatalities 2014-2023



** Data received from China via Sinosteel Wuhan Safety & Environmental Protection Research Institute (SEPRI) does not distinguish between employees and contractors. Data received directly from Chinese worldsteel members does and is included in the analysis.*

The total number of fatalities reported to worldsteel during 2023 was 61, which represents a decrease of 28% compared to 85 in 2022.

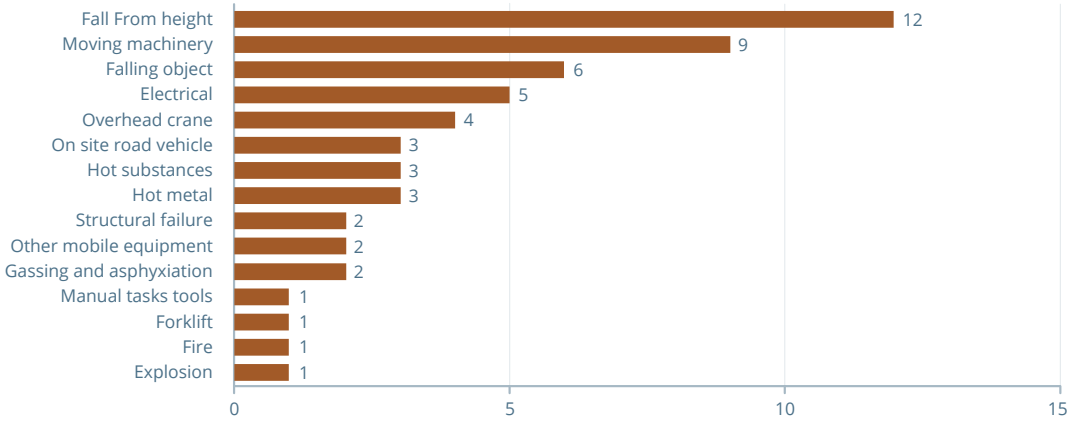
Figure 10: Fatality frequency rate 2014-2023



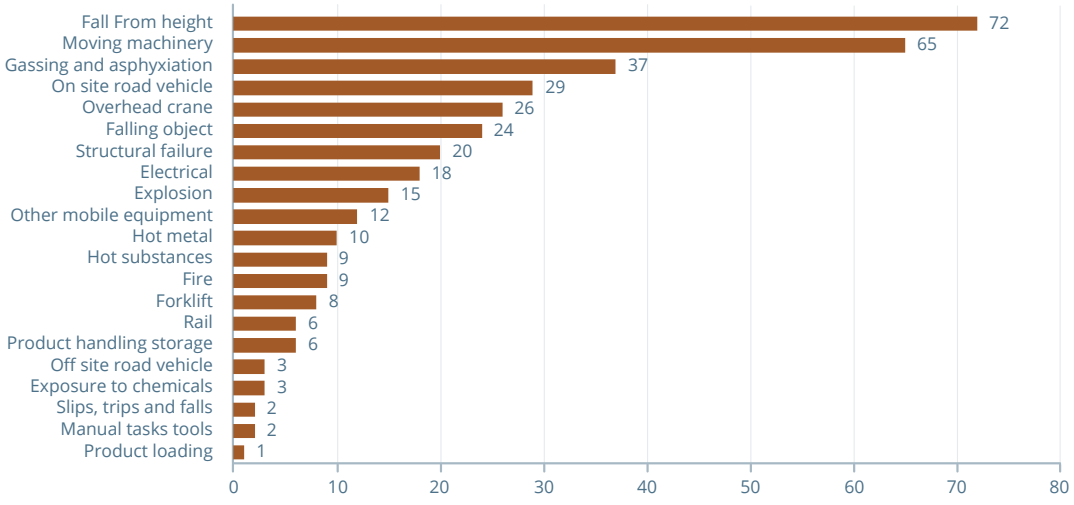
The fatality frequency rate decreased from 0.020 in 2022 to 0.017 in 2023.

