



Government of **Western Australia**  
Department of **Mines, Industry Regulation and Safety**

A decorative graphic consisting of a network of interconnected nodes and lines in shades of purple, green, and grey, positioned above a large green banner.

# **SAFETY PERFORMANCE**

IN THE WESTERN AUSTRALIAN MINERAL INDUSTRY

A decorative graphic consisting of a network of interconnected nodes and lines in shades of purple, green, and grey, positioned below the green banner and above the year text.

# **2016 - 17**

ACCIDENT AND INJURY STATISTICS



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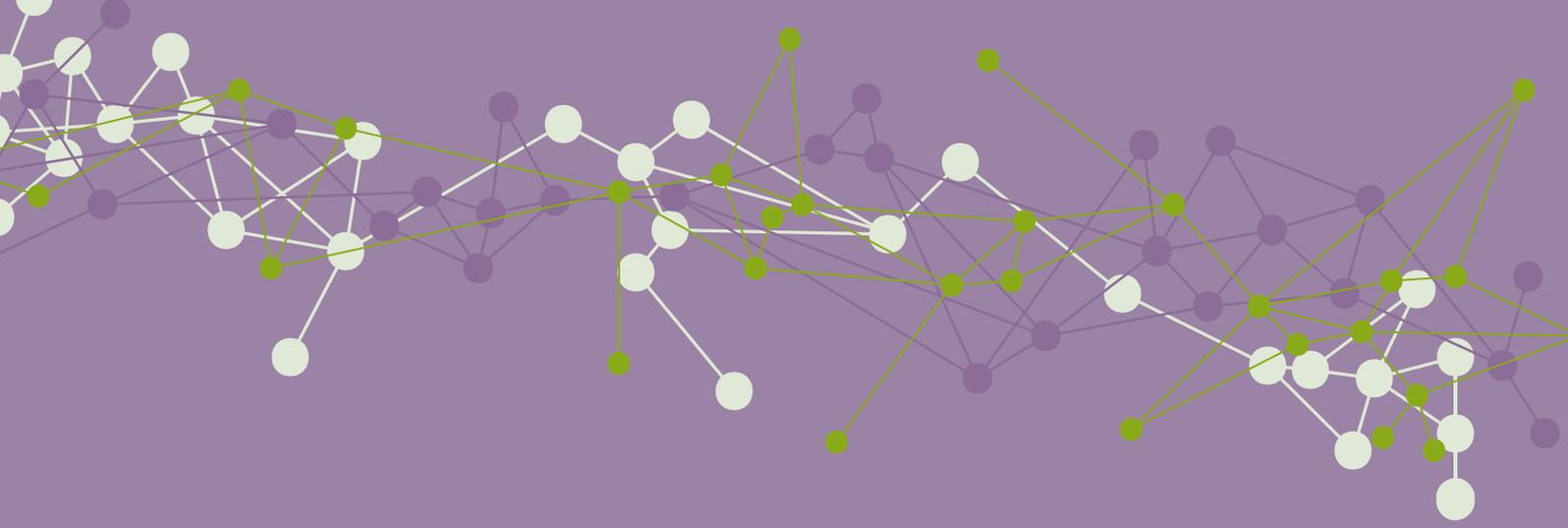
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Government of **Western Australia**  
Department of **Mines, Industry Regulation and Safety**

# **SAFETY PERFORMANCE**

IN THE WESTERN AUSTRALIAN MINERAL INDUSTRY

ACCIDENT AND INJURY STATISTICS 2016-17

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# STATISTICAL SUMMARY

## MINING

- One fatal mining accident occurred during 2016-17, in the processing plant of a gold operation.
- There were 389 LTIs during 2016-17, 12 more than the previous year (377 lost time injuries in 2015-16). Table 5 and Appendix B show a breakdown of the number of injuries by commodity mined.
- Lost time injuries resulted in a total of 8,038 rostered days lost and a further 11,263 rostered days of restricted work in 2016-17.
- There was an average workforce of 106,590 in 2016-17, an increase of approximately 4.1% from the previous year's average of 102,343.
- The overall LTI duration rate improved by approximately 9% during 2016-17, falling from 22.8 to 20.7.
- The overall LTI frequency rate deteriorated by 5% during 2016-17, rising from 2.2 to 2.3.
- The overall injury index (days lost per million hours worked) improved by approximately 5%, falling from 50 in 2015-16 to 47 in 2016-17.
- Serious LTIs in mining during 2016-17 totalled 313, 6 less than in 2015-16, with the overall serious LTIFR remaining almost unchanged at 1.85 from 1.86.
- The iron ore sector LTIFR improved by 21% during 2016-17, falling from 1.4 to 1.1.
- The bauxite and alumina sector LTIFR deteriorated significantly (by 98%) during 2016-17, rising from 4.1 to 8.1.
- The gold sector LTIFR improved by 9% during 2016-17, falling from 2.3 to 2.1.
- The nickel sector LTIFR deteriorated by 30% during 2016-17, rising from 3.0 to 3.9.
- There were 718 RWIs during 2016-17, a 5% improvement on the previous year (752 RWIs reported in 2015-16).
- RWIs resulted in a total of 18,925 rostered days of restricted work in 2016-17.
- The overall RWI frequency rate for 2016-17 improved by 3%, falling from 4.4 to 4.2.

## EXPLORATION

- There were no exploration fatalities in 2016-17.
- There were 10 LTIs reported during 2016-17, 3 less than the previous year.
- Lost time injuries resulted in a total of 138 rostered days lost and a further 262 rostered days of restricted work in 2016-17.
- There was an average workforce of 2,288 workers, an increase of 3% from the previous year's average.
- The overall LTIFR improved by 27% in 2016-17, falling from 3.3 to 2.4. Rates for exploration such as LTIFR may vary significantly from year to year due to the low numbers of both the LTIs reported and hours worked.
- There were 14 restricted work injuries reported for exploration during 2016-17, resulting in a RWI frequency rate of 3.4, 26% lower than the 2015-16 rate of 4.6.
- RWIs resulted in a total of 217 rostered days of restricted work in 2016-17.



1 fatal accident



21% decrease in LTIFR for iron ore sector

9% decrease in LTIFR for gold sector

30% increase in LTIFR for nickel sector

98% increase in LTIFR for bauxite and alumina sector



313 serious LTIs with the overall serious LTIFR at 1.85

LTIs resulted in 8,038 rostered days lost and 11,263 rostered days of restricted work



718 RWIs, 5% decrease from the previous year

RWIs resulted in 18,925 rostered days of restricted work

3% decrease in overall RWIFR



10 LTIs

LTIs resulted in 138 rostered days lost and 262 rostered days of restricted work



14 RWIs

RWIs resulted in 217 rostered days of restricted work



## INTRODUCTION

In 2016-17, one worker was killed while working at a Western Australian mining operation. A further 313 people suffered a serious lost time injury – an injury that disables a worker for two weeks or more.

These figures are a reminder that we still have too many people being put in harms' way while working in Western Australia's mining industry.

While safety is improving, we cannot and should not accept the current number of fatalities and injuries.

As a regulator, the Department of Mines, Industry Regulation and Safety raises awareness and seeks compliance. We are also committed to thoroughly investigating incidents to provide safety information to the industry, which helps protect workers and safeguard the community.

However, each and every person involved in the mining industry must take their safety responsibilities seriously.

Make the safety of yourself and your workmates a priority, even if it's a task you have done a hundred times before. Because it only takes a momentary lapse in applying risk controls for a tragedy to occur.

The department is committed to working with industry to help reduce

serious incidents and provide tangible support in achieving positive cultural change.

To help achieve this, the department launched a number of initiatives including the *Towards 2020* Regulatory Strategy, a focus on human and organisational factors and the inaugural Safety and Health Resources Sector Awards.

*Towards 2020* is the department's vision for a safe and healthy resources industry. It is the first of a series of high-level three-year rolling strategies to guide the Department's efforts to raise awareness and seek compliance in the Western Australian resources sector, going beyond the day-to-day inspectorate activities.

To help increase knowledge about the influence of human and organisational factors on safety in the resources industry, the department held two forums and released a suite of information on its website. This includes information about the top 11 human factors for Western Australia's resources sector.

To recognise and encourage safety innovation, the department held its first Safety and Health Resources Sector Awards. This saw 13 finalists announced and the safety lessons that can be learnt from these projects

are being made available to the industry.

The department has also continued the *Know Your Hazards* video series, which aims to help supervisors and workers correctly identify common workplace hazards that have injured or killed people.

The fourth instalment of the videos were released at this year's Mines Safety Roadshow and highlighted the importance of traffic management and how safe systems, safe vehicles and safe people can contribute to a safe mining operation.

More than 750 workers attended this year's Roadshows as they travelled across Western Australia.

Whether you are an executive, manager, supervisor, worker or regulator, we must all make a commitment to improve safety in Western Australia's mining industry.

It is a commitment we need to make our highest priority, because the costs of not doing so are far too high.

**Andrew Chaplyn**  
*State Mining Engineer*

31 January 2018

Visit [www.dmirs.wa.gov.au](http://www.dmirs.wa.gov.au) for further information on the fatalities and serious injuries reports.



## DEFINITIONS

### **DAYS LOST**

Rostered days absent from work due to work injury

### **DAYS OFF**

Total calendar days, whether rostered or not, absent from work or on alternative duties, restricted duties or restricted hours due to work injury

### **DURATION RATE**

Average number of workdays lost per injury

### **EXPLORATION**

Exploration activities not under the control of a Registered Mine Manager; usually associated with exploration leases

### **FATAL INJURY INCIDENCE RATE**

Number of fatal injuries per 1,000 employees for a 12 month period

### **INCIDENCE RATE**

Number of injuries per 1,000 employees for a 12 month period

### **INJURY INDEX**

Number of workdays lost per million hours worked

### **LOST TIME INJURY (LTI)**

Work injury that results in an absence from work for at least one full day or shift any time after the day or shift on which the injury occurred

### **LOST TIME INJURY FREQUENCY RATE (LTIFR)**

Number of lost time injuries per million hours worked

### **METALLIFEROUS MINES**

All mines other than coal mines are classed as metalliferous mines

### **MINOR INJURY**

Work injury that results in the injured person being disabled for a period of less than two weeks

### **NOC**

Not otherwise classified

### **REPORTABLE INJURY**

A work injury which results in the injured person being unable to fully perform his or her ordinary occupation (regular job) any time after the day or shift on which the injury occurred and includes both lost time and restricted work injuries

### **RESTRICTED WORK INJURY (RWI)**

Work injury (not LTI) that results in the injured person being unable to fully perform his or her ordinary occupation (regular job) any time after the day or shift on which the injury occurred, regardless of whether or not the person is rostered to work, and where alternative or light duties are performed or hours are restricted

### **RESTRICTED WORK INJURY FREQUENCY RATE (RWIFR)**

Number of restricted work injuries per million hours worked

### **SERIOUS INJURY**

Work injury that results in the injured person being disabled for a period of two weeks or more

### **SERIOUS INJURY FREQUENCY RATE**

The number of serious injuries per million hours worked



## EXPLANATORY NOTES

### Introduction

The statistics published in this annual compilation mainly relate to accidents between 1 July 2016 and 30 June 2017 (2016-17) involving time lost from work of one day or more (lost time injuries) on mines in Western Australia. The day on which the accident occurred is not counted as a day lost. The total number of working days lost through injury in 2015-16 has three components:

- i) Initial injuries — days lost in 2016-17 from injuries that occurred in 2016-17
- ii) Recurrent injuries — days lost in 2016-17 through recurrences of injuries that occurred in 2016-17 and previous years
- iii) Carry-over injuries — days lost in 2016-17 by persons continuously off work from injuries that occurred before 1 July 2016.

### Scope

Injuries to all company and contractor employees who worked at mining operations are included in these statistics. The definition of “mining operation” is stated in section 4 of the *Mines Safety and Inspection Act 1994* and includes mining company treatment plants, port facilities and railways.

Mineral exploration has an expanded coverage in this year’s report, with statistics available in the statistical summary, Tables 4, 8 and 10, an LTI performance indicator summary and Appendices M and N.

Restricted work injuries are covered in the statistical summary, “Restricted work injuries” section and Appendices N, O and P.

Injuries that occurred in journey accidents not on mine sites (i.e. travelling to or from work) have not been included in calculations of incidence, frequency or duration rates.

### Fatal accidents

Work days lost have not been allocated to fatal accidents, nor have fatalities been included in injury incidence, frequency or duration rate calculations except in Tables 8 and 9, which are in accordance with Australian Standard AS 1885.1:1990 *Workplace Injury and Disease Recording Standard*. This Standard treats fatalities as lost time injuries with a penalty of 220 work days lost for each.

### Collection of information

Accident and injury details are reported monthly to the Department by mine managers and exploration managers, as are the number of persons employed (including contractor employees) and the hours worked during the month.

This report has been made using data for 2016-17 received by the 26 October 2017. It will not reflect any data received or changed after this date.

During the twelve months covered by this compilation, an average of 469 mining operations and 274 exploration companies reported to the Safety Regulation System (SRS). Of these, 17 mines and 52 exploration companies reported zero hours worked for the year.

Some of the terms most commonly used to describe accident type in incident reports are listed in Appendix A.

### Charts

For clarity, most bar charts in this publication are restricted to 12 or fewer categories.

The term “other” is used for a grouping of accident categories that each contain a smaller proportion of injuries than the smallest individual category shown on the chart (typically less than 2%).

# FATAL ACCIDENTS

## Fatal accidents during 2016-17

### Lindsay Bridges, 26 July 2016

Lindsay Bridges, a boilermaker, was working inside a thickener tank during a shutdown when the gantry above him failed and collapsed, crushing him against the concrete floor.

Mr Bridges had been tasked with removing the thickener's rake shaft in the centre of the tank. The rake shaft was attached to the motor on the self-supporting gantry bridge that spanned the tank. As he stood on the tank floor, cutting into the rake shaft, the gantry failed and collapsed, pinning him to the floor.

It was found that the gantry bridge had deteriorated substantially due to corrosion and relied on the rake shaft to provide primary support.

#### Related safety alert

Mines Safety Significant Incident Report No. 244  
*Failed gantry bridge crushes boilermaker working in thickener tank – fatal accident*

## Fatal injury incidence rate 2007-08 to 2016-17

There was one fatal accident in the Western Australian mineral industry during 2016-17, occurring in the processing plant of a gold operation. This resulted in a fatal injury incidence rate for 2016-17 of 0.009.

While there has been a long term overall decrease in the number of fatalities per thousand employees, the average rate of improvement has slowed in recent years, with a fatal incidence rate of between zero and 0.1 over the last decade (see Figure 1).

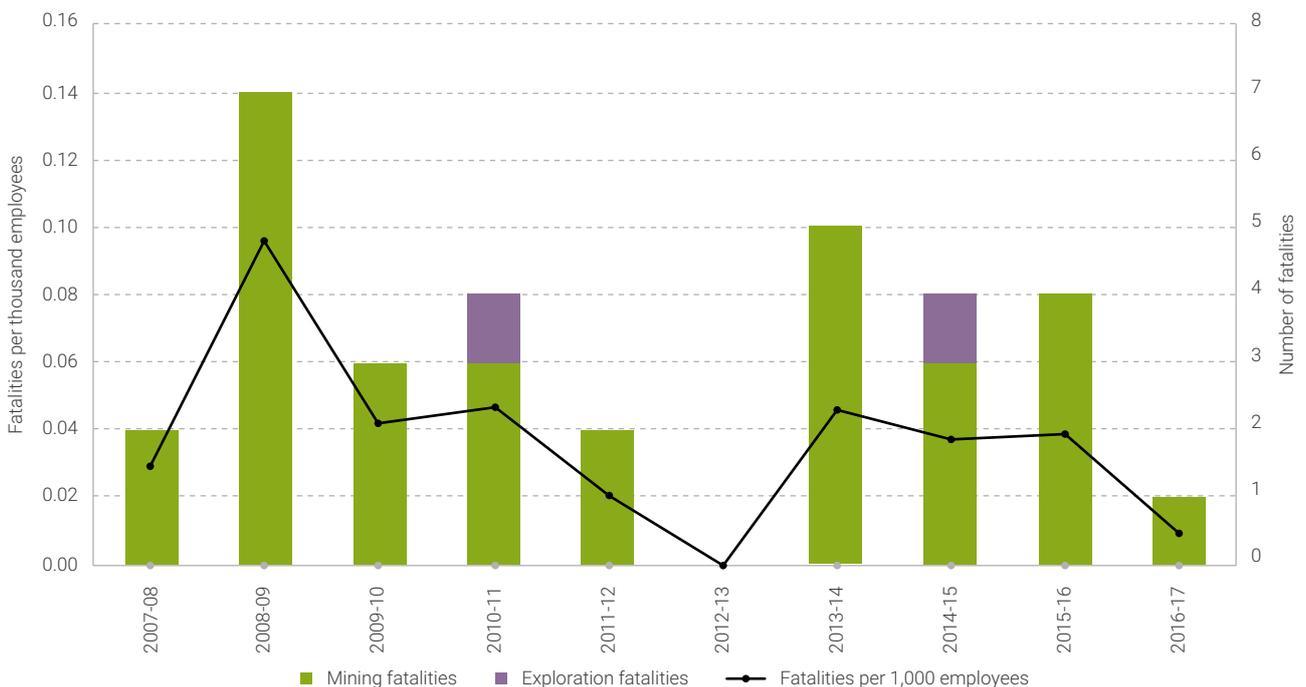
The Department maintains the view that no fatal accident is acceptable, and that a fatal injury incidence rate of zero is achievable. The zero fatal incidence rate achieved for 2012-13 supports this view.

## Fatal injury incidence rate by mineral mined 2012-13 to 2016-17

Table 1 lists fatal injury incidence rates by mineral mined for the past five years, as well as the grouped information for all surface and underground mines.

The underground fatal injury incidence rate over that period was 5.3 times higher than the fatal injury incidence rate for surface operations.

FIGURE 1 FATAL INJURY INCIDENCE RATE 2007-08 TO 2016-17



## FATALITIES 2012-13 TO 2016-17



**Surface: Struck by object** had the highest number of fatalities at **3**



**Underground: Rockfall** had the highest number of fatalities at **2**



**Exploration: The 1** fatality for exploration was due to **struck by object**

## Fatal accidents by type of accident 2012-13 to 2016-17

Table 2 indicates the type of accidents for the 14 fatalities in the mining industry (including exploration) over the past five years, with four underground, nine at surface operations and one in exploration.

The three types of underground fatal accident which occurred during the past five years were rockfall (two fatalities), caught by machine (one fatality) and exposure to environmental heat (one fatality).

Of the five types of surface fatal accident occurring in the past five years the most common was struck by object (three fatalities), followed by caught by or between objects and fall from height (two fatalities each) and struck by vehicle or mobile equipment and vehicle or mobile plant rollover (one fatality each).

The type of accident resulting in the exploration fatality was struck by object.

**TABLE 1** FATAL INJURY INCIDENCE RATE BY MINERAL MINED 2012-13 TO 2016-17

Category		Fatalities per thousand employees
<b>Mineral</b>	Base metals	0.079
	Gold	0.063
	Bauxite and alumina	0.055
	Iron ore	0.011
<b>Underground</b>		0.100
<b>Surface</b>		0.018
<b>Exploration</b>		0.086

**TABLE 2** NUMBER OF FATALITIES BY TYPE OF ACCIDENT 2012-13 TO 2016-17

Category		Number of fatalities
<b>Underground</b>	Rockfall	2
	Caught by machine	1
	Exposure to environmental heat	1
<b>Surface</b>	Struck by object	3
	Caught by or between objects	2
	Fall from height	2
	Struck by vehicle or mobile plant	1
	Vehicle or mobile plant rollover	1
<b>Exploration</b>	Struck by object	1
<b>Total</b>		<b>14</b>

# SERIOUS INJURIES

## Review of serious injuries during 2016-17

There were 313 serious lost time injuries reported in the mining industry during 2016-17, little different to the 319 in 2015-16. Of these, 302 were in metalliferous mines and 11 were in coal mines. There were a further 10 serious lost time injuries reported for exploration (8 in 2015-16).

### Some examples of serious injuries in 2016-17

#### Road train roll-over

A loaded road train was travelling on a mine access road when the driver lost control of the vehicle while attempting to negotiate a corner. The prime mover and front trailer tipped onto their sides, while the middle and last trailers remained upright. An emergency was called and the emergency response team (ERT) and ambulance attended the scene. The driver was conveyed to hospital where he was treated for a punctured lung, broken ribs and contusions.

#### Fall with jackhammer down stairs

While carrying a jack hammer, a process technician at a refinery missed a step down a set of four stairs and fell on one knee. An x-ray confirmed a fractured patella, and the technician was placed on medical restrictions.

#### Hand injury on drill rig

A driller's offsider was retrieving a 3 m drill rod from an exploration rig when he lost balance and grasped the pull down rope which was being lowered at the time. The offsider's hand was pulled into an unguarded sheave causing a crush injury and degloving of the little finger. The offsider was taken to the medical centre for treatment and transferred to hospital for surgery.

#### Drill bit 'grab' causes fracture

A maintenance technician was drilling a hole in the base of a safety shower when the drill bit grabbed, causing the technician's hand to impact the upright of the safety shower. First aid treatment was provided and the worker was referred to a doctor when the pain and swelling persisted. Subsequent x-rays confirmed a fractured hand.

#### LV rollover driver out of contact

The driver of a light vehicle (LV) lost control of the vehicle on a slippery section of haul road while delivering tanks of diesel fuel to a mine site. The rear of the vehicle slid to the left and the front right-hand side of the vehicle made contact with a loose dirt windrow causing the vehicle to roll onto its roof. The driver was suspended by the seat belt for some time before releasing it and falling onto his head and shoulders. The driver attempted to raise the alarm but the UHF radio aerial was crushed in the incident. It was about two hours before a passer-by found him, raised the alarm and obtained emergency help. The driver sustained a fractured vertebra.

