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

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 (PSIF) 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.

The number of individual sites reporting to worldsteel using of 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

<table>
<thead>
<tr>
<th>Fatalities*</th>
<th>Total 35</th>
<th>PSIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lost time injuries</td>
<td>2,173</td>
<td>581</td>
</tr>
<tr>
<td>All other injuries**</td>
<td>21,035</td>
<td>497</td>
</tr>
<tr>
<td>Near misses</td>
<td>142,120</td>
<td>5,570</td>
</tr>
<tr>
<td>Precursors</td>
<td>3,249,061</td>
<td>166,420</td>
</tr>
</tbody>
</table>

* 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 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**

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.

* 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:

- 1. Fatalities
- 2. Lost time injuries
- 3. Restricted work cases
- 4. Medical treatment injuries
- 5. Minor injuries
- 6. Near misses
- 7. Unsafe acts and situations

Contractors:

- 1. Fatalities
- 2. Lost time injuries
- 3. Restricted work cases
- 4. Medical treatment injuries
- 5. Minor injuries
- 6. Near misses
- 7. Unsafe acts and situations

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

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

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.

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.
Lost time injury (LTI) analysis

Lost time injury (LTI). 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**

- Manual tasks tools: 170
- Slip, trip and fall: 68
- Falling object: 63
- Unknown: 44
- Moving machinery: 42
- Fall from height: 38
- Hot substances: 28
- On site road vehicle: 25
- Product handling storage: 15
- Overhead crane: 15
- Other mobile equipment: 12
- Forklift: 11
- Gassing and asphyxiation: 10
- Electrical: 9
- Off site road vehicle: 8
- Fire: 7
- Hot metal: 5
- Exposure to chemicals: 5
- Object in the eye: 4
- Explosion: 4
- Structural failure: 3
- Rail: 3
- Product loading: 2

**Causes of lost time injuries - employees 2023**

- Slip, trip and fall: 325
- Manual tasks tools: 319
- Moving machinery: 76
- Product handling storage: 73
- Fall from height: 57
- Overhead crane: 50
- Falling object: 50
- Hot substances: 47
- On site road vehicle: 34
- Hot metal: 26
- Object in the eye: 24
- Unknown: 23
- Electrical: 16
- Exposure to chemicals: 15
- Fire: 13
- Forklift: 10
- Product loading: 9
- Other mobile equipment: 8
- Structural failure: 7
- Rail: 5
- Gassing and asphyxiation: 5
- Explosion: 5
- Off site road vehicle: 1

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

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

* 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.

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

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**

![Bar chart showing the distribution of causes of employee fatalities in 2023]

**Figure 13: Causes of contractor fatalities 2023**

![Bar chart showing the distribution of causes of contractor fatalities in 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

<table>
<thead>
<tr>
<th>Typical process safety events</th>
<th>Quantity</th>
<th>Main causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fires</td>
<td>294</td>
<td>Inadequate planned inspections</td>
</tr>
<tr>
<td>Explosions</td>
<td>26</td>
<td>Gas explosion due to high temperature during the waste process</td>
</tr>
<tr>
<td>Molten metal and water reactions</td>
<td>34</td>
<td>Damp casting powder causing slag entrainment and breakout</td>
</tr>
<tr>
<td>Gas and liquid releases (flammable, toxic or asphyxiant gases)</td>
<td>825</td>
<td>Barrier activations/failures</td>
</tr>
</tbody>
</table>
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., RP API 754); however, a specific set of indicators and guidance are being developed.
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

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa and Middle East (AME)</td>
<td>0.13</td>
<td>0.25</td>
<td>0.23</td>
<td>0.29</td>
<td>1.06</td>
<td>0.18</td>
<td>1.01</td>
<td>2.51</td>
<td>3.95</td>
</tr>
<tr>
<td>Asia/Pacific</td>
<td>0.12</td>
<td>0.08</td>
<td>0.08</td>
<td>0.19</td>
<td>0.15</td>
<td>0.05</td>
<td>0.11</td>
<td>0.54</td>
<td>0.69</td>
</tr>
<tr>
<td>Russia &amp; other CIS + Ukraine</td>
<td>0.75</td>
<td>1.26</td>
<td>1.41</td>
<td>0.6</td>
<td>1.38</td>
<td>1.88</td>
<td>1.73</td>
<td>2.33</td>
<td>3.76</td>
</tr>
<tr>
<td>Europe</td>
<td>1.11</td>
<td>2.02</td>
<td>2.26</td>
<td>1.92</td>
<td>3.32</td>
<td>3.89</td>
<td>4.36</td>
<td>5.59</td>
<td>3.83</td>
</tr>
<tr>
<td>North America</td>
<td>0.14</td>
<td>0.14</td>
<td>0.14</td>
<td>0.23</td>
<td>0.22</td>
<td>0.42</td>
<td>0.14</td>
<td>1.31</td>
<td>1.27</td>
</tr>
<tr>
<td>South America</td>
<td>0.3</td>
<td>0.53</td>
<td>0.48</td>
<td>0.43</td>
<td>0.75</td>
<td>0.46</td>
<td>0.42</td>
<td>3.03</td>
<td>1.59</td>
</tr>
</tbody>
</table>

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.