Figure 11: Causes of fatalities 2014-2023

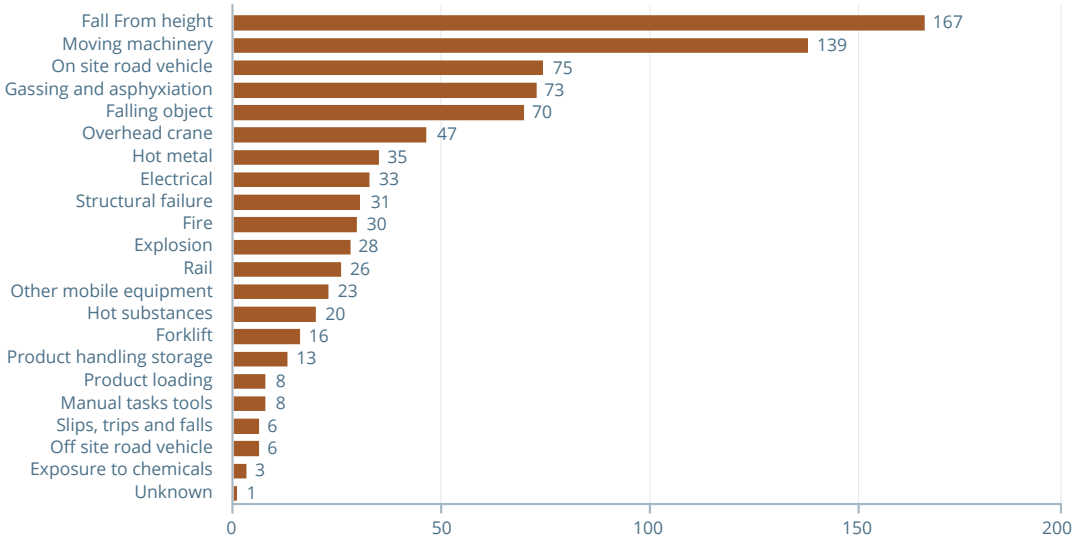
Causes of fatalities 2023



Causes of fatalities last 5 years (2019-2023)



Causes of fatalities last 10 years (2014-2023)



The top 5 causes of fatalities over the past decade were falling from height, moving machinery, on site road vehicles, gassing and asphyxiation and falling objects. These are consistent over time.

The following graphs show the distribution of causes split by employees and contractors.

Figure 12: Causes of employee fatalities 2023

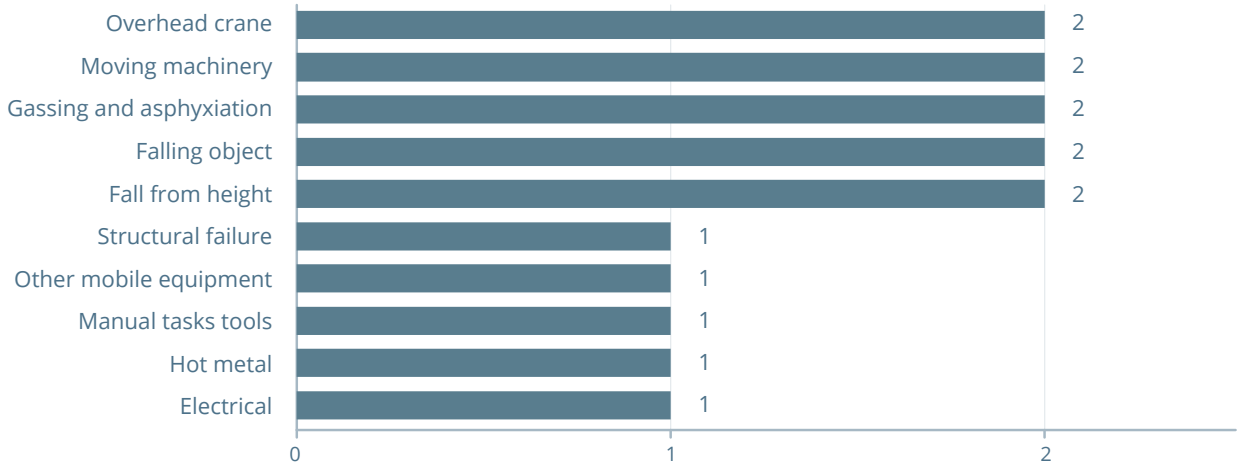
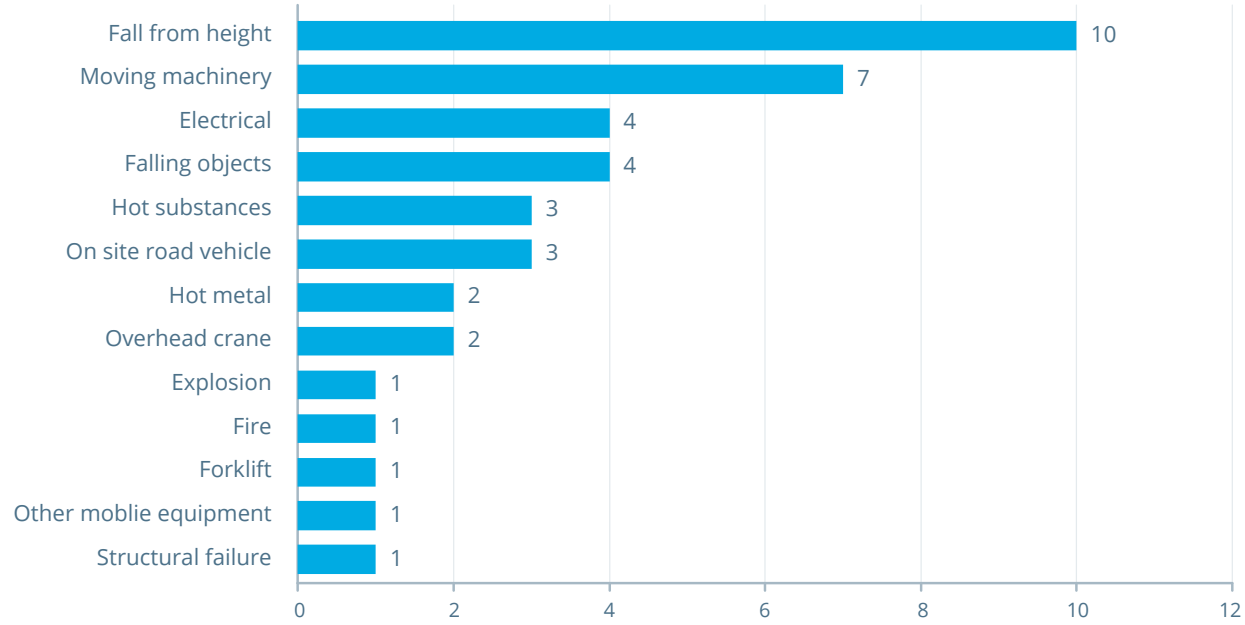