#### Falling scaffolding hits worker

A scaffolder received a laceration to the head and potential loss of consciousness when a scaffold standard dropped from approximately five metres hit the ground and bounced, striking the scaffolder on the back of the head. The individual was taken to the medical centre and transferred to hospital for further treatment.

## SERIOUS INJURIES 2012-13 TO 2016-17

### Injuries by severity

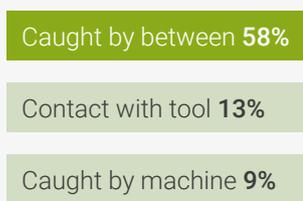


312 of the 388 LTIs were classified as serious

### Part of body (top 5)



### Hand injury (top 3)





### **Battery cover crushes fingers**

A fitter was closing the battery compartment cover of an underground loader when the cover fell, crushing the fingers of his right hand. The fitter was holding the weight of the cover in his left hand, while unclipping the safety pin on the support strut with his right, when his left hand slipped causing him to release the cover which then made contact with the fingers of his right hand.

### **Arc flash from battery bank**

An electrician had commenced reconnecting battery terminals, while conducting fault-finding on an uninterrupted power supply (UPS) battery bank, when a short circuit from an incorrect termination resulted in an arc flash. The electrician received burns to the hand and was given first aid on-site before being transferred to hospital for treatment.

### **Fall from conveyor**

A maintenance fitter was walking on a conveyor at a processing facility, after completing work on a tail pulley, when he stood on a rock and rolled his ankle. The worker fell to the ground where he was found by another worker. He was taken to the on-site medic for treatment and completed his normal roster. He experienced pain while on break and sought medical treatment. An X-ray and a magnetic resonance imaging (MRI) scan showed damage requiring surgery.

### **Trip in car park**

A cleaner tripped over a vehicle bump stop in a site office car park and fell forward onto the ground, resulting in a dislocated shoulder.

### **Boilermaker burnt by hot grease**

A boilermaker tasked with repairing a crack in the bucket jaw arm of an 800T shovel was burned while pre-heating the area in preparation for welding when hot grease was released. The grease made contact with the boilermaker resulting in burns to the face, neck, arms and hands.

### **Fall on stairs carrying a ladder**

An electrical maintenance technician was walking down a flight of stairs carrying a ladder when he fell down the stairs and received multiple injuries, including a possible fractured vertebra. The technician reported to first aid for treatment and was referred to a doctor for a medical review. He was taken for diagnostic imaging and medical restrictions were issued.

### **Hand injury from angle grinder**

A boilermaker using a four inch portable angle grinder while replacing wear plates on the bucket of a front end loader lost control of the grinder and received an 8 cm laceration to the back of the hand. The boilermaker was given first aid treatment on site and transported to hospital for stitches.

### **Severe back pain from over-exertion**

A process operator experienced discomfort while operating seized valves at a refinery. The valves were at various heights between ground level and head height and the worker had asked for assistance to prevent over-exertion. On returning to work after sitting down for a lunch break, the pain level increased and the operator found it difficult to walk and breathe freely. Later in the shift, while performing an escort, the operator experienced intense back pain and spasm. The operator reported to the supervisor with severe pain around the mid- to lower-back and difficulty in breathing. The individual was assisted to a vehicle for transport to the medical centre.

### **Stumble worsened by spillage**

A beltman was tracking a belt at an ore processing facility, using an adjustable spanner (with some scaffold tubing for extra leverage) to apply tension to the right-hand side screw take-up of a tail pulley, when the spanner slipped on the nut. This caused the beltman to stumble backwards, tripping over some spillage in the work area and injuring his ankle. A preliminary injury diagnosis indicated a double fracture of the ankle.

### **Fall from excavator tracks**

A serviceman was working on an excavator when he fell from the tracks of the machine to the ground. While completing a scheduled service, the worker had descended the emergency exit ladder and climbed onto the tracks of the excavator when his boot slipped, causing him to fall about 1.7 m, suffering fractures to the tibia and fibula, and a dislocated ankle. The Royal Flying Doctor Service (RFDS) airlifted him to hospital for surgery and treatment.

### **Fall from safety step**

A process operator was using an adjustable pipe wrench with both hands to loosen a valve at a processing facility when the valve moved. The operator fell backwards off a safety step, landing on his back and hitting his head and elbow. The individual was unable to stand and received multiple injuries to the back, head and elbow.

### **Knee strain using stairs**

A fixed plant mine worker was changing out a roller on a conveyor belt at a processing facility and had carried a chain block, weighing ~ 5 kg, down the stairs. While walking back up the stairs, the worker experienced pain in the left knee. The worker was diagnosed with a strain injury to the knee.

## SERIOUS INJURIES CONTINUED

### Serious injury incidence rate by mineral mined 2012-13 to 2016-17

Figure 2 is a chart of incidence rates for serious injuries for the past five years. The top of the chart shows the serious injury incidence rates for surface and underground operations. The lower part shows serious injury incidence rates by mineral mined.

The serious injury incidence rate for underground mining (4.8) was 45% higher than that for surface operations (3.3).

Of the major mining sectors, coal had the highest five-year average serious injury incidence rate (14.9), followed by bauxite-alumina at 8.0. The mining sector referred to as "Other", with a five-year average serious injury incidence rate of 5.8, contained 3% of the total number of employees spread over 21 commodity groups.

### Serious injury frequency rate 2012-13 to 2016-17

Figure 3 shows that over the five years since 2012-13 the total mining serious injury frequency rate has improved slightly (from 2.0 to 1.8), with the rate for surface metalliferous mining falling from 1.9 to 1.7, for underground metalliferous mining from 2.5 to 2.3 and for coal from 9.6 to 7.2.

Serious LTIFR for coal and underground metalliferous mining operations deteriorated during 2015-16, but in 2016-17 both improved (falling by approximately 12% and 18% respectively).

Overall, the total serious injury frequency rate improved by approximately 5% in 2016-17, from 1.9 to 1.8.

FIGURE 2 SERIOUS INJURY INCIDENCE RATE 2012-13 TO 2016-17

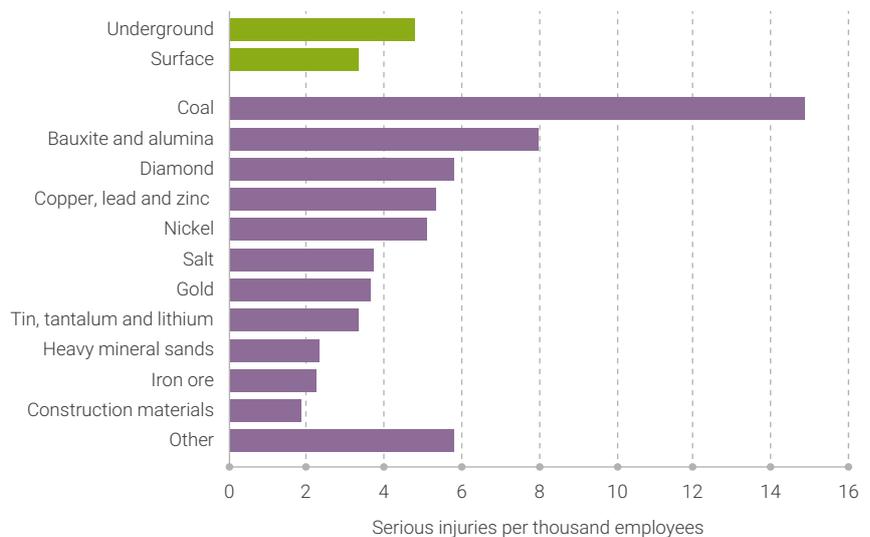
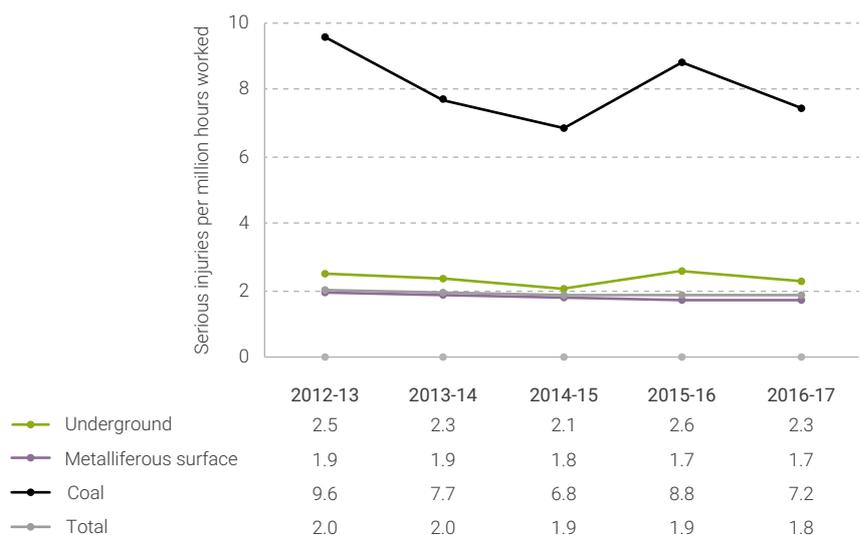


FIGURE 3 SERIOUS INJURY FREQUENCY RATES 2012-13 TO 2016-17





## Serious injury percentage breakdown for 2016-17

Appendices C and D provide a percentage breakdown of the number of serious injuries by part of body, nature of injury, location of accident, and type of accident for underground and surface operations, respectively.

### Injuries by part of body

- **Underground:** Injuries to ankles accounted for the largest proportion of serious injuries at 22%, followed by knee injuries at 19%, then injuries to back and shoulder, each at approximately 14%. In total, 43% of serious injuries were to legs and 8% were to arms, including shoulders.
- **Surface:** Injuries to hands accounted for the largest proportion of serious injuries at 18%, followed by back injuries at 15%, knee injuries at 13% and shoulder injuries at 11%. In total, 30% of serious injuries were to legs, 18% were to hands and 18% were to arms (including shoulders).

### Injuries by nature

- **Underground:** Sprain or strain represented the highest proportion by nature of injury (68%), followed by fracture (14%) and dislocation (8%).
- **Surface:** Sprain or strain represented the highest proportion by nature of injury (50%). Fracture was the next highest (16%), followed by laceration at 7% and crushing at 5%.

### Injuries by location

- **Underground:** The largest proportion of serious injuries underground was in production and development areas (60%), followed by underground access and haulage ways (27%) then underground storage (8%).
- **Surface:** The largest proportion of serious injuries on the surface occurred in treatment plants (44%), followed by open pits at 24%, then workshops at 16%.

### Injuries by type of accident

- **Underground:** The most common accident type associated with serious injuries underground was over-exertion or strenuous movements at 35%, followed by stepping at 19% then vehicle or mobile equipment jolting or jarring at 8%.
- **Surface:** The most common accident type associated with serious injuries on the surface was over-exertion or strenuous movements (26%), followed by stepping (16%) and caught by or between objects (13%).



## LOST TIME INJURIES

### Review of lost time injuries during 2016-17

In 2016-17, 16858 days were lost through occupational injuries on mines in Western Australia. This figure is made up of the number of days lost from injuries occurring in 2016-17 (8,038), recurrences of injuries sustained before 2016-17 and in 2016-17 (661), and LTIs and recurrences carried over into

2016-17 from accidents before July 2016 (8,159). A breakdown of work days lost in coal and metalliferous mining is given in Table 3.

During 2016-17, there were 399 LTIs in the State's mineral industry. Of those, 376 were in metalliferous mines, 13 in coal mines and 10 in exploration. A breakdown of these data with performance indicators is given in Tables 4 and 5.

In addition to the initial injuries, there were 22 recurrences of previous injuries, resulting in 661 work days lost in 2016-17. A breakdown of recurrent injuries by calendar year of initial injury is given in Table 6.

One hundred and six people who were still off work from injuries received before July 2016 lost 8,159 work days in 2016-17. A breakdown of these carry-over injuries is given in Table 7.

**TABLE 3** DAYS LOST THROUGH INJURY DURING 2016-17

Mines	Initial injuries	Recurrent injuries	Carry-over injuries	Total
	Days lost			
Metalliferous	7,792	641	7,827	16,260
Coal	246	20	332	598
<b>Total mining</b>	<b>8,038</b>	<b>661</b>	<b>8,159</b>	<b>16,858</b>

**TABLE 4** INITIAL LOST TIME INJURIES DURING 2016-17

Sector	No. of employees	No. of LTIs	Incidence rate	Frequency rate	Duration rate	Injury index	Days lost
Metalliferous surface	97,022	329	3.4	2.2	20.8	45	6,838
Metalliferous underground	8,470	47	5.5	2.9	20.3	58	954
Metalliferous total	105,492	376	3.6	2.2	20.7	46	7,792
Coal total	1,098	13	11.8	8.5	18.9	160	246
<b>Total mining</b>	<b>106,590</b>	<b>389</b>	<b>3.6</b>	<b>2.3</b>	<b>20.7</b>	<b>47</b>	<b>8,038</b>
Exploration	2,288	10	4.4	2.4	13.8	33	138

**TABLE 5** INJURIES BY MINERAL MINED DURING 2016-17

Mineral mined	No. of employees	No. of LTIs	Incidence rate	Frequency rate	Duration rate	Injury index	Days lost
Iron ore	53,013	89	1.7	1.1	24.6	26	2,188
Gold	27,073	90	3.3	2.1	23.4	48	2,108
Bauxite and alumina	6,645	99	14.9	8.1	14.4	116	1,425
Nickel	5,900	46	7.8	3.9	11.2	44	513
Construction materials	2,456	5	2.0	3.3	24.0	79	120
Mineral sands	2,404	5	2.1	1.9	16.4	31	82
Base metals	2,249	17	7.6	4.5	32.9	148	559
Coal	1,098	13	11.8	8.5	18.9	160	246
Tin, tantalum and lithium	1,084	6	5.5	2.4	10.0	24	60
Salt	845	2	2.4	2.0	17.0	34	34
Diamonds	821	6	7.3	3.9	46.2	182	277
Other	3,002	11	3.7	3.1	38.7	121	426
<b>Total mining</b>	<b>106,590</b>	<b>389</b>	<b>3.6</b>	<b>2.3</b>	<b>20.7</b>	<b>47</b>	<b>8,038</b>

Note: Duration in Tables 4 and 5 does not take into consideration time lost after 30 June 2017 by persons still off work at the end of the fiscal year, time lost from recurrent injuries, or time lost by persons with carry-over injuries from before July 2016.

**TABLE 6** RECURRENT INJURIES DURING 2016-17

Calendar year	Metalliferous mines		Coal mines		Total mining	
	No. of injuries	Days lost	No. of injuries	Days lost	No. of injuries	Days lost
2017*	2	84			2	84
2016	17	483	1	20	18	517
2015	2	60			2	60
<b>Total</b>	<b>21</b>	<b>627</b>	<b>1</b>	<b>20</b>	<b>22</b>	<b>661</b>

Note: Apart from the information shown in Tables 3, 6 and 7, analysis of recurrent and carry-over injuries has not been presented in this publication.

\* Covers period from 1 January to 30 June 2017



## LOST TIME INJURIES CONTINUED

**TABLE 7** CARRY-OVER INJURIES DURING 2016-17

Calendar year	Metalliferous mines		Coal mines		Total mining	
	No. of injuries	Days lost	No. of injuries	Days lost	No. of injuries	Days lost
2016*	60	3,830	4	266	64	4,096
2015	28	2,285	2	66	30	2,351
2014	5	410			5	410
2013	4	519			4	519
2012	2	522			2	522
2011	1	261			1	261
<b>Total</b>	<b>100</b>	<b>7,827</b>	<b>6</b>	<b>332</b>	<b>106</b>	<b>8,159</b>

\* Covers period from 1 January to 30 June 2016

### Review of lost time injuries during 2016-17 in accordance with Australian Standard AS 1885.1:1990

The *National Standard for Workplace Injury and Disease Recording* is designed to be used by individual workplaces. Tables 8 and 9 provide statistical information in accordance with AS 1885.1:1990.

There are two major differences between reporting for AS 1885.1:1990 and the Department's SRS database.

The Australian Standard treats fatalities as LTIs with a penalty of 220 workdays lost for each, whereas fatalities are reported separately from other injury data in the SRS database.

The incidence rate reported in accordance with the Australian Standard definition is injuries per hundred employees, rather than injuries per thousand employees.



**TABLE 8 INITIAL LOST TIME INJURIES DURING 2016-17 (AS 1885.1:1990)**

Sector	No. of employees	No. of LTIs	Injuries per hundred	Frequency rate	Duration rate	Days lost
Metalliferous surface	97,022	330	0.34	2.2	21.4	7,058
Metalliferous underground	8,470	47	0.55	2.9	20.3	954
Metalliferous total	105,492	377	0.36	2.2	21.3	8,012
Coal total	1,098	13	1.18	8.5	18.9	246
<b>Total mining</b>	<b>106,590</b>	<b>390</b>	<b>0.37</b>	<b>2.3</b>	<b>21.2</b>	<b>8,258</b>
Exploration	2,288	10	0.44	2.4	13.8	138

Note: Duration in Tables 8 and 9 does not take into consideration time lost after 30 June 2017 by persons still off work at the end of the fiscal year, time lost from recurrent injuries, or time lost by persons with carry-over injuries from before July 2016.

**TABLE 9 INJURIES BY MINERAL MINED DURING 2016-17 (AS 1885.1:1990)**

Mineral mined	No. of employees	No. of LTIs	Injuries per hundred	Frequency rate	Duration rate	Days lost
Iron ore	53,013	89	0.17	1.1	24.6	2,188
Gold	27,073	91	0.34	2.1	25.6	2,328
Bauxite and alumina	6,645	99	1.49	8.1	14.4	1,425
Nickel	5,900	46	0.78	3.9	11.2	513
Construction materials	2,456	5	0.20	3.3	24.0	120
Mineral sands	2,404	5	0.21	1.9	16.4	82
Base metals	2,249	17	0.76	4.5	32.9	559
Coal	1,098	13	1.18	8.5	18.9	246
Tin, tantalum and lithium	1,084	6	0.55	2.4	10.0	60
Salt	845	2	0.24	2.0	17.0	34
Diamonds	821	6	0.73	3.9	46.2	277
Other	3,002	11	0.37	3.1	38.7	426
<b>Total mining</b>	<b>106,590</b>	<b>390</b>	<b>0.37</b>	<b>2.3</b>	<b>21.2</b>	<b>8,258</b>



# AUSTRALIAN WORK HEALTH AND SAFETY STRATEGY 2012–2022

The Australian Work Health and Safety Strategy 2012–2022 was launched by Safe Work Australia in October 2012. There are three specific targets to be achieved by 2022.

- 20 percent or greater reduction in the number of worker fatalities due to injury
- 30 percent or greater reduction in the incidence rate of workers' compensation claims where the worker has been off work for one or more working weeks
- 30 percent or greater reduction in the incidence rate of workers' compensation claims for musculoskeletal disorders where the worker has been off work for one or more working weeks.



Further information on the Australian Work Health and Safety Strategy 2012–2022 is available on Safe Work Australia's website.

[Australian Work Health and Safety Strategy 2012–2022](#)

[Measuring progress towards targets](#)

## Western Australia's safety performance

Because the number of fatalities can vary considerably from year to year, Safe Work Australia is measuring progress towards the national target for worker fatalities using a three-year rolling average. This guards against an unusually low number of fatalities in 2022 meeting the target by chance rather than by sustained improvement.

Figure 4 shows the Western Australian fatality data for mining and exploration as a three-year rolling average for the number of fatalities, as well as a line representing a 20% improvement over 11 years.

Safe Work Australia's targets for injuries, including musculoskeletal disorders, relate to compensation claims. Serious claims are defined as those where the worker has been off work for one or more working weeks. This differs from the definition used for reporting serious mining and exploration injuries to the Department. However, for consistency, injury reports for mining and exploration fitting the Safe Work Australia definition have been extracted and the same targets applied to injury incidence rates.

Figure 5 shows the Western Australian data for reportable injuries per 1000 employees where the injured person did not return to their regular occupation within 7 days, as well as a line representing a 30% reduction over 11 years.

Figure 6 shows the Western Australian statistics for musculoskeletal reportable injuries per 1000 employees where the injured person did not return to their regular occupation within 7 days, also with a line representing a 30% reduction over 11 years.

The injury reporting requirements for petroleum facilities do not allow a similar data treatment.

*Note: Safe Work Australia presents the national data in calendar years, with the targets applying from 2012 to 2022. The safety performance data for mining and exploration in Western Australia is reported for financial years and hence the Safe Work Australia targets are applied from 2011–12 to 2022–23.*

FIGURE 4 NUMBER OF MINING AND EXPLORATION FATALITIES THREE-YEAR ROLLING AVERAGE

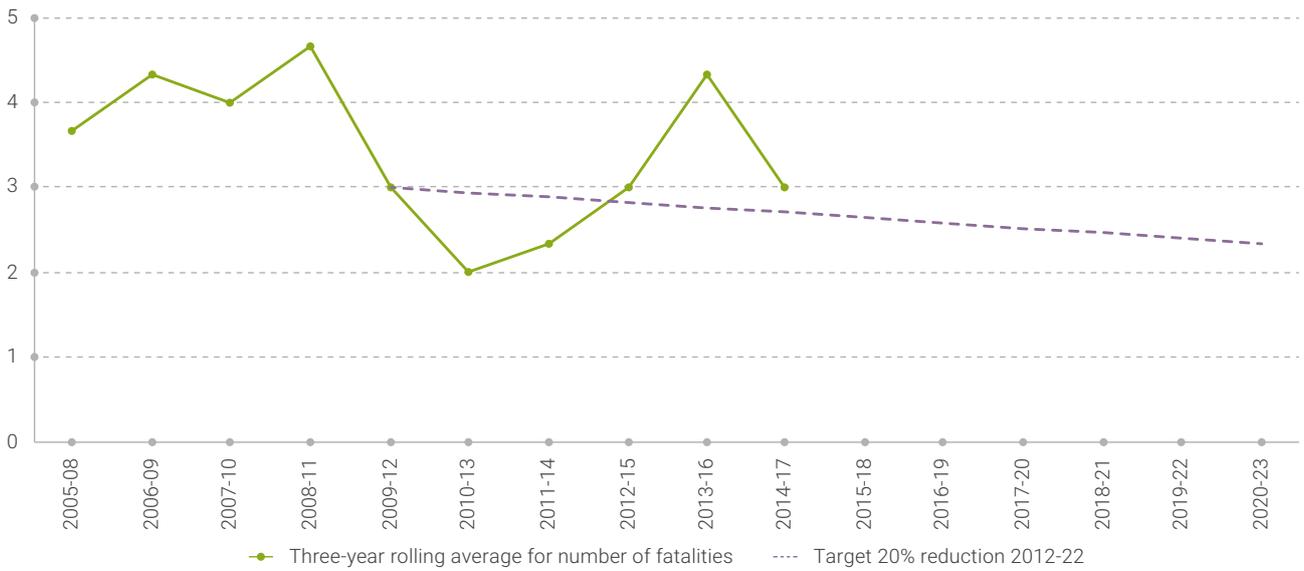


FIGURE 5 MINING AND EXPLORATION INJURIES OF DURATION ONE WEEK OR MORE PER 1,000 EMPLOYEES (INCIDENCE RATE)

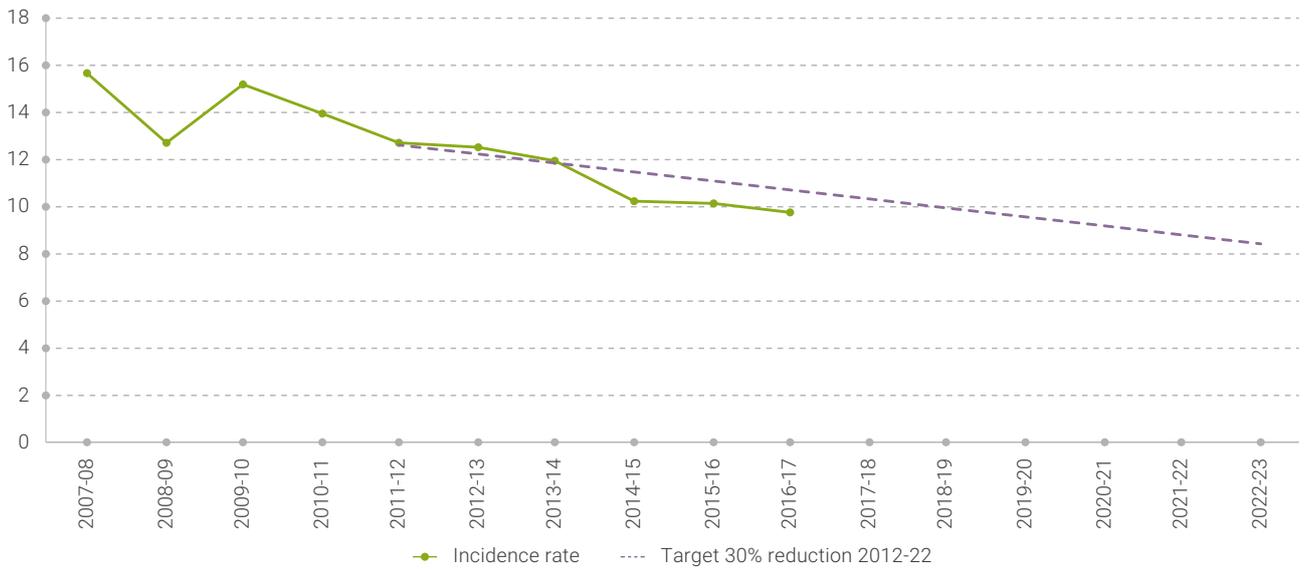


FIGURE 6 MUSCULOSKELETAL INCIDENCE RATE (DURATION ONE WEEK OR MORE)





## INJURIES BY COMMODITIES

### Metalliferous performance indicators

The performance indicators for the metalliferous mining sector show increasing rates of injuries occurring in 2016-17, with a decrease in the average days lost per injury. Figures 7 to 10 depict the performance indicators of incidence, frequency, duration rates and injury index (see [page 2](#) for definitions).

Performance indicator trends for metalliferous mining in 2016-17 are summarised below.

- The overall incidence rate deteriorated by 3%, rising from 3.5 to 3.6. The surface incidence rate remained unchanged at 3.4, while the underground incidence rate deteriorated by 4% (from 5.3 to 5.5).
- The overall frequency rate deteriorated by 5%, rising from 2.1 to 2.2. The surface frequency rate deteriorated by 10% (from 2.0 to 2.2), while the underground frequency rate deteriorated by 7% (from 2.7 to 2.9).
- The overall duration rate improved by 10%, falling from 23.0 to 20.7. The surface duration rate improved by 8%, falling from 22.6 to 20.8. The underground duration rate improved by 22% (falling from 26.0 to 20.3).
- The rise in the frequency rate was offset by the larger fall in the duration rate resulting in the overall injury index improving by 4%, from 48 to 46. The surface injury index improved by 2% (from 46 to 45), while the underground injury index improved by 18% (from 71 to 58).

### Metalliferous injury percentage breakdown for 2016-17

Appendices E and F provide a percentage breakdown of the number of injuries for part of body, nature of injury, location of accident, and type of accident for underground and surface operations, respectively.

#### Injuries by part of body

- **Underground:** Injuries to ankles and hands, each at 19%, were the most frequently occurring underground injuries, followed by knee injuries at 17%, shoulder injuries at 15% and back injuries at 13%. Overall, leg injuries made up 38% of injuries, with injuries to arms (including shoulders) representing a further 21%.
- **Surface:** Injuries to hands, closely followed by back injuries, at approximately 16% each, were the most frequently injured parts of body, followed by knee injuries (12%) and ankle injuries (10%). Overall, leg injuries made up 29% of the total, with arm, hand and back injuries each representing a further 16%.

#### Injuries by nature

- **Underground:** Sprain or strain was the highest ranking nature of injury for underground injuries at 60%, followed by fracture, at 11%, and crushing at 6%.
- **Surface:** Sprain or strain was the highest ranking nature of injury for surface injuries at 47%, followed by fracture at 13% and laceration at 6%.

### Injuries by location

- **Underground:** The largest proportion of underground injuries occurred in production and development areas (62%), followed by underground access and haulage at 21% and underground storage areas at 9%.
- **Surface:** The largest proportion of surface injuries occurred in treatment plants at 46%, followed by open pits at 19% then workshops at 15%.

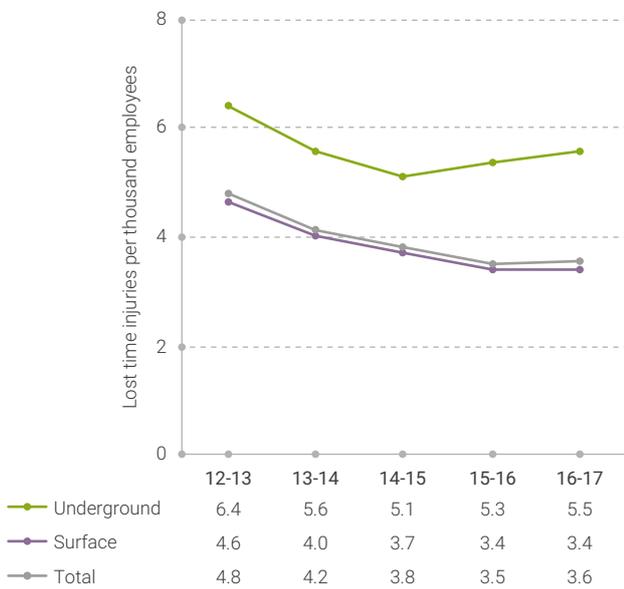
### Injuries by type of accident

- **Underground:** Over-exertion or strenuous movements was the most common accident type for underground injuries at 30%, followed by stepping at 17%. Caught by or between objects accounted for 11% and slip or trip at 9%.
- **Surface:** The most common accident type for surface injuries was over-exertion or strenuous movements at 26%, followed by stepping, at 16%, and slip or trip at 12%.

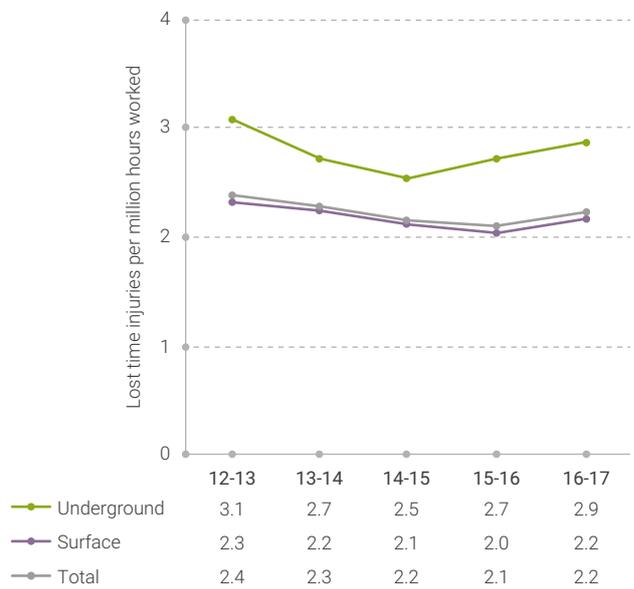


## Metalliferous performance indicators 2012-13 to 2016-17

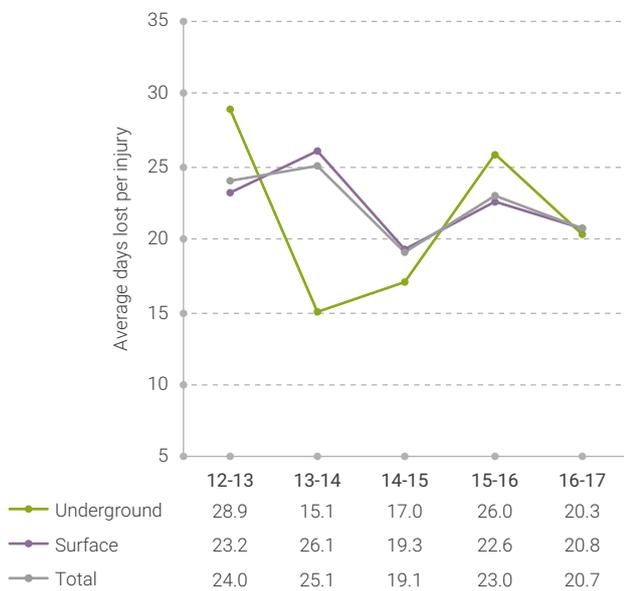
**FIGURE 7 INCIDENCE RATE**



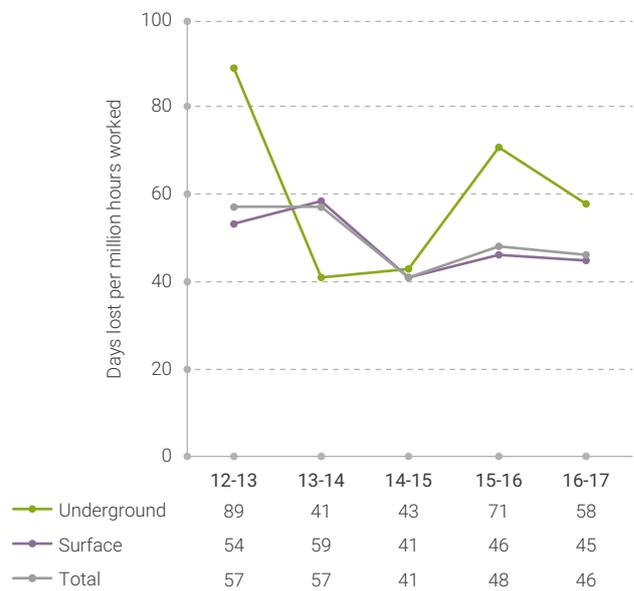
**FIGURE 8 FREQUENCY RATE**



**FIGURE 9 DURATION RATE**



**FIGURE 10 INJURY INDEX**





## INJURIES BY COMMODITIES CONTINUED

### Iron ore performance indicators

The performance indicators for the iron ore sector showed an overall improvement during 2016-17. Figures 11 to 14 depict the performance indicators of incidence, frequency and duration rates, and injury index.

Performance indicator trends for the iron ore sector in 2016-17 are summarised below.

- The incidence rate improved by 29%, falling from 2.4 to 1.7.
- The frequency rate improved by 21%, falling from 1.4 to 1.1.
- The duration rate deteriorated by 8%, rising from 22.7 to 24.6.
- The fall in the frequency rate was greater than the rise in the duration rate, resulting in an improvement of 19% in the injury index (from 32 to 26).

### Iron ore injury percentage breakdown for 2016-17

Appendix I provides a percentage breakdown of the number of injuries for part of body, nature of injury, location of accident, and type of accident.

#### Injuries by part of body

- Hand injuries, at 28%, accounted for the largest proportion of injuries, followed by back injuries at 11% and ankle injuries, at 10%.
- Leg injuries together made up 22% of the total and injuries to arms made up 15%.

#### Injuries by nature

- Sprain or strain was the highest ranking nature of injury at 37%.
- Fracture was the second highest ranking nature of injury at 21%, followed by amputation and crushing, both at 7%.

### Injuries by location

- The largest proportion of injuries occurred in treatment plants, which accounted for 26%. The second largest proportion occurred in open pits at 25%, followed by workshops at 19%.

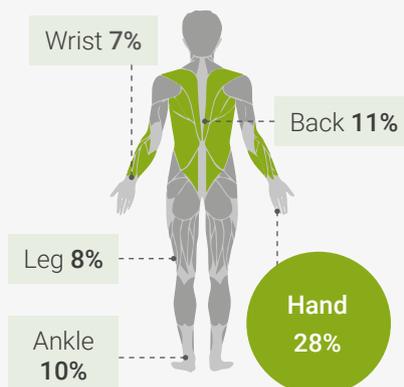
### Injuries by type of accident

- Caught by or between objects was the most common type of accident resulting in injury, at 19%.
- Over-exertion or strenuous movement, at 18%, was the next most common type of accident, followed by stepping at 15%, then struck by object at 9%.

### IRON ORE INJURIES 2016-17



50% of the 106,590 average workforce were in iron ore



LTIFR for iron ore was 1.1, compared to 2.3 for all mining



## Iron ore performance indicators 2012-13 to 2016-17

FIGURE 11 INCIDENCE RATE

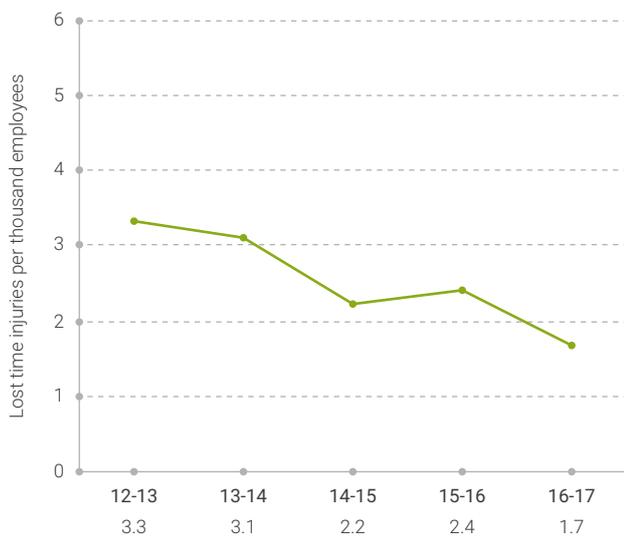


FIGURE 12 FREQUENCY RATE

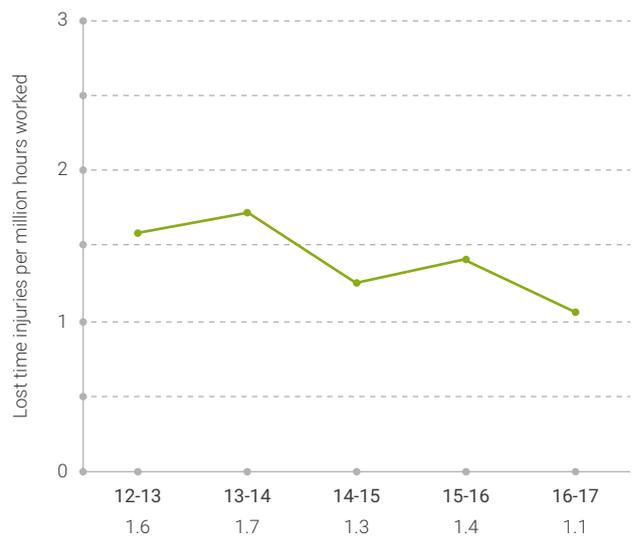


FIGURE 13 DURATION RATE

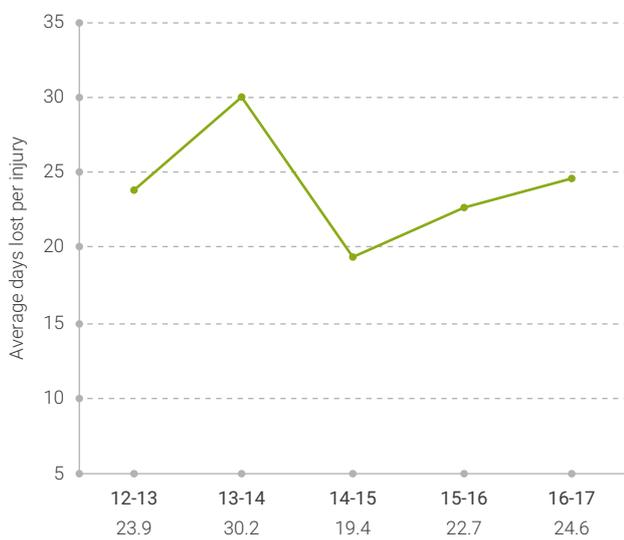
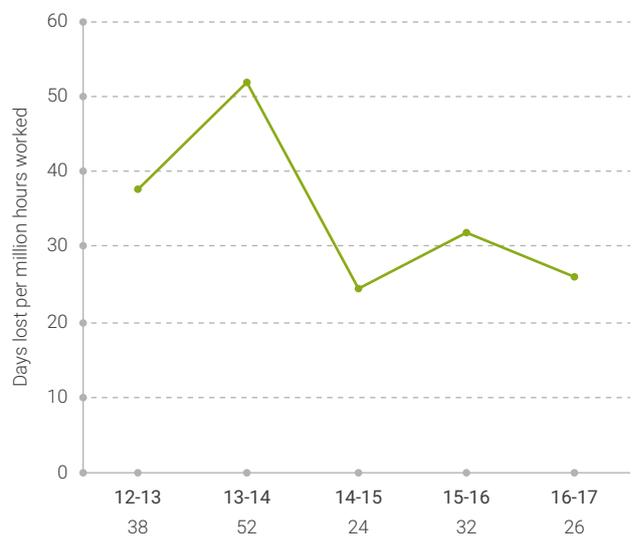


FIGURE 14 INJURY INDEX



# INJURIES BY COMMODITIES CONTINUED

## Gold performance indicators

The performance indicators for the gold sector were generally improved during 2016-17, although the days lost per injury for surface operations increased. Figures 15 to 18 depict the performance indicators of incidence, frequency and duration rates, and injury index.

Performance indicator trends for the gold sector in 2016-17 are summarised below.

- The overall incidence rate improved by 13%, falling from 3.8 to 3.3. The surface incidence rate improved by 11% (from 3.7 to 3.3) and the underground incidence rate improved by 22% (from 4.1 to 3.2).
- The overall frequency rate improved by 13%, falling from 2.3 to 2.0. The surface frequency rate improved by 8% (from 2.4 to 2.2), and the underground frequency rate improved by 19%, falling from 2.1 to 1.7.
- The overall duration rate improved by 9%, falling from 26.1 to 23.7. The surface duration rate deteriorated by 8%, rising from 23.8 to 25.6, and the underground duration rate improved by 48% (from 33.0 to 17.3).
- The overall improvement in both the frequency rate and the duration rate resulted in a 20% improvement in the injury index, falling from 60 to 48. The surface injury index remained unchanged

at 56) and the underground injury index improved by 57% (from 70 to 30).

## Gold injury percentage breakdown for 2016-17

Appendices G and H provide a percentage breakdown of the number of injuries for part of body, nature of injury, location of accident and type of accident for the underground and surface sectors, respectively.

### Injuries by part of body

- **Underground:** Hand injuries made up 24% of underground injuries. Injuries to knees accounted for the next largest proportion of underground injuries at 19%, followed by ankle and shoulder injuries, each contributing 14% of the total. Overall, injuries to legs made up 33% of injuries and arms 19%.
- **Surface:** Back, ankle and hand injuries, at 19%, 16% and 15% respectively, were the most common surface gold mining injuries. Overall, injuries to legs (ankles, knees and other parts of the leg) made up 34% of the total.

### Injuries by nature

- **Underground:** Sprain or strain was the highest ranking nature of injury for underground injuries at 62%, followed by crushing and fracture at 14% and 10% respectively.

- **Surface:** Sprain or strain was the highest ranking nature of injury for surface injuries at 49%, followed by fracture (19%) and laceration (7%).

### Injuries by location

- **Underground:** The largest proportion of underground injuries occurred in production and development (71%), followed by access and haulage ways at 24% and underground workshops at 5%.
- **Surface:** The largest proportion of surface injuries occurred in treatment plants (38%), followed by open pit, at 31% and workshop, at 13%.