Figure 13: Causes of contractor fatalities 2023



Note: events registered as 'other' or 'Unknown' are not included.

Contractors remain a vulnerable community within the global steel industry. Causes of fatalities for contractors and employees are different, reflecting the different activities and risks faced by each group.

Process safety management (PSM) analysis

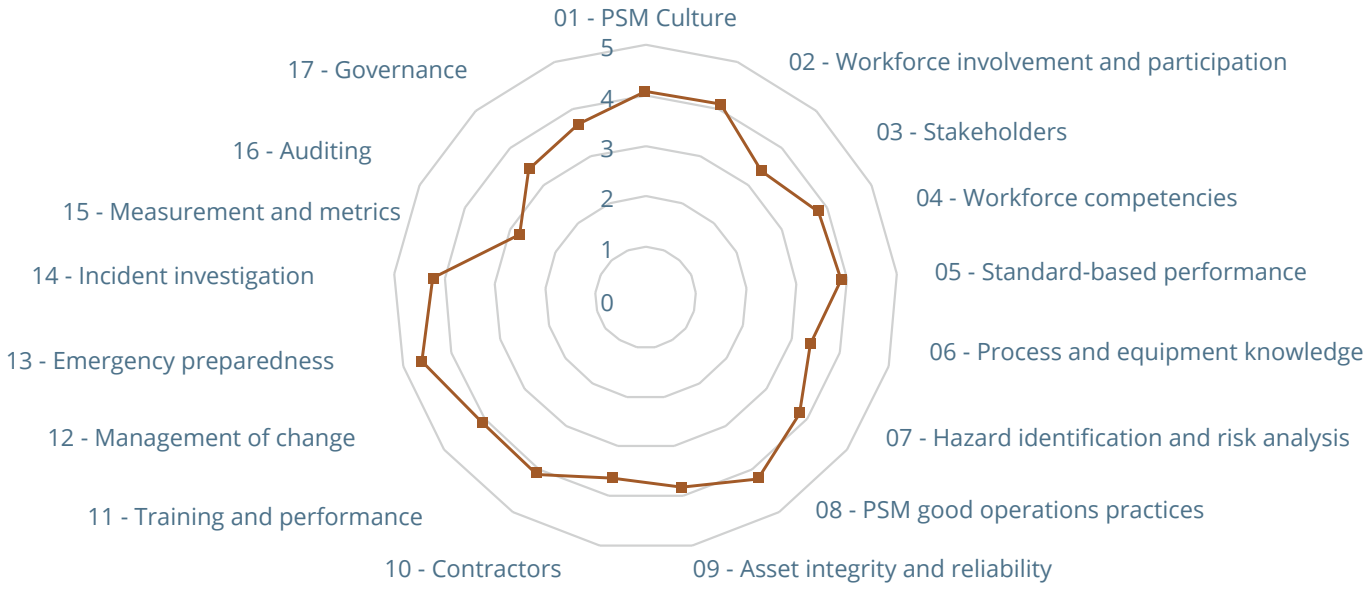
Process safety management (PSM) is a blend of operational, engineering and management skills focused on preventing catastrophic accidents and near misses, particularly explosions, fires, structural collapse, and damaging releases associated with a loss of containment of energy or dangerous substances such as molten metals, fuels, and chemicals.