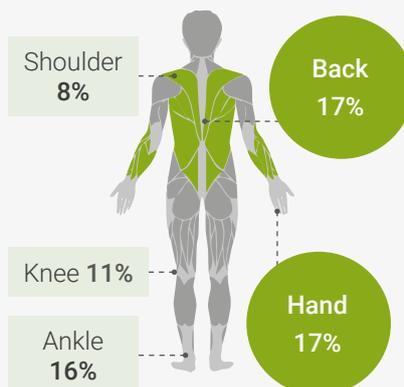
### Injuries by type of accident

- **Underground:** Over-exertion or strenuous movements was the most common accident type for underground injuries at 24%, followed by stepping at 19%, and caught by or between objects at 14%.
- **Surface:** The most common accident type for surface injuries was stepping, at 19%, followed by over-exertion or strenuous movements at 15%, then caught by or between objects and slip or trip, both at 9%.

## GOLD INJURIES 2016-17



25% of the 106,590 average workforce were in gold



LTIFR for gold was 2.1, compared to 2.3 for all mining



## Gold performance indicators 2012-13 to 2016-17

FIGURE 15 INCIDENCE RATE

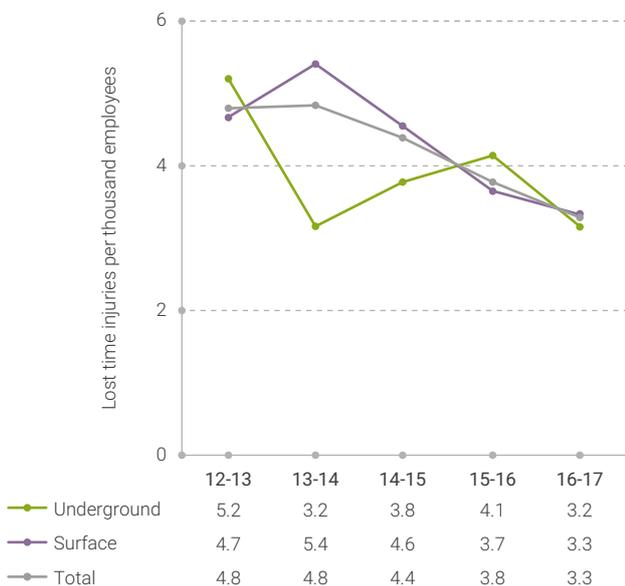


FIGURE 16 FREQUENCY RATE

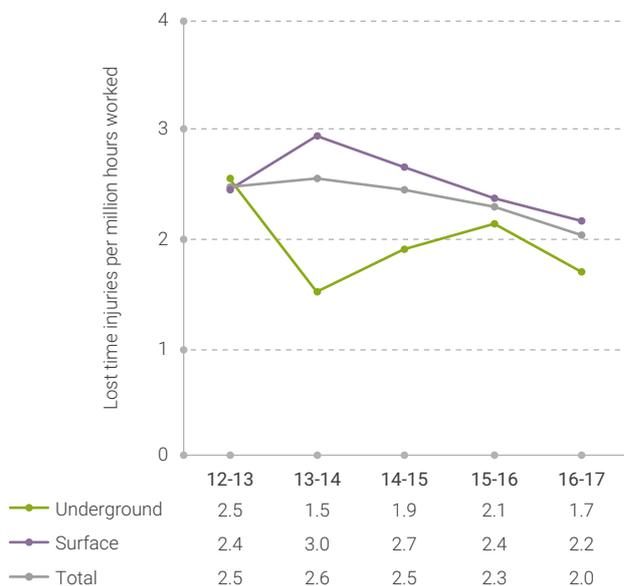


FIGURE 17 DURATION RATE

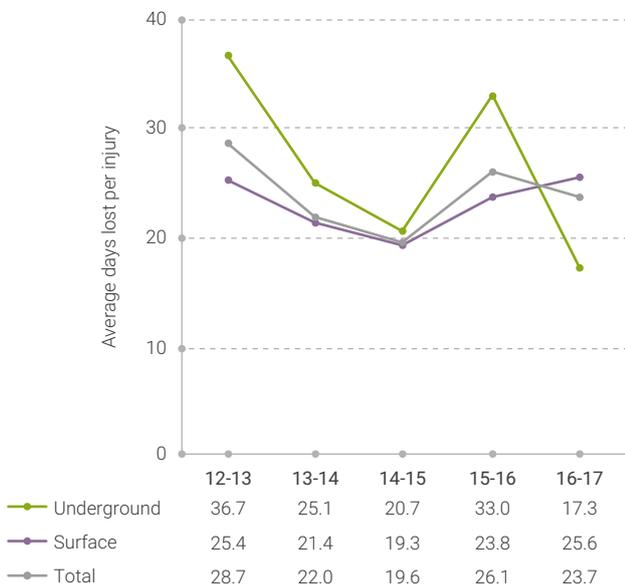
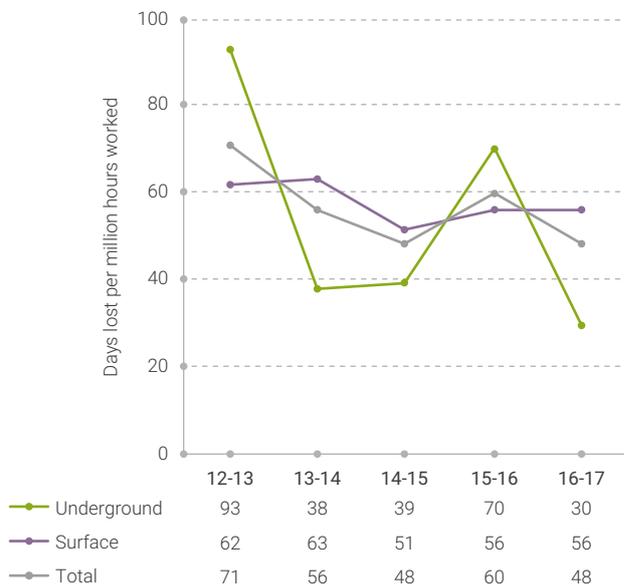


FIGURE 18 INJURY INDEX



## INJURIES BY COMMODITIES CONTINUED

### Bauxite and alumina performance indicators

The performance indicators for the bauxite and alumina sector deteriorated in 2016-17. Figures 19 to 22 depict the performance indicators of incidence, frequency and duration rates, and injury index.

Performance indicator trends for the bauxite and alumina sector in 2016-17 are summarised below.

- The incidence rate deteriorated significantly, by 99%, rising from 7.5 to 14.9.
- The frequency rate deteriorated significantly, by 98%, rising from 4.1 to 8.1.
- The duration rate deteriorated by 21%, rising from 11.9 to 14.4.
- The deterioration in both the frequency rate and the duration rate resulted in the injury index deteriorating significantly by 137%, rising from 49 to 116.

### Bauxite and alumina injury percentage breakdown for 2016-17

Appendix J provides a percentage breakdown of the number of injuries for part of body, nature of injury, location of accident, and type of accident.

#### Injuries by part of body

- Back injuries accounted for the largest proportion of injuries at 19%.
- Injuries to knees and shoulders were the next highest proportion of injuries, at 17% and 12% respectively, followed by ankle, eye, hand and head injuries, all at 7%.
- Combined, all injuries to legs contributed 28% of injuries. All arm injuries made up 16% of the total.

#### Injuries by nature

- Sprain or strain was the highest ranking nature of injury at 53%.
- Effects of chemicals or fumes was the second highest ranking nature of injury at 13%, followed by bruise or contusion and pain, both at 7%.

#### Injuries by location

- The largest proportion of injuries occurred in treatment plants, accounting for 65%.
- The next largest proportion of injuries occurred in open pits and workshops (both 12%), followed by administration areas (8%).

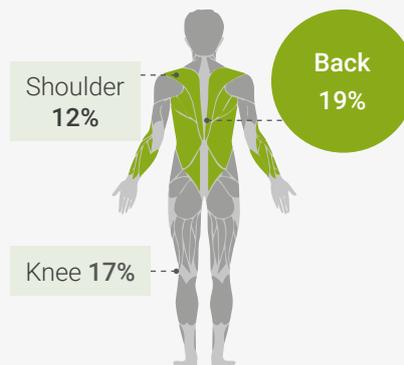
#### Injuries by type of accident

- Over-exertion or strenuous movements was the most common type of accident resulting in injury (34%).
- Stepping, at 13%, contributed the next highest proportions of injury, followed by contact with chemical or fume at 12% and slip or trip at 10%.

### BAUXITE AND ALUMINA INJURIES 2016-17



6% of the 106,590 average workforce were in **bauxite and alumina**



LTIFR for bauxite and alumina was **8.1**, compared to 2.3 for all mining



## Bauxite and alumina performance indicators 2012-13 to 2016-17

FIGURE 19 INCIDENCE RATE

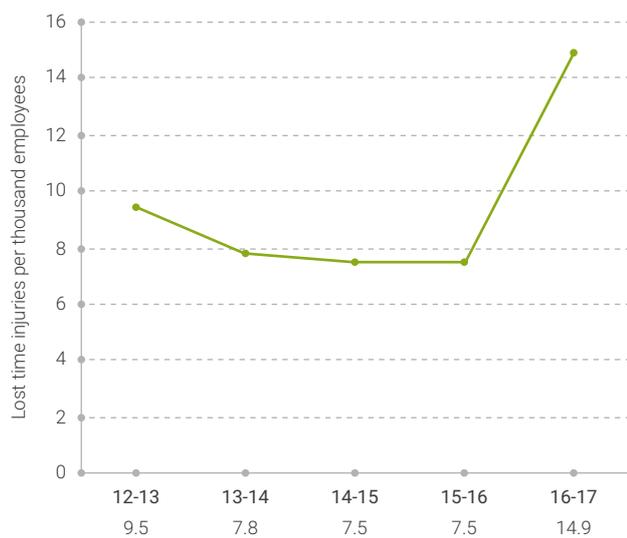


FIGURE 20 FREQUENCY RATE

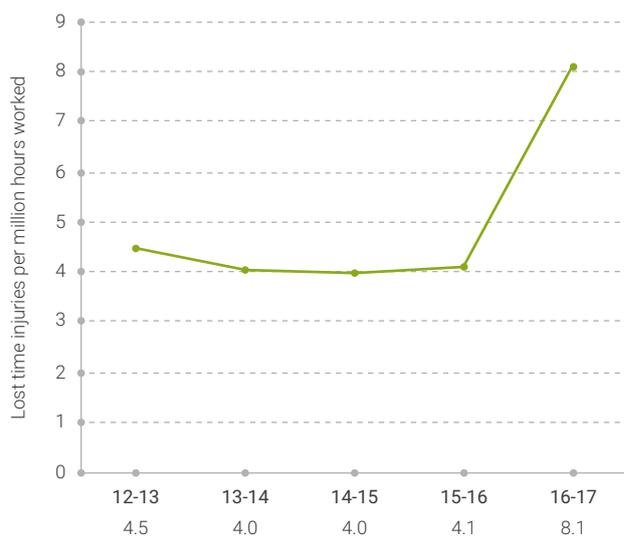


FIGURE 21 DURATION RATE

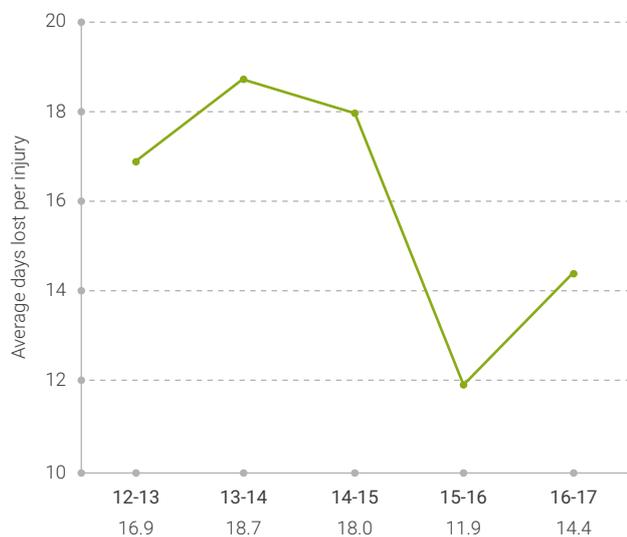
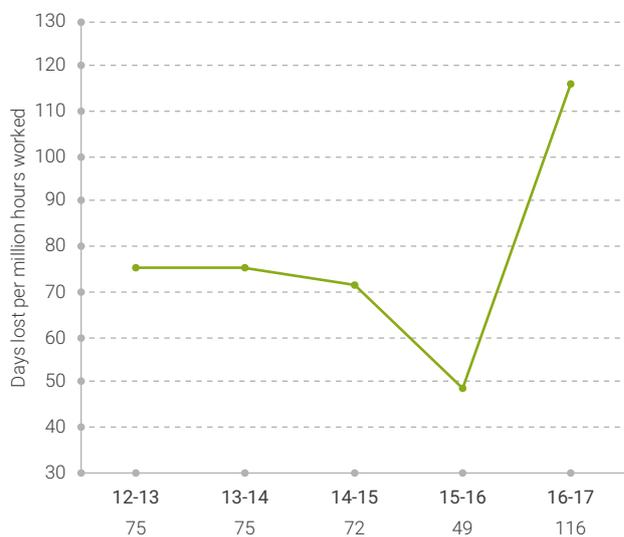


FIGURE 22 INJURY INDEX



# INJURIES BY COMMODITIES CONTINUED

## Nickel performance indicators

The performance indicators for the nickel sector were mixed for 2016-17. Figures 23 to 26 depict the performance indicators of incidence, frequency and duration rates, and injury index.

Performance indicator trends for the nickel sector in 2016-17 are summarised below.

- The overall incidence rate deteriorated by 30%, rising from 6.0 to 7.8. The surface incidence rate deteriorated by 9%, (from 5.3 to 5.8), while the underground incidence rate deteriorated by 107%, (from 10.2 to 21.1).
- The overall frequency rate deteriorated by 30%, rising from 3.0 to 3.9. The surface frequency rate deteriorated by 11% (from 2.7 to 3.0), while the underground frequency rate deteriorated by 85% (from 4.8 to 8.9).
- The overall duration rate improved significantly by 66% after the poor results of 2015-16, falling from 32.6 to 11.2. The surface duration rate improved by 72% (from 36.5 to 10.2), while the underground duration rate improved by 35% (from 19.9 to 12.9).
- The rise in frequency rate was offset by the fall in duration rate, resulting in an improvement of 55% in the injury index, falling from

98 to 44. The surface injury index improved by 69% (from 99 to 31), however the underground injury index deteriorated by 20% (from 96 to 115).

## Nickel injury percentage breakdown for 2016-17

Appendices K and L provide a percentage breakdown of the number of injuries for part of body, nature of injury, location of accident, and type of accident for the underground and surface sectors, respectively.

### Injuries by part of body

- **Underground:** Ankle, back, hand and shoulder injuries together accounted for twelve of the sixteen underground injuries reported, with three injuries or 19% of the total each.
- **Surface:** Hand injuries, at 23%, accounted for the largest proportion of the thirty surface injuries, followed by back and knee injuries at 17% each. Leg injuries in total accounted for 37% of injuries.

### Injuries by nature

- **Underground:** Sprain or strain was the highest ranking nature of injury for underground injuries at 63%, followed by six other categories, all one injury or approximately 6% of the total each.

- **Surface:** Sprain or strain was the highest ranking nature of injury for surface injuries at 50%, followed by crushing at 17% and fracture at 10%.

### Injuries by location

- **Underground:** The largest proportion of underground injuries occurred in production and development areas (56%), followed by underground access haulage ways and underground storage, with 2 injuries (12%) each.
- **Surface:** The largest proportion of surface injuries occurred in treatment plants (63%), followed by general surface areas at 17%.

### Injuries by type of accident

- **Underground:** Over-exertion or strenuous movements was the most common accident type for underground injuries at 31% or 5 injuries, followed by slip or trip, stepping and vehicle or mobile equipment jolting or jarring, each at 12%.
- **Surface:** The most common accident type for surface injuries was over-exertion or strenuous movements at 33%, followed by caught by or between objects at 20% then stepping at 17%.





## Nickel performance indicators 2012-13 to 2016-17

FIGURE 23 INCIDENCE RATE

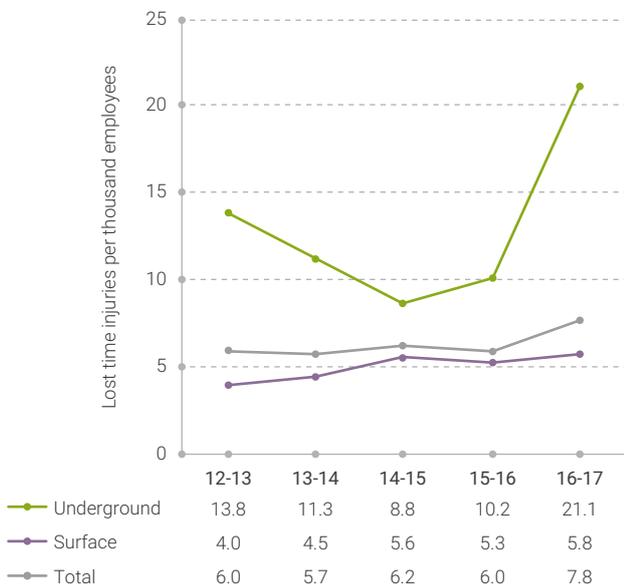


FIGURE 24 FREQUENCY RATE

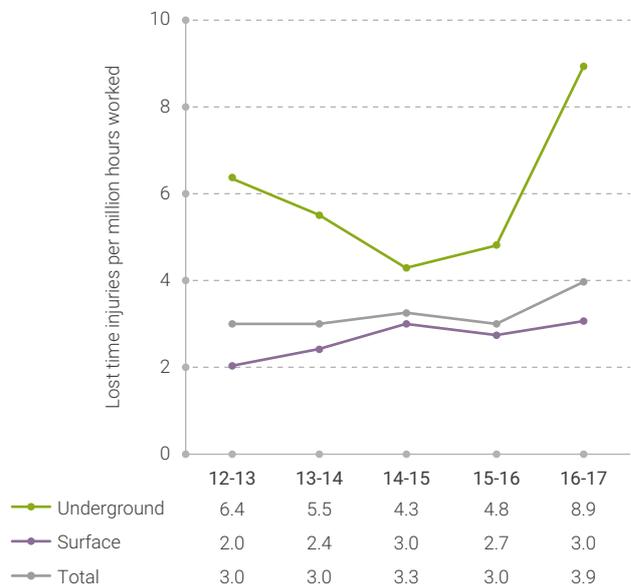


FIGURE 25 DURATION RATE

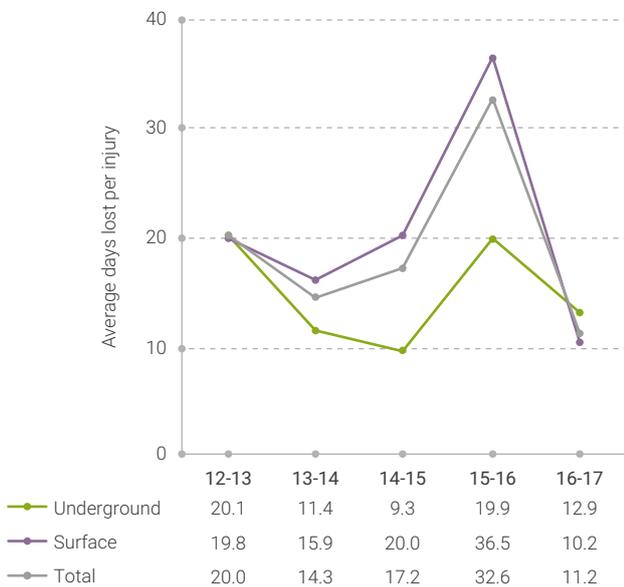
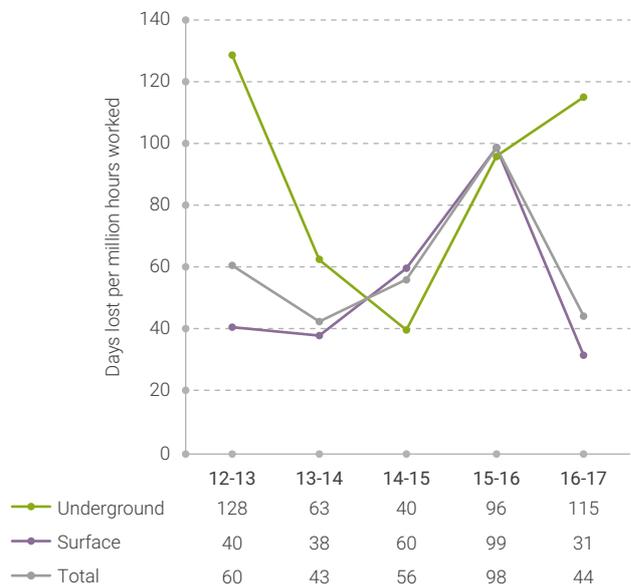


FIGURE 26 INJURY INDEX





## EXPLORATION INJURIES

The performance indicators for the mineral exploration sector showed an overall improvement for 2016-17. Figures 27 to 30 depict the performance indicators of incidence, frequency and duration rates, and injury index.

Performance indicator trends for the exploration sector in 2016-17 are summarised below

- The incidence rate improved by 24%, falling from 5.8 to 4.4.
- The frequency rate improved by 27%, falling from 3.3 to 2.4.
- The duration rate improved by 47%, falling from 26.1 to 13.8.
- The fall in both duration rate and frequency rate resulted in an improvement of 61% in the injury index, falling from 87 to 33.

### Exploration injury percentage breakdown for 2016-17

Appendix M provides a percentage breakdown of the number of injuries for part of body, nature of injury, location of accident, and type of accident for exploration.

#### Injuries by part of body

- Hand injuries, at 50%, accounted for the largest proportion of the ten exploration injuries, followed by arm at 20%.

#### Injuries by nature

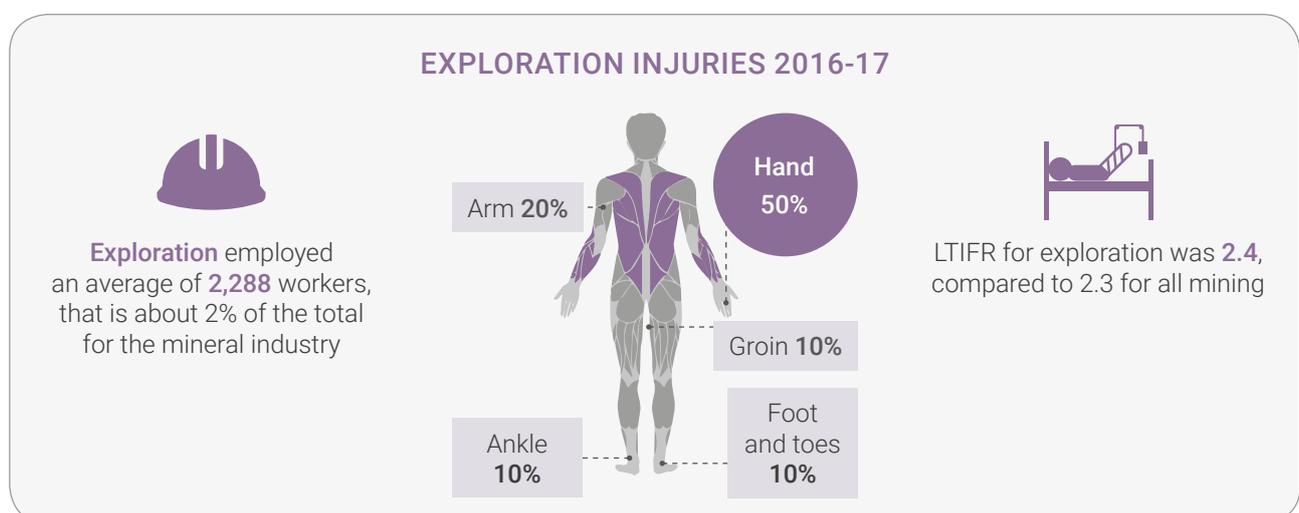
- Fracture was the highest ranking nature of injury for surface injuries at 30%, followed equally by crushing and sprain or strain, each at 20%.

#### Injuries by location

- The largest proportion of surface injuries occurred in exploration areas (90%), with one injury, or 10%, occurring in a Storage yard / rebuild area.

#### Injuries by type of accident

- The most common accident type for injuries were caught by or between objects, at 40%, followed by struck by object at 20%.





## Exploration performance indicators 2012-13 to 2016-17

FIGURE 27 INCIDENCE RATE

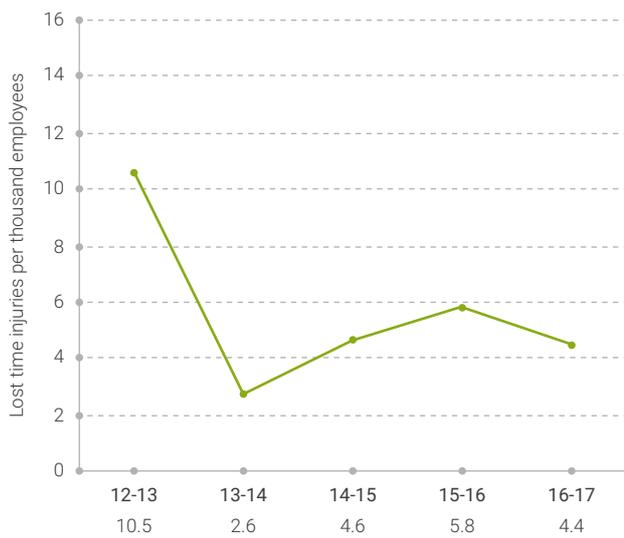


FIGURE 28 FREQUENCY RATE

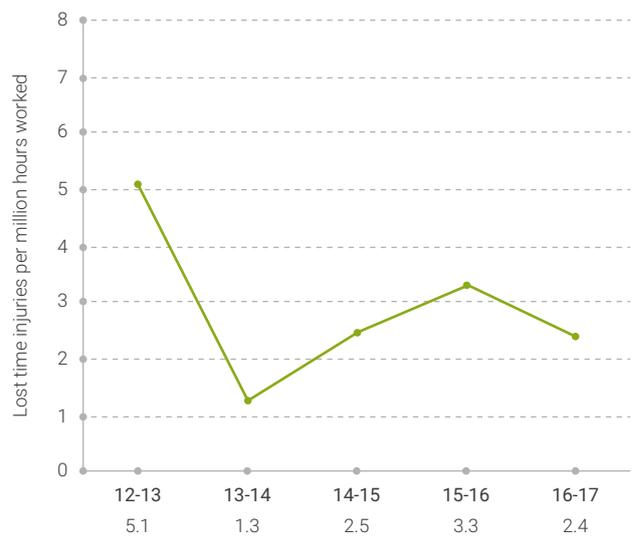


FIGURE 29 DURATION RATE

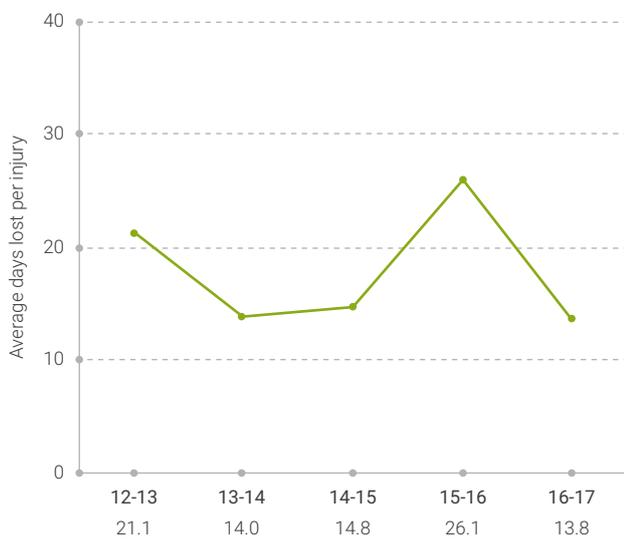
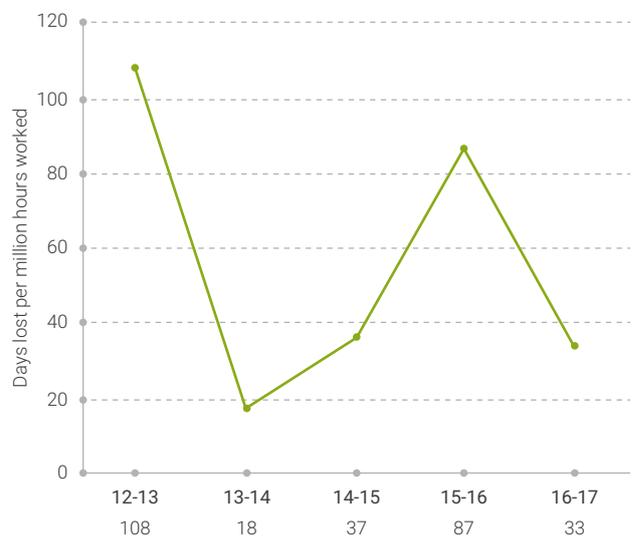


FIGURE 30 INJURY INDEX





## RESTRICTED WORK INJURIES

### Review of restricted work injuries during 2016-17

In addition to the 389 mining LTIs in 2016-17, there were 718 restricted work injuries (RWIs) reported (705 in metalliferous mines and 13 in coal mines), bringing the total number of mining reportable injuries to 1,107. There were also 10 exploration LTIs and 14 exploration RWIs reported, resulting in 24 reportable injuries. A breakdown of these data with performance indicators is shown in Tables 10 and 11.

Of the 718 restricted work injuries, 520 mining and 7 exploration injuries resulted in the injured person not returning to their regular duties for two weeks or more.

*Note: Restricted work injury includes circumstances where the injured person:*

- *is placed in a different occupation or job, whether on full or restricted work hours*
- *remains in his or her normal occupation or job, but is not able to perform the full range of work duties*
- *remains in his or her normal occupation or job, but on restricted hours.*

**TABLE 10** RESTRICTED WORK INJURIES 2016-17

Sector	No. of employees	Restricted work injuries			Reportable injuries (RWIs and LTIs)		
		No. of injuries	Incidence rate	Frequency rate	No. of injuries	Incidence rate	Frequency rate
Metalliferous surface	97,022	585	6.0	3.9	914	9.4	6.0
Metalliferous underground	8,470	120	14.2	7.3	167	19.7	10.2
Metalliferous total	105,492	705	6.7	4.2	1,081	10.2	6.4
Coal total	1,098	13	11.8	8.5	26	23.7	16.9
<b>Total mining</b>	<b>106,590</b>	<b>718</b>	<b>6.7</b>	<b>4.2</b>	<b>1,107</b>	<b>10.4</b>	<b>6.5</b>
Exploration	2,288	14	6.1	3.4	24	10.5	5.8



**TABLE 11** RESTRICTED WORK INJURIES BY MINERAL MINED 2016-17

Mineral mined	No. of employees	Restricted work injuries			Reportable injuries (RWIs and LTIs)		
		No. of injuries	Incidence rate	Frequency rate	No. of injuries	Incidence rate	Frequency rate
Iron ore	53,013	224	4.2	2.7	313	5.9	3.7
Gold	27,073	220	8.1	5.1	310	11.5	7.1
Bauxite and alumina	6,645	120	18.1	9.8	219	33.0	17.8
Nickel	5,900	93	15.8	8.0	139	23.6	11.9
Construction materials	2,456	1	0.4	0.7	6	2.4	3.9
Mineral sands	2,404	5	2.1	1.9	10	4.2	3.8
Base metals	2,249	16	7.1	4.2	33	14.7	8.7
Coal	1,098	13	11.8	8.5	26	23.7	16.9
Tin, tantalum and lithium	1,084	9	8.3	3.6	15	13.8	6.0
Salt	845	1	1.2	1.0	3	3.6	3.0
Diamonds	821	5	6.1	3.3	11	13.4	7.2
Other	3,002	11	3.7	3.1	22	7.3	6.2
<b>Total mining</b>	<b>106,590</b>	<b>718</b>	<b>6.7</b>	<b>4.2</b>	<b>1,107</b>	<b>10.4</b>	<b>6.5</b>



## RESTRICTED WORK INJURIES CONTINUED

### Restricted work injury performance indicators

The restricted work injury performance indicators for the mining sector showed an overall improvement during 2016-17. Figures 31 to 34 depict the performance indicators of incidence rate, frequency rate, days off per injury and days off per million hours worked.

- The overall incidence rate for mining improved by 8%, falling from 7.3 to 6.7. The surface incidence rate improved by 12% (from 6.9 to 6.1), while the underground incidence rate deteriorated by 5% (from 13.5 to 14.2). The incidence rate for exploration improved by 25%, falling from 8.1 to 6.1.
- The overall mining frequency rate improved by 5%, falling from 4.4 to 4.2. The surface frequency rate improved by 5%, falling from 4.1 to 3.9, while the underground frequency rate deteriorated by 6%, rising from 6.9 to 7.3. The frequency rate for exploration improved by 26%, falling from 4.6 to 3.4.
- The average number of rostered days of restricted work per mining RWI (comparable to the LTI Duration rate) deteriorated by 1%, rising from 26.1 to 26.4. Surface restricted work days per RWI deteriorated by 3% (from 25.9 to 26.6), while restricted work days per underground RWI improved by 8% (from 27.5 to 25.2). Average restricted work days per RWI for exploration improved by 15%, falling from 18.2 to 15.5.
- The fall in both the frequency rate and the restricted work days worked per restricted work injury resulted in an improvement of 2% in the overall restricted work days worked per million hours

(comparable to the LTI Injury Index) for mining, from 114 to 112. The surface restricted work days per million hours worked improved by 3% (from 107 to 104), and the restricted work days per million hours worked underground improved by 3% (from 190 to 185). Exploration restricted work days per million hours worked improved by 37%, falling from 84 to 53.

### Restricted work injury percentage breakdown for 2016-17

Appendices N, O and P provide a percentage breakdown of the number of injuries for part of body, nature of injury, location of accident and type of accident for the underground and surface sectors

#### Injuries by part of body

- **Underground:** Hand injuries, at 24% of the total, were the most frequently occurring, followed by back injuries at 12%, arm injuries (not including shoulder) at 11%, knee injuries at 9% and shoulder injuries at 8%.
- **Surface:** Hand injuries accounted for the largest proportion of surface restricted work injuries at 25%, followed by back injuries at 17%, shoulder injuries at 12%, knee injuries at 7% and ankle injuries at 6%.
- **Exploration:** Hand injuries accounted for 36% of RWIs, followed by back injuries at 21%

#### Injuries by nature

- **Underground:** Sprain or strain was the highest ranking nature of injury for underground restricted work injuries at 45%, followed by laceration at 12% and pain at 9%.

- **Surface:** Sprain or strain was the highest ranking nature of injury for surface restricted work injuries at 54%, followed by laceration at 12%, then fracture at 8%.
- **Exploration:** Fracture and Sprain or strain, both at 21%, were the highest ranking natures of injury, followed by laceration at 14%

#### Injuries by location

- **Underground:** The largest proportion of underground injuries occurred in production and development areas (70%), followed by access and haulage ways (21%).
- **Surface:** The largest proportion of surface injuries occurred in treatment plants (33%) followed by open pits (28%), and workshops (18%).
- **Exploration:** 12 RWIs, or 86% of the total, occurred in general exploration areas. A further 14% was made up of two injuries, one on an access road and one at the camp.

#### Injuries by type

- **Underground:** Over-exertion or strenuous movement (27%) was the most common accident type for underground injuries, followed by struck by object (15%), caught by or between objects (12%), stepping (11%), and slip or trip (10%)
- **Surface:** The most common accident type for surface injuries was over-exertion or strenuous movements at 36%, followed by stepping at 12% and caught by or between objects, at 11%.
- **Exploration:** Over exertion or strenuous movement at 29% was the most common type of accident, followed by struck by object at 14%.



## Restricted work injury performance indicators 2012-13 to 2016-17

FIGURE 31 INCIDENCE RATE

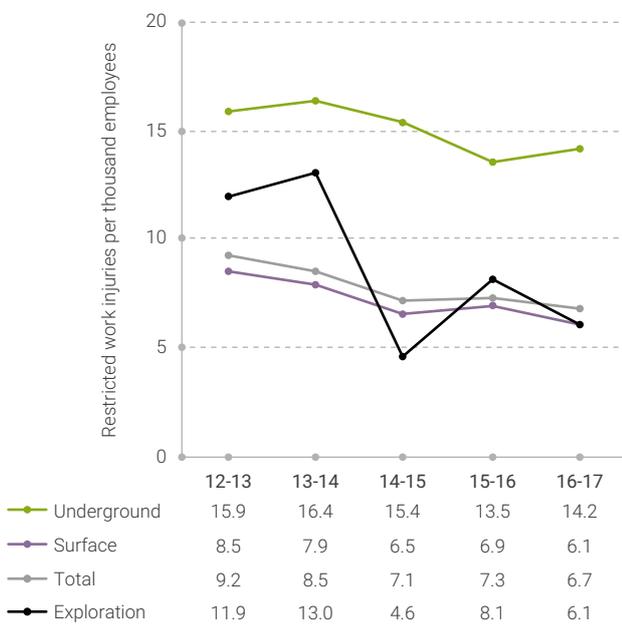


FIGURE 32 FREQUENCY RATE

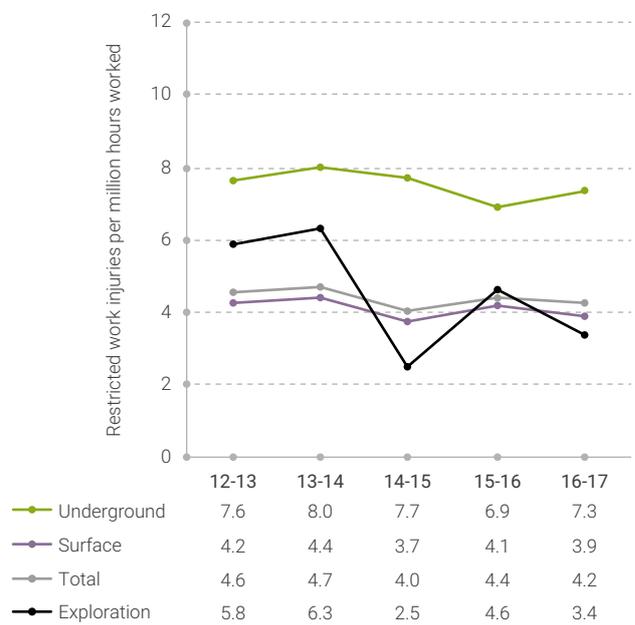


FIGURE 33 DURATION RATE

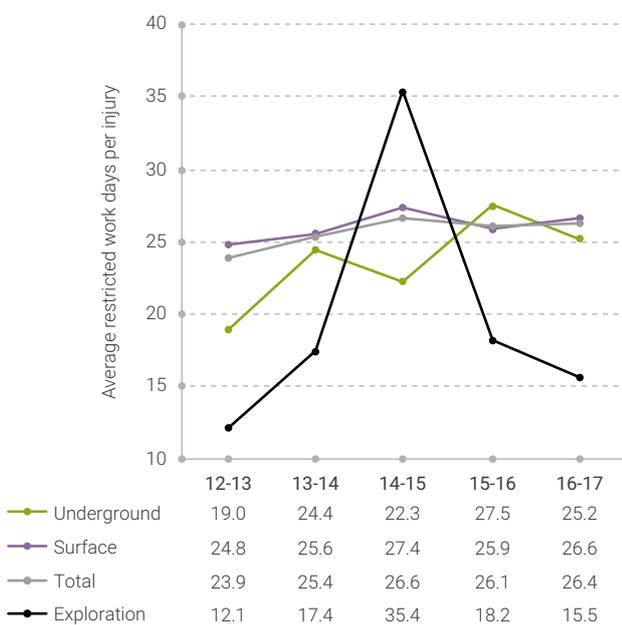
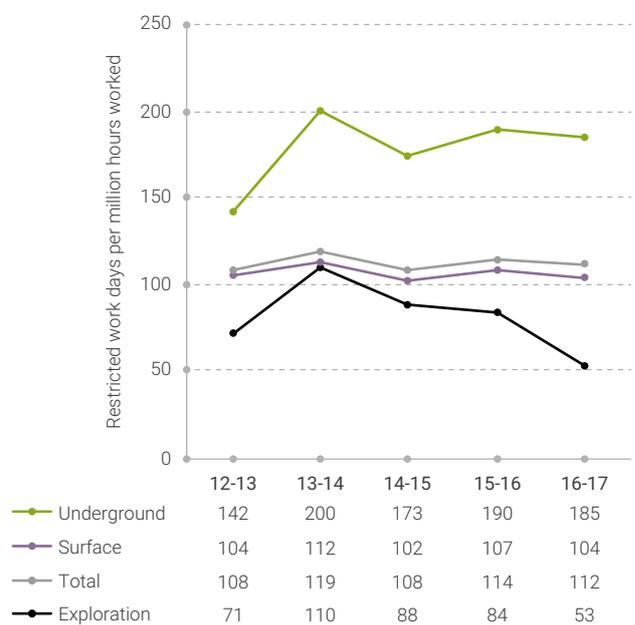


FIGURE 34 INJURY INDEX







# APPENDICES

## ABBREVIATIONS USED IN APPENDICES

**Effects of chem/fumes** – exposure to environmental heat; usually results in injuries related to heat stress

**NOC** – not otherwise classified

**Sprain/strain** – strain or sprain injuries

**U/g** – underground

**U/g access/haul** – underground access, travelling or haulage ways

**U/g prod/dev** – underground production or development areas

**U/g ore/waste dmpg** – underground ore or waste dumping areas

# APPENDIX A

## DESCRIPTIONS OF COMMONLY USED TERMS FOR THE TYPE OF ACCIDENT

**Bite insect/animal** – bites or stings from insects, spiders, snakes and other animals

**C/by between** – caught by or between still or moving objects (e.g. finger caught between two pipes while attempting to move one of them) but does not include getting caught between parts of an operating machine

**C/by machine** – caught between parts of an operating machine

**C/w chem/fumes** – inhalation, absorption or ingestion of chemicals or fumes; includes smoke, blast fumes, acids, caustic substances and industrial solvents

**C/w electric current** – contact with electric current; includes electric shock, electrocution, burning from electric current and static electricity discharge

**C/w foreign body** – contact with foreign body; includes entry into the skin, eyes, nose, ears, mouth or other part of the body by an object, but does not include sharp objects such as metal splinters

**C/w friction/rubbing** – blistering or abrasion due to rubbing by footwear, clothing or personal equipment

**C/w hi press fluid** – contact with high pressure fluid, including hydraulic fluid.

**C/w hot substance** – contact with hot solid, liquid, gas or steam, molten metal or naked flame; usually results in burns

**C/w sharp object** – contact with sharp object (e.g. metal splinter) but does not include objects such as sharp tools or operating machines

**C/w tool** – contact with a handheld manual or power tool

**Exp to dust** – exposure to environmental dust

**Exp to heat** – exposure to environmental heat; usually results in injuries related to heat stress

**Exp to mental stress** – stress-related conditions; includes post-traumatic stress and effects of workplace harassment

**Explosion NOC** – gas ignition.

**Fall from height** – fall from height equal to or greater than 0.5 metres; includes falls from vehicles or mobile equipment but does not include falls while getting on or off the vehicle or mobile equipment

**Fall getting on/off** – falls getting on or off vehicles or mobile equipment but does not include falls stepping on uneven ground while disembarking from a vehicle or mobile equipment