The manufacturing of steel involves processes with intrinsic hazards that need careful management. The measures required 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 the surrounding community.

Table 2: Significant events benchmark

Typical process safety events	Quantity	Main causes
Fires	294	Inadequate planned inspections | Falling of spatter | Poor housekeeping | Welding spatters | Combustible dusts (Ti) | Oil spills | Burns of grease and scale | Non-compliance with procedure | Protections and barriers out of standard, inadequate material | Inadequate engineering system | Preventive/predictive maintenance not correctly specified | Electrical | Molten metal leakage | Maintenance failure | Coke oven gas leakage because of corrosion.
Explosions	26	Gas explosion due to high temperature during the waste process | Explosive mixture formation | Oxygen pipe | Protections and barriers are out of standard, inadequate material | Inadequate engineering system | Preventive/predictive maintenance not correctly specified | Non-compliance with procedure | Contact of steel and water | Explosive materials | Explosion of the open circuit corrosion inhibitor tank as a result of the chemical reaction caused by adding hypochlorite to the open circuit corrosion inhibitor's main tank.
Molten metal and water reactions	34	Damp casting powder causing slag entrainment and breakout|Probable water ingress in the slag pit| Minor explosions in the slag chamber due to heavy rain and minor explosion in tapping pit due to high groundwater level | Inadequate engineering system | Preventive/predictive maintenance not correctly specified | Work order incomplete | Non-intentional error | Inadequate material | Cooling water leakage | BPCS control loop failure | Water contaminated scrap |
Gas and liquid releases (flammable, toxic or asphyxiant gases)	825	Barrier activations/failures | Gas leakage through pipeline flanges | Inadequate engineering system | Preventive/predictive maintenance not correctly specified | Non-compliance with procedure | Inadequate material | Inadequate engineering system | Work order incomplete, task not designed correctly | Corrosion in gas pipelines | Lockout/tagout failure | Flow reversion |Critical equipment failure | Personnel error: chemical reaction that occurs when two different chemicals are mixed | Dimensional incompatibility Issues |Chemical spillage during process | NaOH leakge due to valve failure |Inadequate supervision | Protections and barriers out of standard.

Figure 13: Process safety management maturity assessment results 2023



The Process Safety Management maturity analysis was derived from data provided by 20 organisations, representing 22% of worldsteel members.

Increasing maturity in process safety management can be observed. The industry has grown in experience and expertise in process safety management; however, there is an important area of improvement for element 15 (measurement and metrics). Process Safety KPIs are different from Occupational Safety KPIs. This issue has led to requests from worldsteel members to provide effective indicators for benchmarking and monitoring purposes. In the past, worldsteel has referenced well-accepted frameworks (e.g., API RP 754); however, a specific set of indicators and guidance are being developed

worldsteel's approach to process safety management is built on the American Petroleum Institute Recommended Practice 754, and identifies 17 key PSM elements.