**Jumping** – jumping by a person; includes jumping to a higher or lower level or from a moving object

**Over/stren mov** – over-exertion or strenuous movements; usually associated with lifting, carrying, pulling, pushing and moving objects; also includes strenuous movements, repetitive movements with no specific event, and working in a confined area or while in an awkward posture

**Rockfall** – falls of rock usually from the face, walls and backs of underground excavations or from the face and walls of surface excavations

**S/against object** – struck against stationary or moving objects (e.g. hitting head on low structure while walking)

**S/by object** – struck by falling, flying, sliding or moving objects but does not include rockfalls or being struck by persons, vehicles or mobile equipment

**S/by veh/mob** – struck by a vehicle or mobile equipment

**Slip/trip** – other falls not from height or while getting on or off vehicles or mobile equipment; includes falls on stairs, falls on slippery or uneven ground, falls over loose or fixed objects and falls while handling equipment

**Stepping** – stepping on object, loose rock, uneven surface or to a higher or lower level; includes stepping on uneven ground while disembarking from a vehicle or mobile equipment; usually results in a sprain or strain to the ankle or knee

**Veh/mob collision** – vehicle or mobile equipment collision; includes colliding with stationary objects or walls

**Veh/mob jolt/jar** – vehicle or mobile equipment jolting or jarring (e.g. jolting or jarring while driving over an uneven surface, sitting in a truck being loaded with large material, bogging a face, ripping with a bulldozer)

**Veh/mob rollover** – vehicle or mobile equipment rollovers; includes partial rollovers

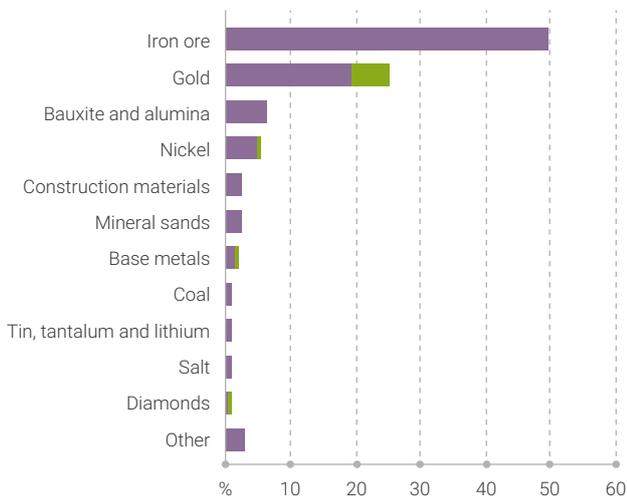
# APPENDIX B

## WESTERN AUSTRALIAN MINES 2016-17

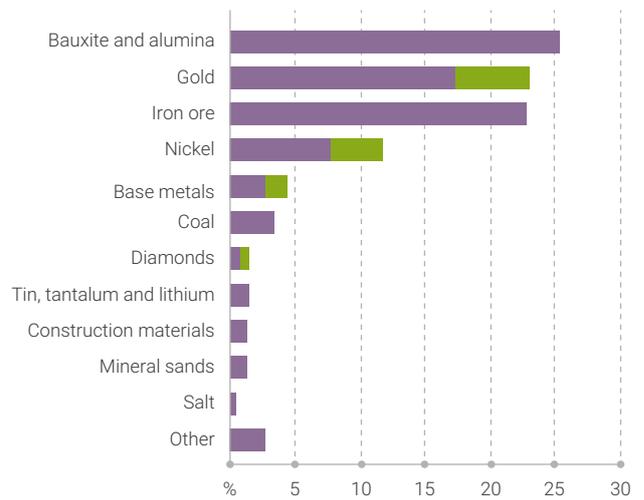
389 lost time injuries

■ Surface ■ Underground

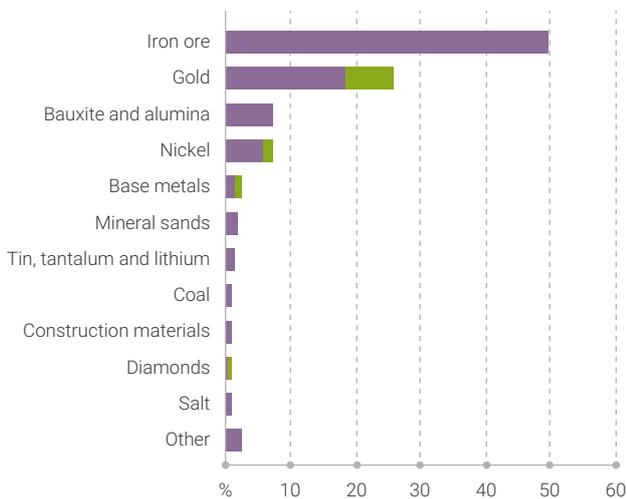
PERCENTAGE OF EMPLOYEES



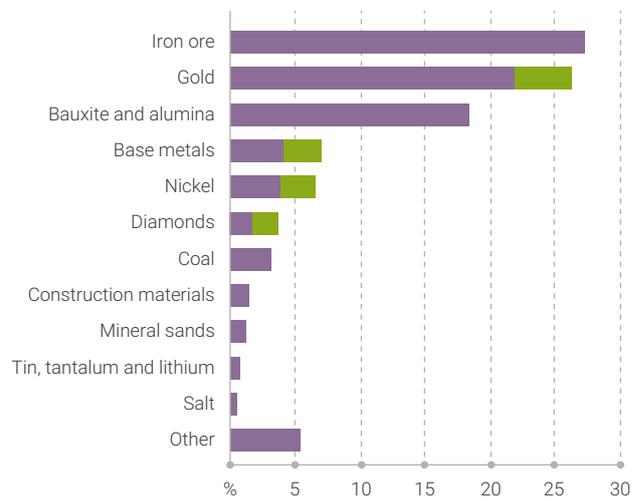
PERCENTAGE OF INJURIES



PERCENTAGE OF HOURS WORKED



PERCENTAGE OF WORK DAYS LOST

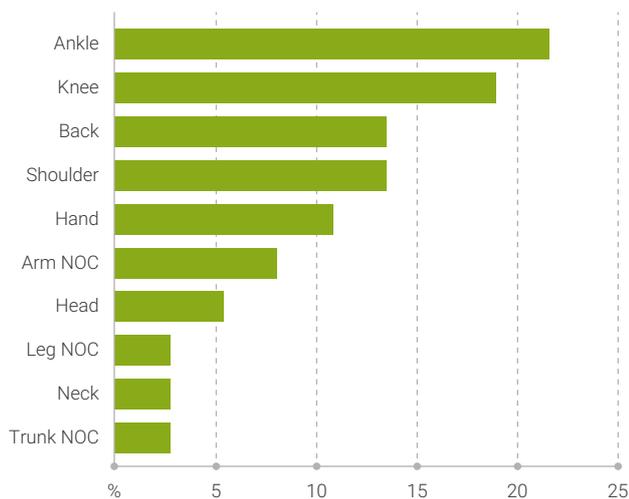


# APPENDIX C

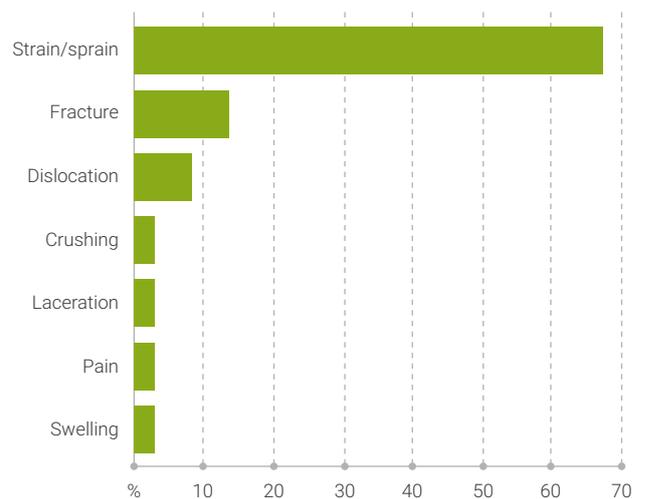
## SERIOUS INJURIES UNDERGROUND 2016-17

37 lost time injuries

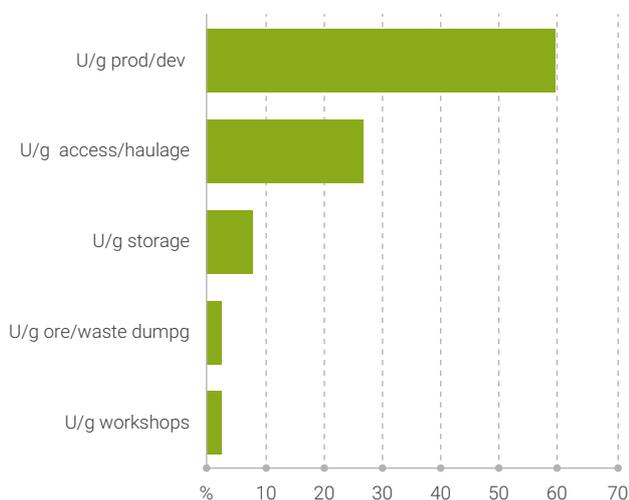
PART OF BODY



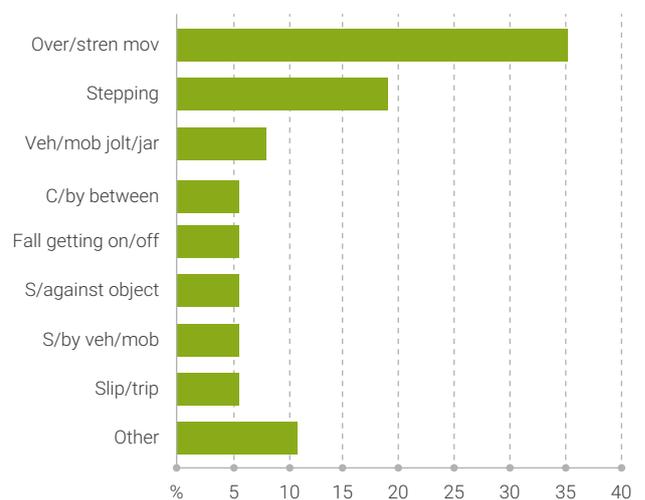
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

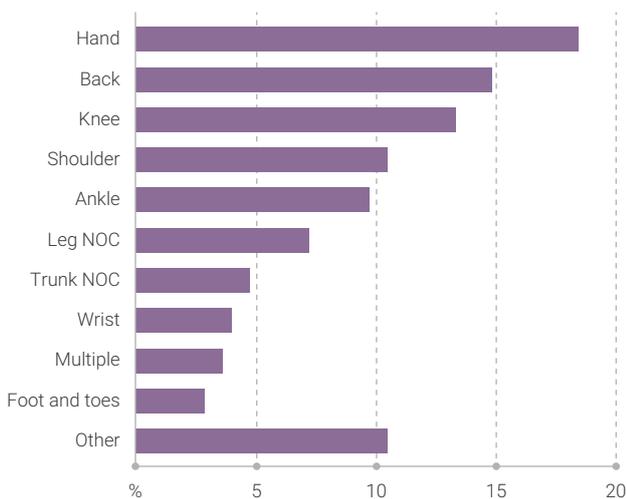


# APPENDIX D

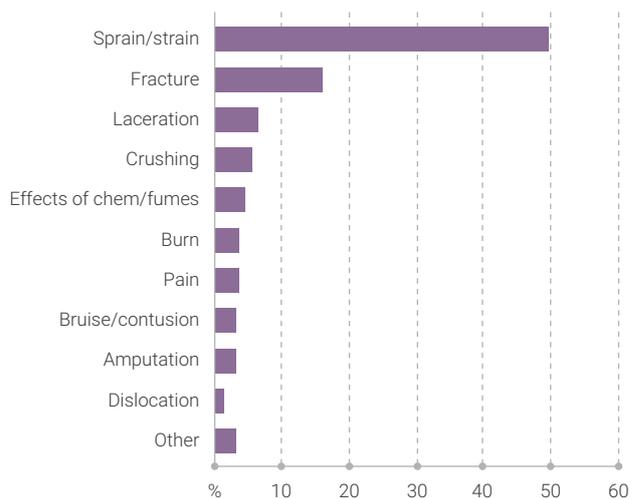
## SERIOUS INJURIES SURFACE 2016-17

276 lost time injuries

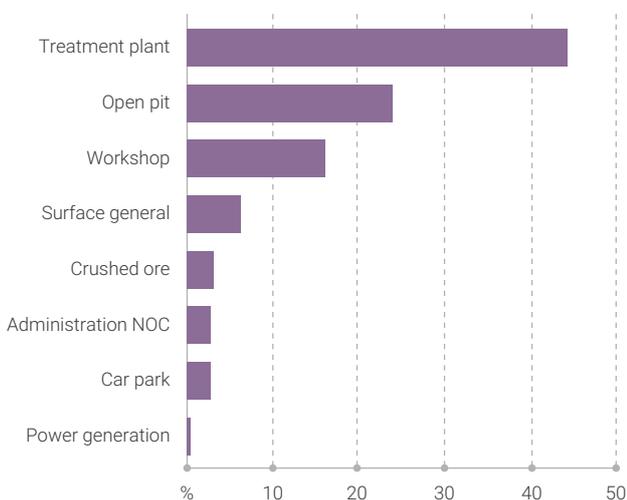
PART OF BODY



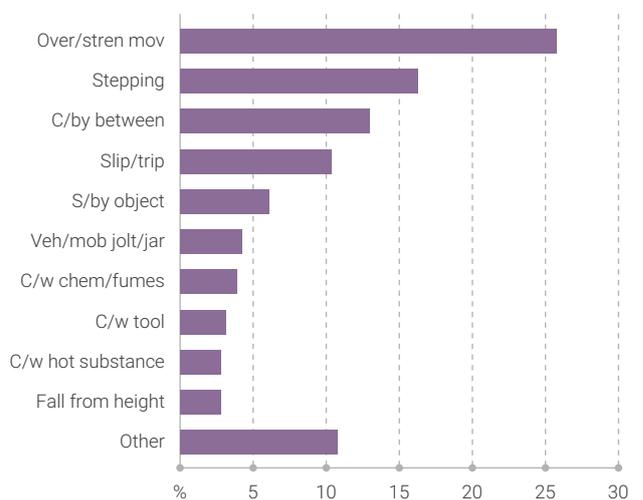
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

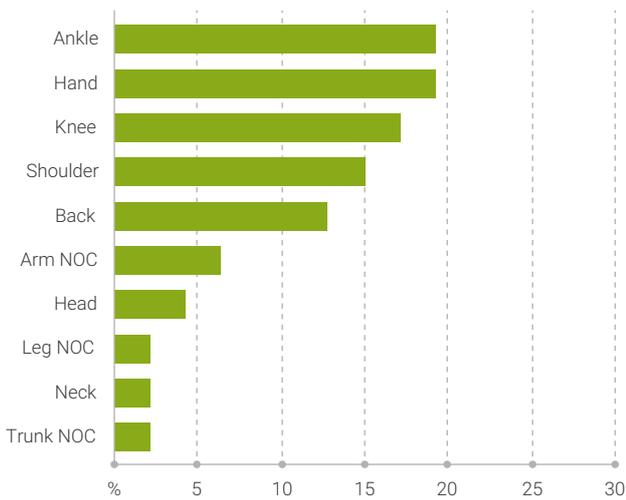


# APPENDIX E

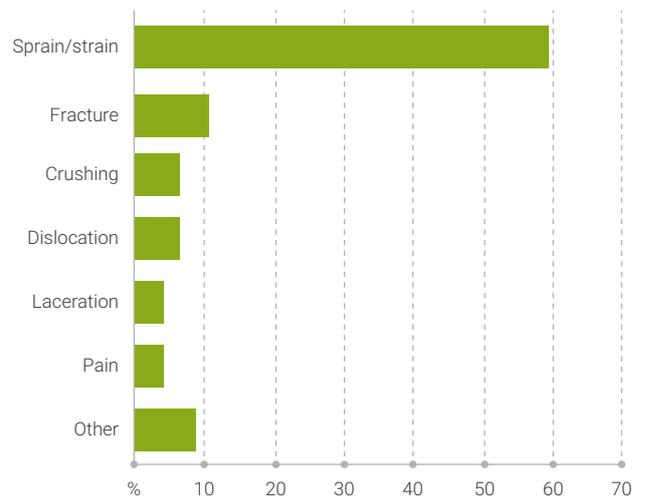
## METALLIFEROUS UNDERGROUND INJURIES 2016-17

47 lost time injuries

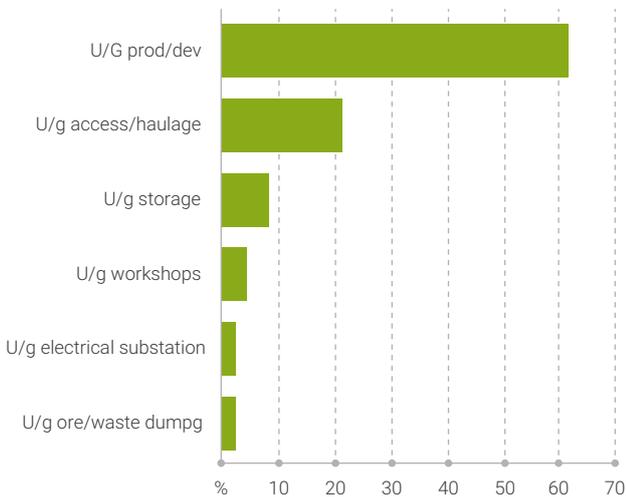
PART OF BODY



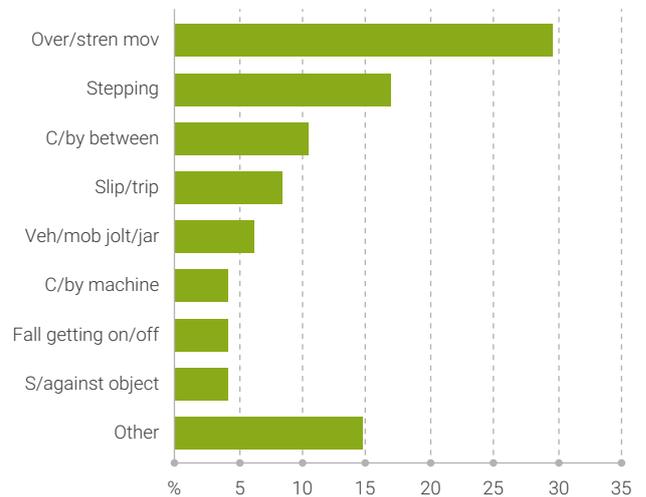
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

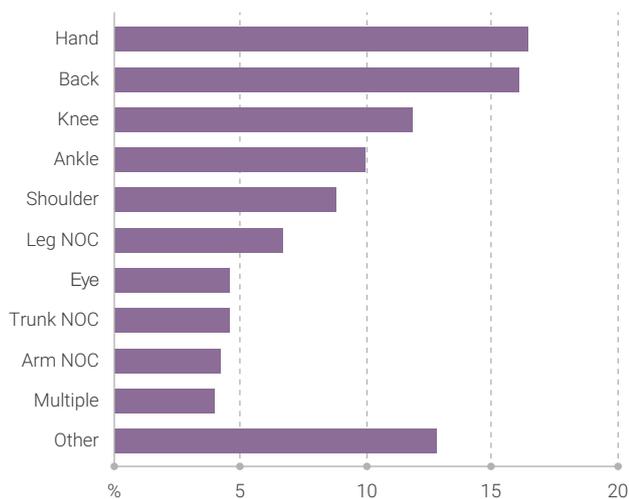


# APPENDIX F

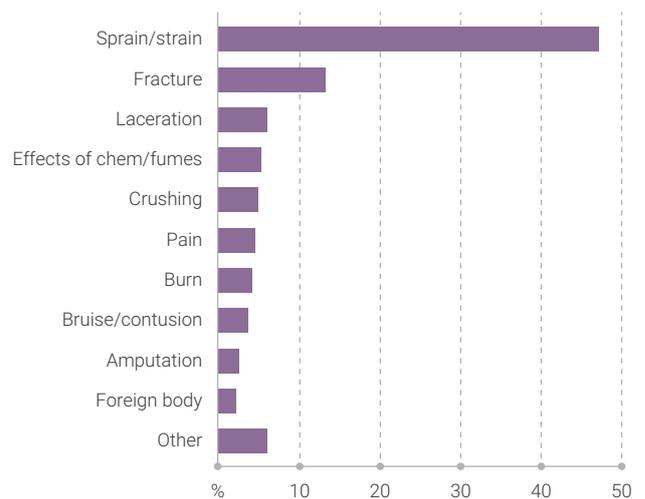
## METALLIFEROUS SURFACE INJURIES 2016-17

329 lost time injuries

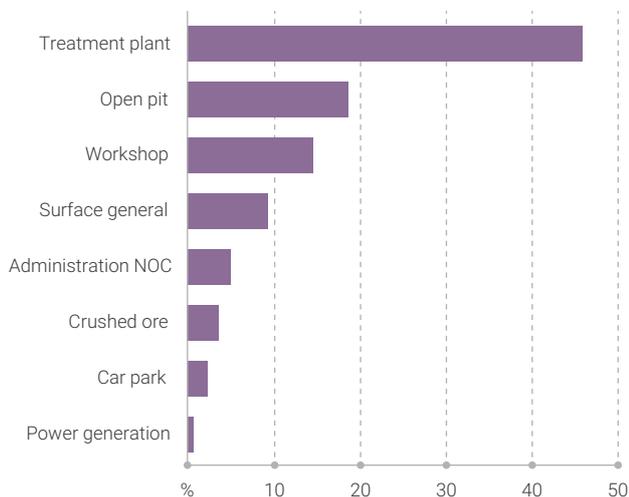
PART OF BODY



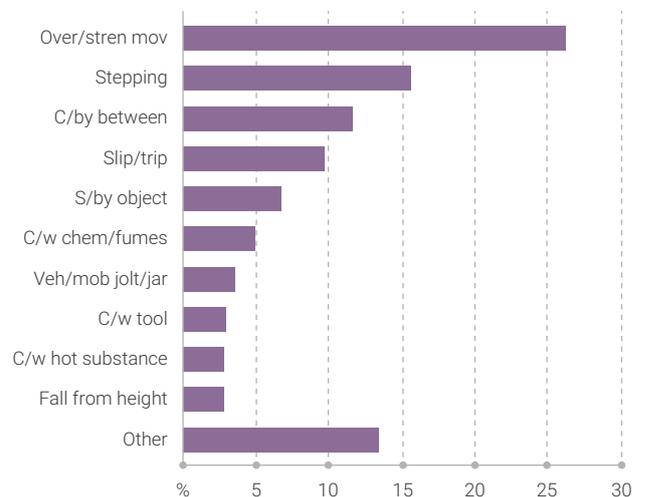
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

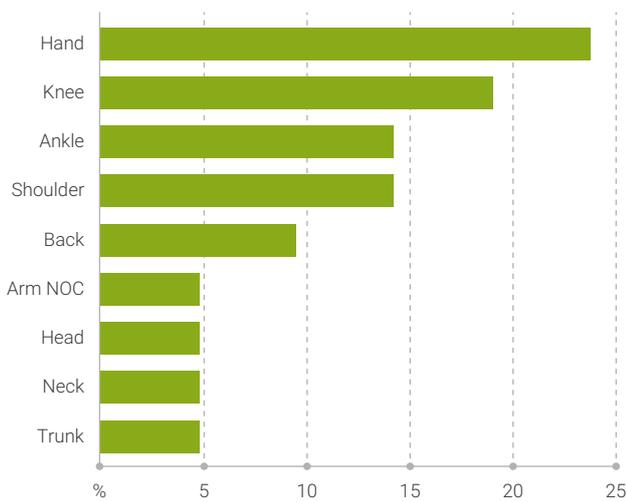


# APPENDIX G

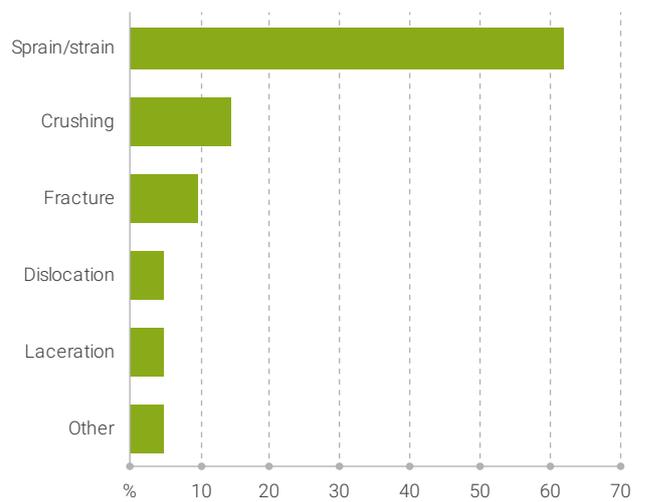
## GOLD UNDERGROUND INJURIES 2016-17

### 22 lost time injuries

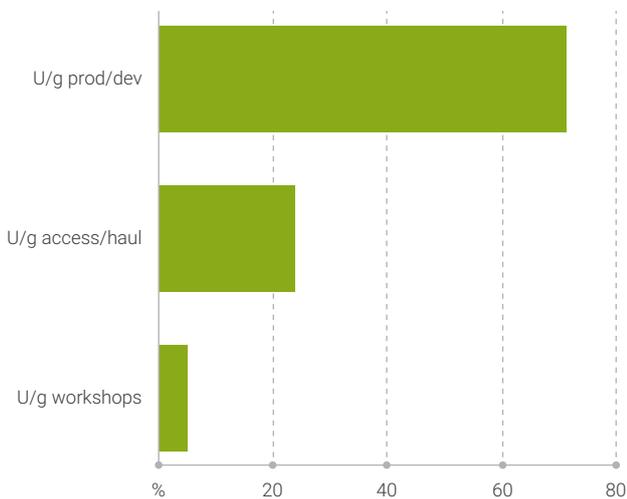
PART OF BODY



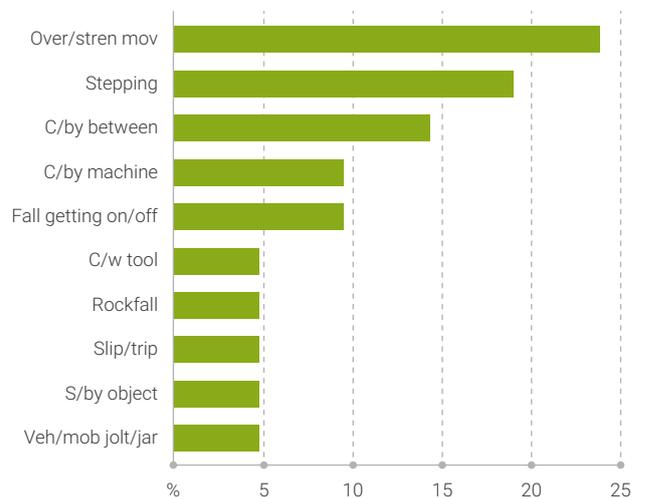
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

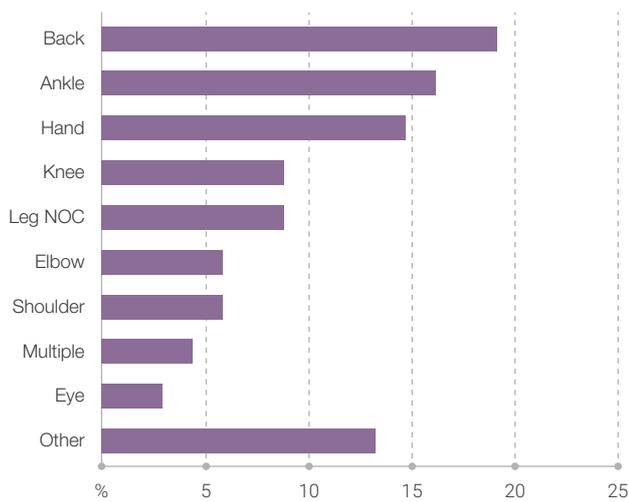


# APPENDIX H

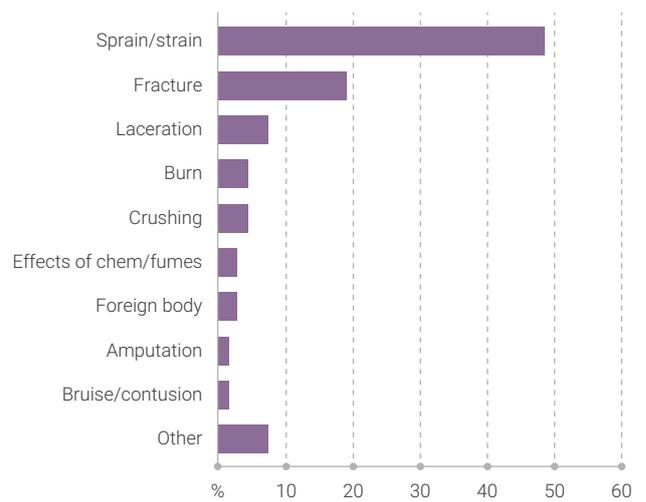
## GOLD SURFACE INJURIES 2016-17

68 lost time injuries

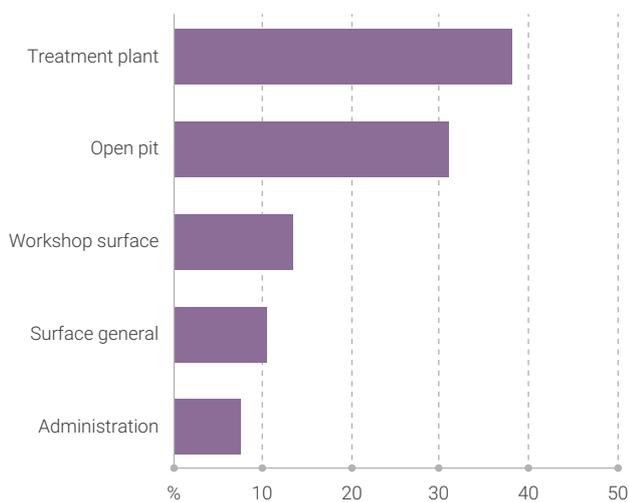
PART OF BODY



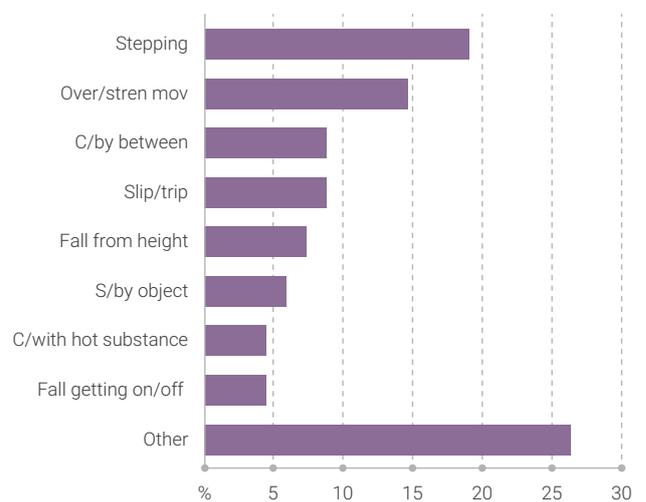
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

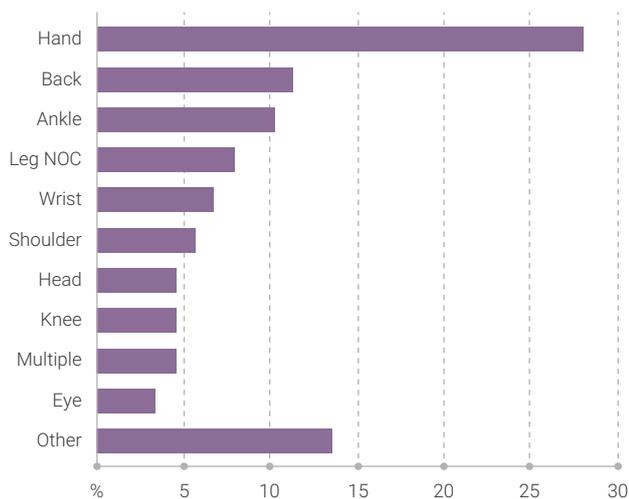


# APPENDIX I

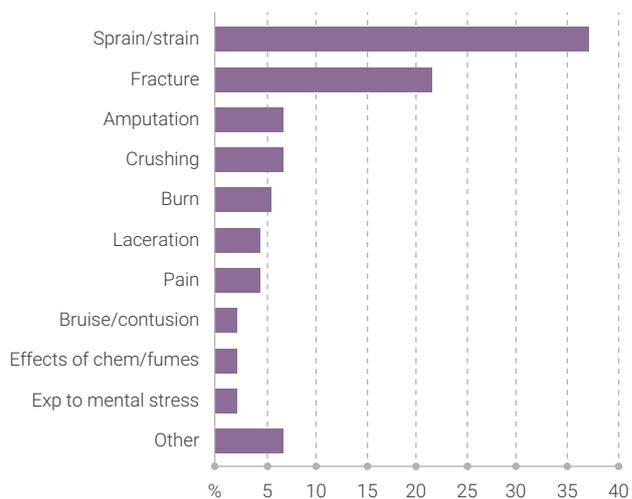
## IRON ORE INJURIES 2016-17

89 lost time injuries

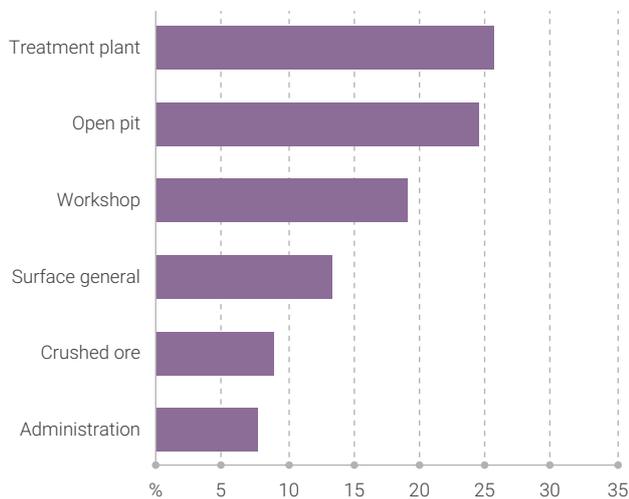
PART OF BODY



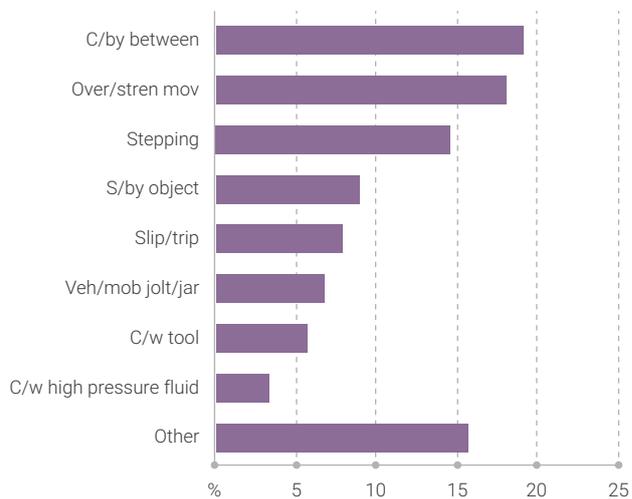
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

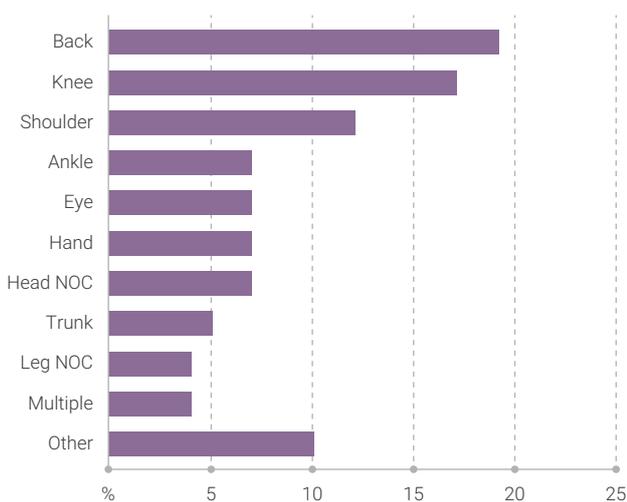


# APPENDIX J

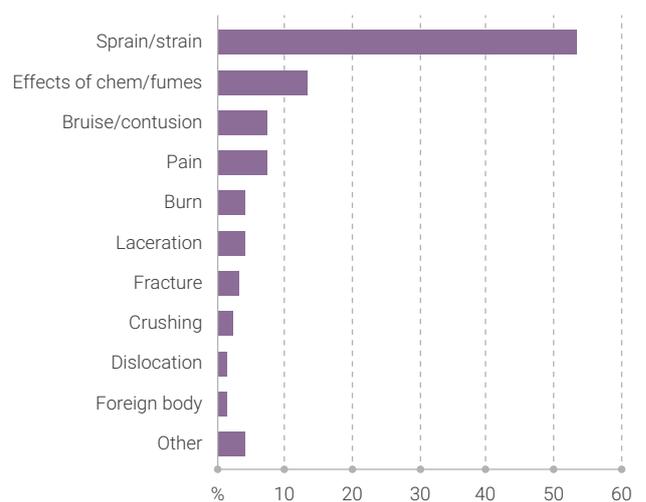
## BAUXITE AND ALUMINA INJURIES 2016-17

99 lost time injuries

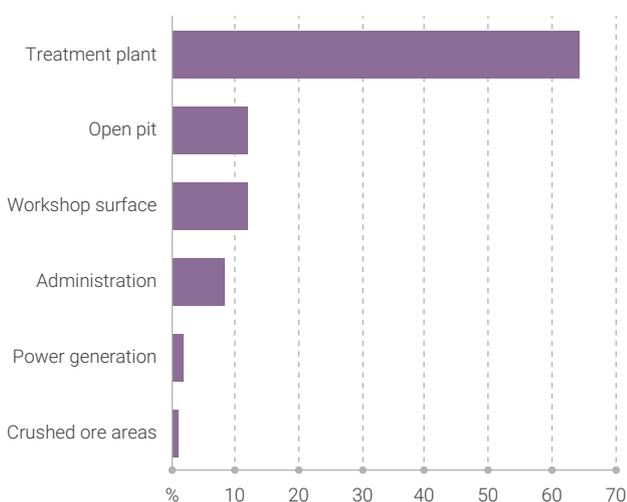
PART OF BODY



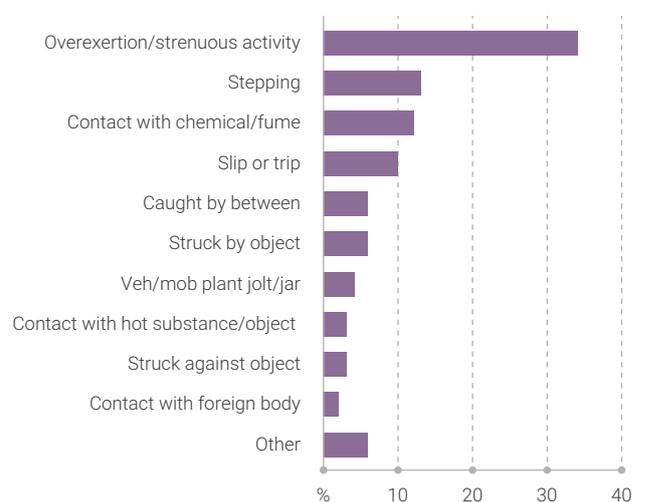
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

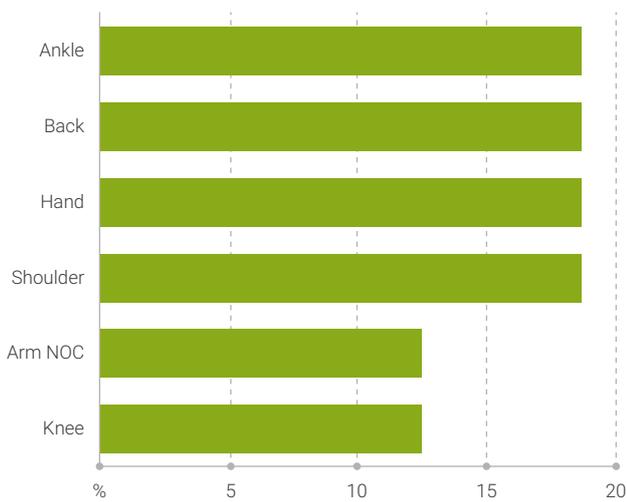


# APPENDIX K

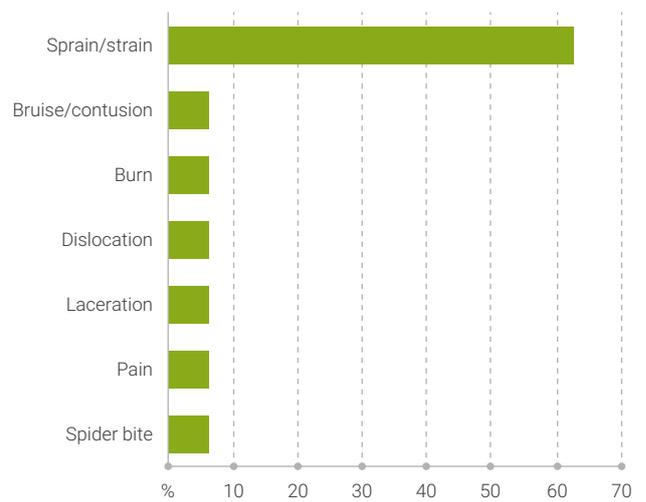
## NICKEL UNDERGROUND INJURIES 2016-17

### 16 lost time injuries

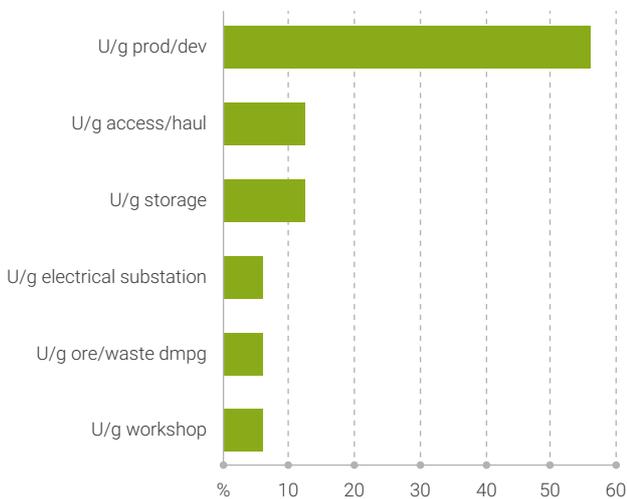
PART OF BODY



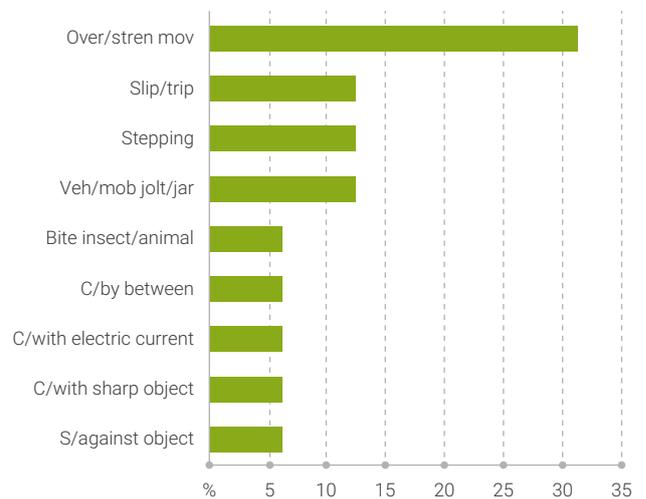
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