Sickness absence

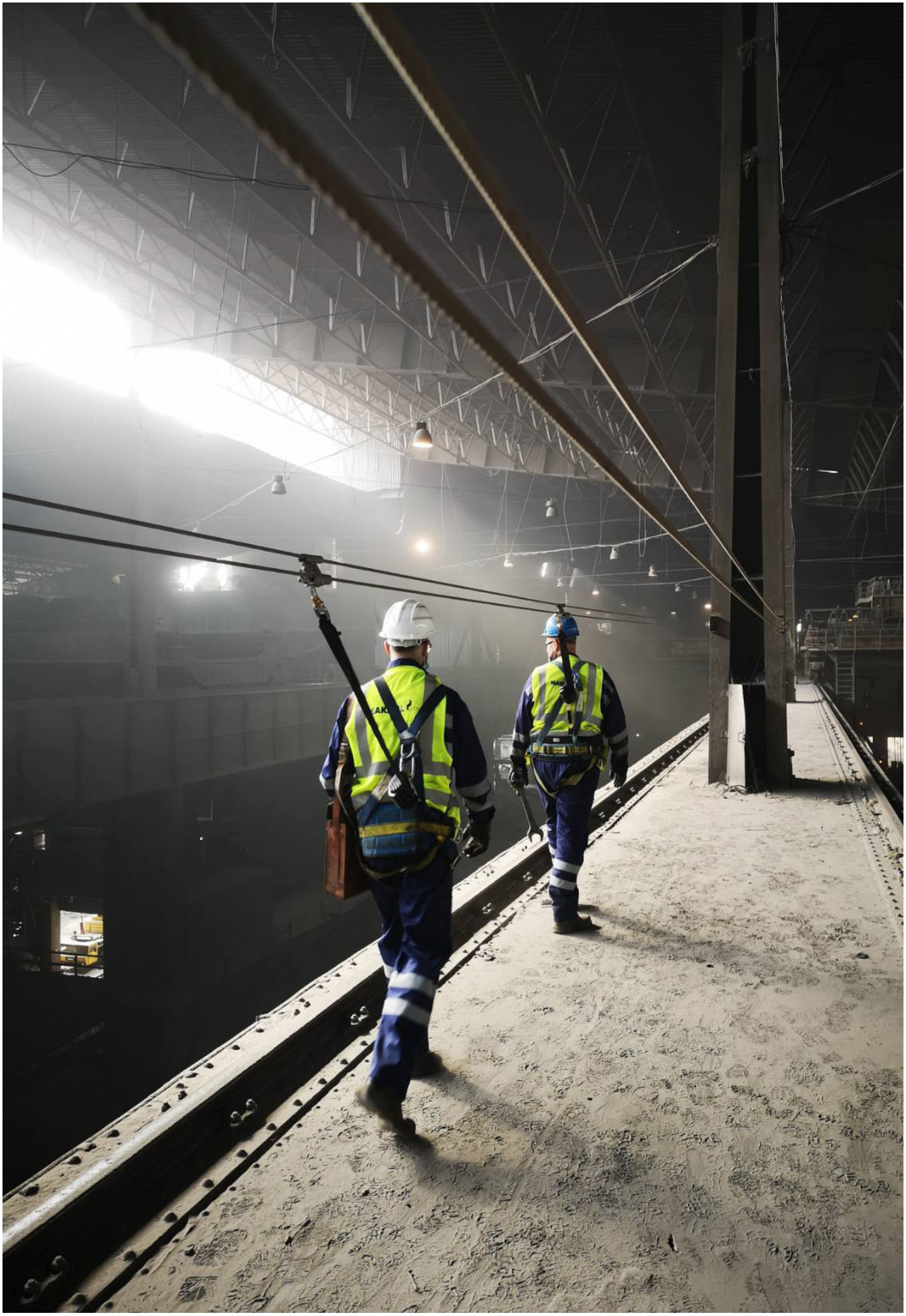
Sickness absence [Percentage] is calculated as the total number of hours of sickness absence per total work hours. This indicator is only calculated for employees.

The following table shows the sickness absence per region.

Table 3: Sickness absence per region 2015 – 2023

% Sickness absence	2015	2016	2017	2018	2019	2020	2021	2022	2023
Africa and Middle East (AME)	0.13	0.25	0.23	0.29	1.06	0.18	1.01	2.51	3.95
Asia/Pacific	0.12	0.08	0.08	0.19	0.15	0.05	0.11	0.54	0.69
Russia & other CIS + Ukraine	0.75	1.26	1.41	0.6	1.38	1.88	1.73	2.33	3.76
Europe	1.11	2.02	2.26	1.92	3.32	3.89	4.36	5.59	3.83
North America	0.14	0.14	0.14	0.23	0.22	0.42	0.14	1.31	1.27
South America	0.3	0.53	0.48	0.43	0.75	0.46	0.42	3.03	1.59

Reported occupational sickness levels vary between regions due to differences in industry composition, regulatory standards, and access to healthcare. Cultural attitudes towards reporting workplace-related illnesses and socioeconomic factors also play a role in the disparities. Efforts to improve healthcare access can help promote healthier working environments worldwide.



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