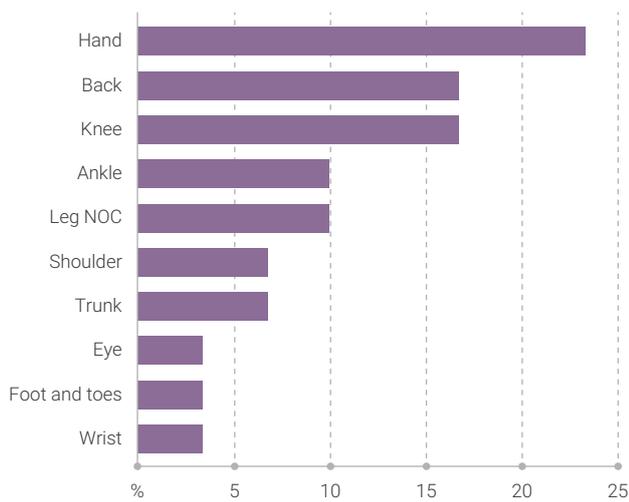


# APPENDIX L

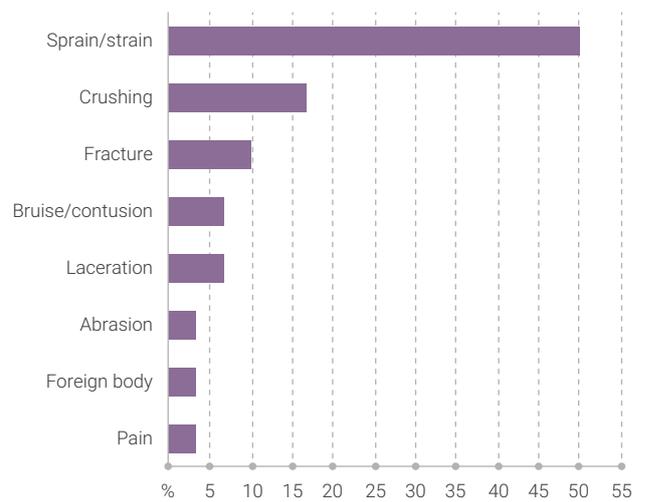
## NICKEL SURFACE INJURIES 2016-17

30 lost time injuries

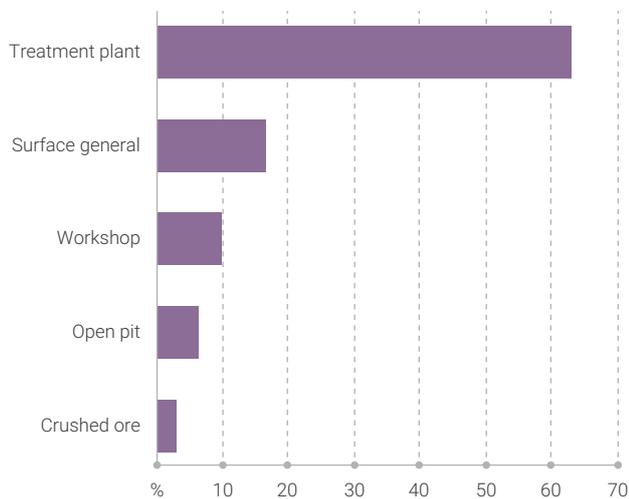
PART OF BODY



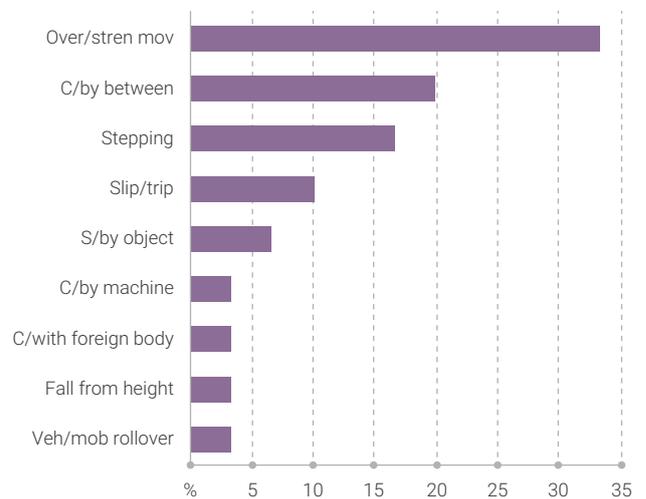
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

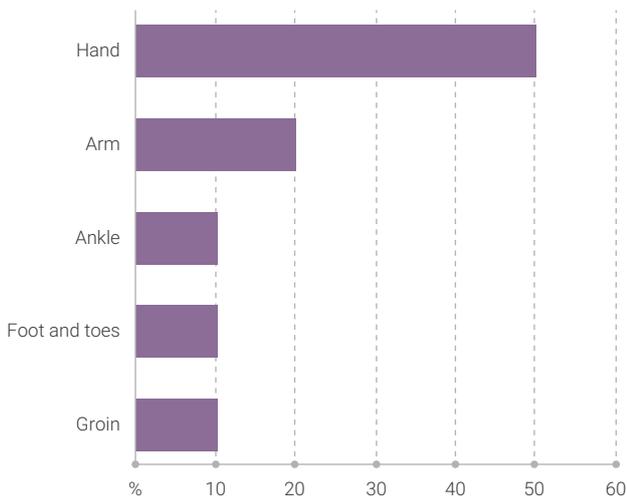


# APPENDIX M

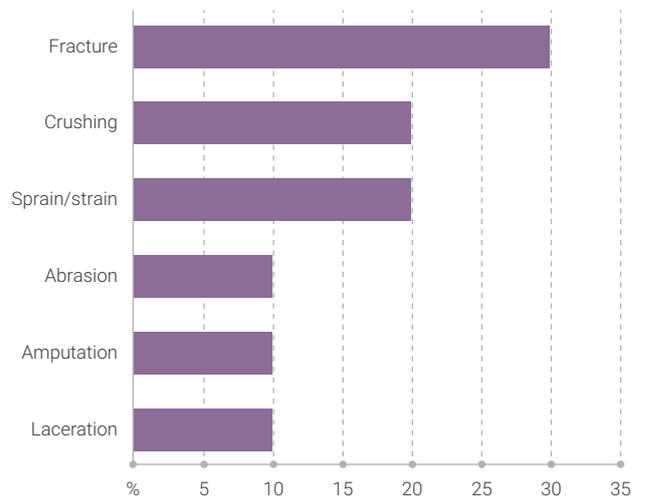
## EXPLORATION INJURIES 2016-17

### 10 lost time injuries

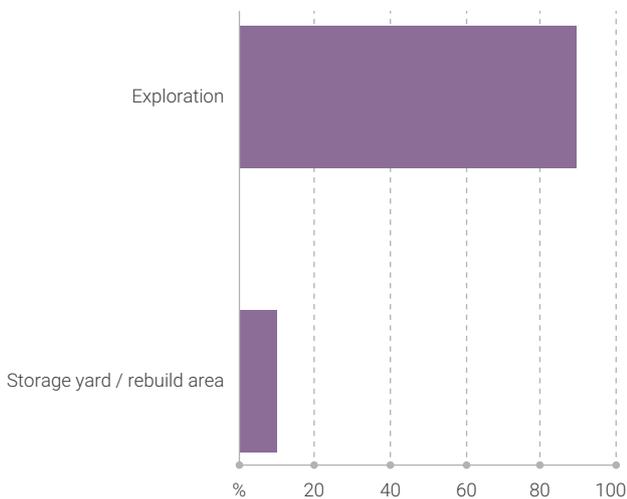
PART OF BODY



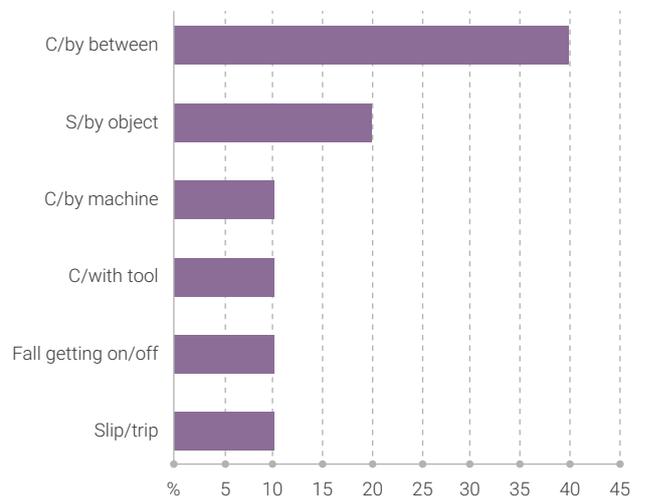
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

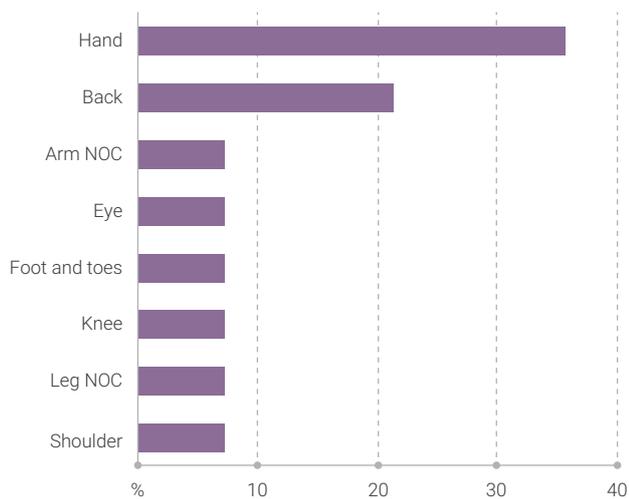


# APPENDIX N

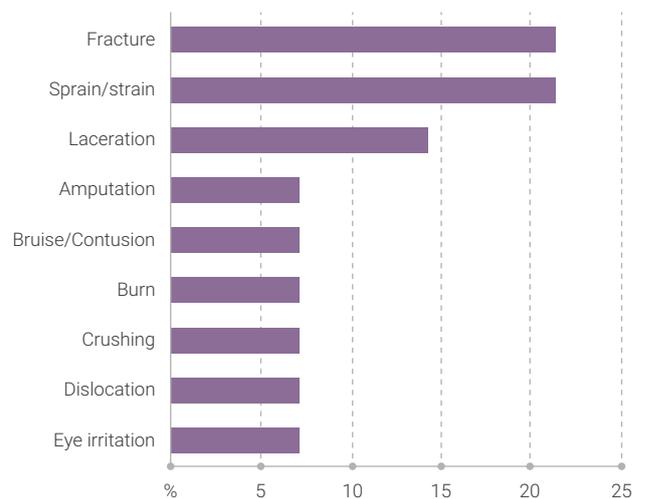
## EXPLORATION RESTRICTED WORK INJURIES 2016-17

14 restricted work injuries

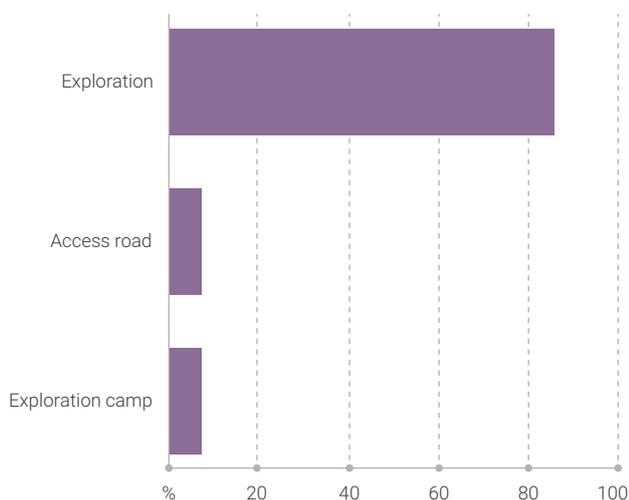
PART OF BODY



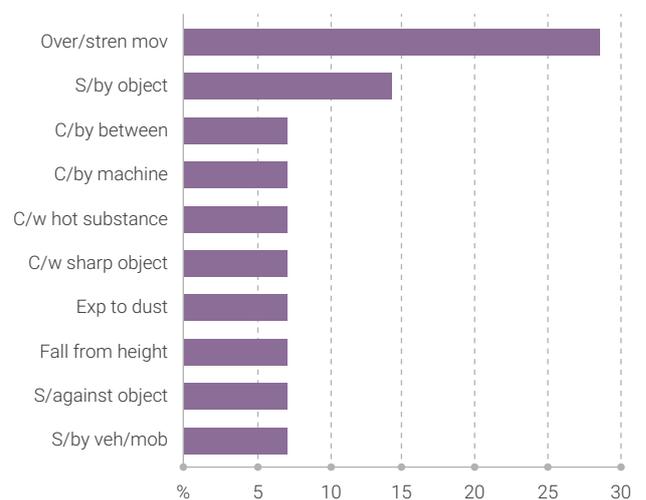
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

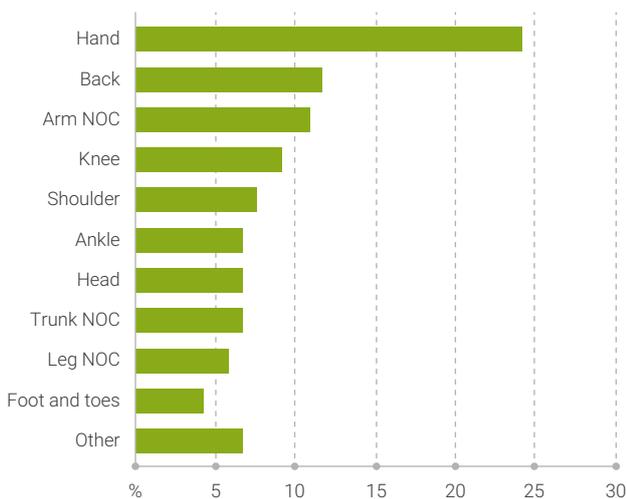


# APPENDIX 0

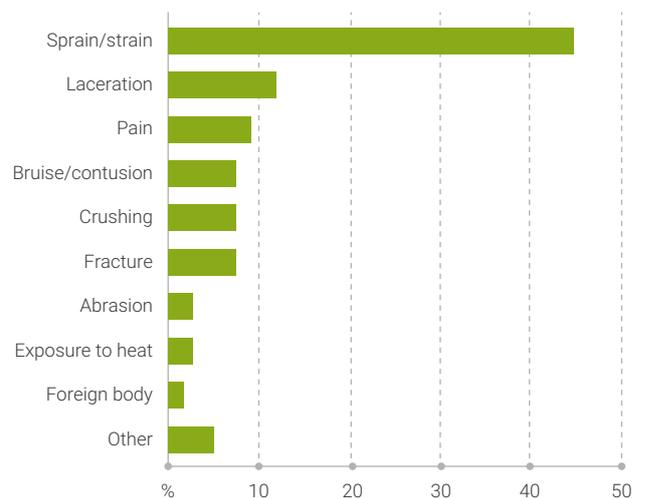
## RESTRICTED WORK INJURIES UNDERGROUND 2016-17

120 restricted work injuries

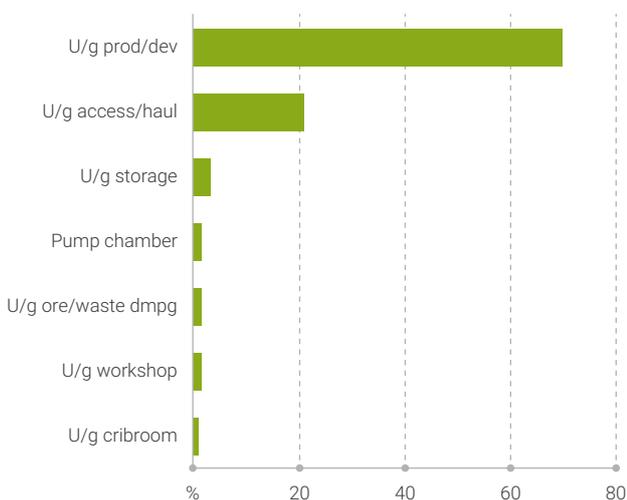
PART OF BODY



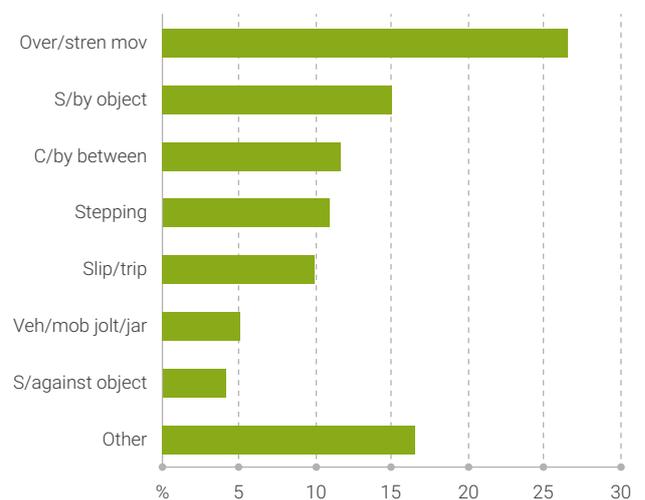
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

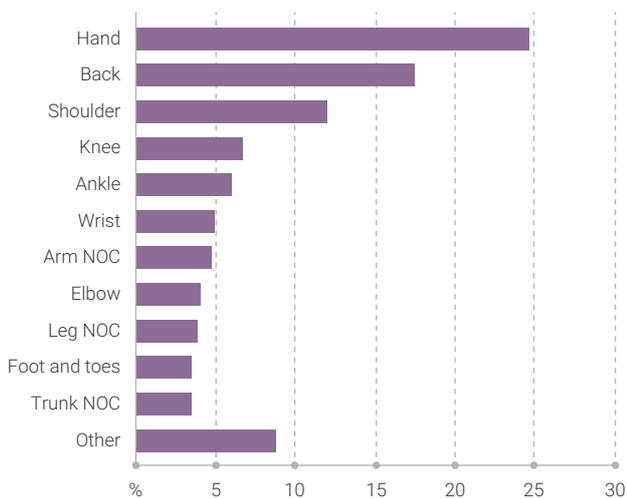


# APPENDIX P

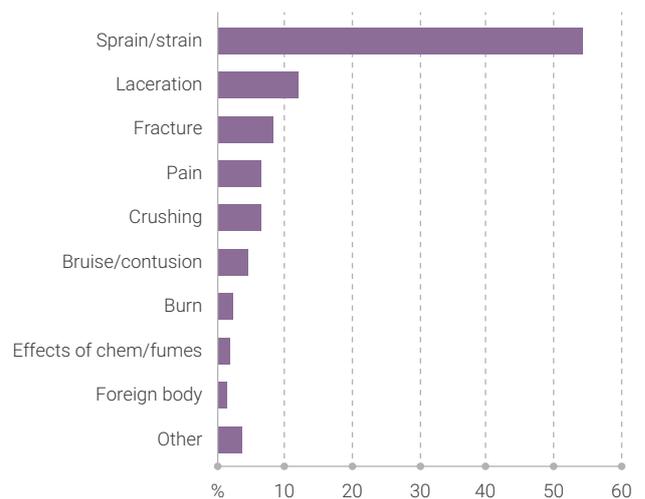
## RESTRICTED WORK INJURIES SURFACE 2016-17

598 restricted work injuries

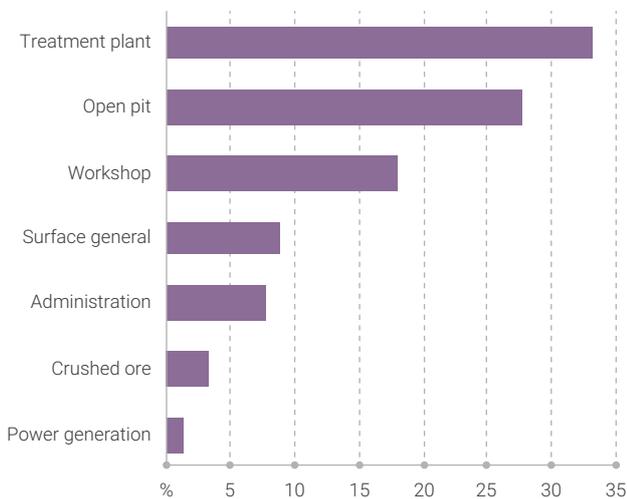
PART OF BODY



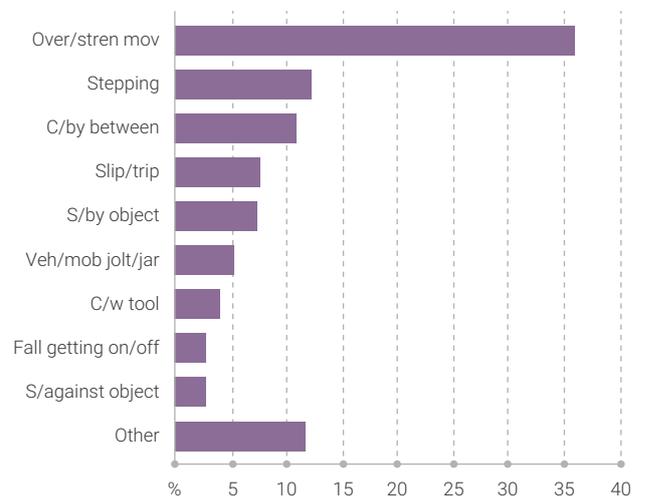
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT





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Department of Mines, Industry Regulation and Safety

Department of Mines, Industry Regulation and Safety  
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Telephone: + 61 8 9358 8001

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Website: [www.dmirs.wa.gov.au](http://www.dmirs.wa.gov.au)