SAFETY PERFORMANCE

IN THE WESTERN AUSTRALIAN MINERAL INDUSTRY

ACCIDENT AND INJURY STATISTICS 2015-2016

Government of **Western Australia**
Department of **Mines and Petroleum**
Resources Safety

Reference

The recommended reference for this publication is: Department of Mines and Petroleum, 2016, Safety performance in the Western Australian mineral industry — accident and injury statistics 2015-16: Resources Safety, Department of Mines and Petroleum, Western Australia, 49 pp.

ISBN 978 1 922149 48 0

This publication is available on request in other formats for people with special needs.

This publication is also available in digital format (PDF) online at **www.dmp.wa.gov.au**

Further details of publications produced by Resources Safety can be obtained by contacting:

Resources Safety — Support and Development
Department of Mines and Petroleum
Mineral House, 100 Plain Street
East Perth
Western Australia 6004

Telephone

+ 61 8 9358 8002 (general queries)
+ 61 8 9358 8154 (publication orders)

NRS

13 36 77

Facsimile

+ 61 8 9358 8000

Email

ResourcesSafety@dmp.wa.gov.au
(general queries)

RSDComms@dmp.wa.gov.au
(publication orders)

Government of **Western Australia**
Department of **Mines and Petroleum**
Resources Safety

SAFETY PERFORMANCE
IN THE WESTERN AUSTRALIAN MINERAL INDUSTRY

ACCIDENT AND INJURY STATISTICS 2015-2016

CONTENTS

LIST OF FIGURES

LIST OF TABLES

STATISTICAL SUMMARY

MINING

- There were four fatal mining accidents during 2015-16. One occurred underground in a gold mine. The other three fatalities occurred on the surface in an iron ore mine, a gold mine and an alumina refinery.
- There were 377 LTIs during 2015-16, 36 less than the previous year (413 lost time injuries in 2014-15). Table 5 and Appendix A show a breakdown of the number of injuries by commodity mined.
- Lost time injuries resulted in a total of 8,596 rostered days lost and a further 11,455 rostered days of restricted work in 2015-16.
- There was an average workforce of 102,343 in 2015-16, a decrease of approximately 3.4% from the previous year's average of 105,964.
- The overall LTI duration rate deteriorated by approximately 19% during 2015-16, rising from 19.1 to 22.8.
- The overall LTI frequency rate for 2015-16 remained unchanged from that of 2014-15 at 2.2.
- The overall injury index deteriorated by approximately 19%, rising from 42 in 2014-15 to 50 in 2015-16.
- Serious LTIs in mining during 2015-16 totalled 319, 32 less than in 2014-15, however the overall serious LTIFR remained unchanged at 1.9.
- The iron ore sector LTIFR deteriorated by 8% during 2015-16, rising from 1.3 to 1.4.
- The bauxite and alumina sector LTIFR deteriorated slightly (by 2%) during 2015-16, rising from 4.0 to 4.1.
- The gold sector LTIFR improved by 8% during 2015-16, falling from 2.5 to 2.3
- The nickel sector LTIFR improved by 9% during 2015-16, falling from 3.3 to 3.0.
- There were 752 RWIs during 2015-16, 1 less than the previous year (753 RWIs reported in 2014-15)
- RWIs resulted in a total of 19,649 rostered days of restricted work in 2015-16
- The overall RWI frequency rate for 2015-16 deteriorated by 10%, rising from 4.0 to 4.4.

EXPLORATION

- There were no exploration fatalities in 2015-16.
- There were 13 LTIs reported during 2015-16, 3 more than the previous year.
- Lost time injuries resulted in a total of 339 rostered days lost and a further 223 rostered days of restricted work in 2015-16.
- There was an average workforce of 2,223 workers, an increase of 2% from the previous year's average.
- The overall LTIFR deteriorated by 34% in 2015-16, rising from 2.5 to 3.3. 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 18 restricted work injuries reported for exploration during 2015-16, resulting in an RWI frequency rate of 4.6, 85% higher than the 2014-15 rate of 2.5.
- RWIs resulted in a total of 328 rostered days of restricted work in 2015-16.

INTRODUCTION

In 2015-16, four people were killed while working at Western Australian mining operations. A further 319 people suffered a serious lost time injury – an injury that disables a worker for two weeks or more.

These figures are a reminder that people are still being killed or maimed while working in Western Australia's mining industry. While safety is improving compared to a decade ago, we cannot and should not accept the current number of injuries and fatalities.

Providing safe systems of work and applying appropriate risk management must be given the highest priority on mining operations. A momentary lapse in applying risk controls can be punished with life-changing consequences. Not just for the victim, but also for the victim's family, friends and co-workers.

We must learn from these tragedies and do everything we can to avoid them being repeated.

The Department of Mines and Petroleum is committed to working with industry to help reduce serious incidents and provide tangible support in achieving positive cultural change.

Part of the department's role is providing safety information to industry. That is why the department formed a specialist investigations branch, which has enhanced its ability to conduct investigations.

The timely and thorough completion of more investigations has enabled the department to increase the amount of safety information published, which helps the resources sector protect workers and safeguard the community.

The faster the department can establish the root cause of an incident, the sooner industry has access to safety information that has the potential to prevent similar incidents from occurring.

In the past three years, the department has produced 99 Significant Incident Reports and Safety Bulletins – two more than the number produced in the previous seven years.

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

The third instalment of the videos was released at this year's Mines Safety Roadshow and focussed on the risks associated with getting caught, trapped or crushed.

Over the past 12 months, the department has also released important safety guidance for autonomous mining technology, isolating hazardous energies, and tyre safety for earth-moving equipment.

Collaboration with industry has been an important part of developing safety guidance.

Not only does the final product benefit from the accumulated knowledge and practical experience of industry, but effective consultation helps ensure a relationship of mutual trust and respect between the regulator and industry.

As a regulator, the department raises awareness and seeks compliance. However, each and every person involved in the mining industry must take their safety responsibilities seriously.

Whether you are an executive, manager, supervisor, worker or regulator, we all have a critical role to play in improving safety in Western Australia's mining industry.

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

Andrew Chaplyn
State Mining Engineer

8 December 2016

Visit **www.dmp.wa.gov.au/Safety/Reports-16199.aspx** 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

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 FREQUENCY RATE
The number of serious 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

ABBREVIATIONS

C/BY BETWEEN	caught by or between moving or stationary objects or both
C/BY MACHINE	caught by or between operating machine
CHEM/FUMES	chemicals or fumes
COMP	compressed
C/W	contact with
DETON	detonation
ENV	environment
EXP	exposure
FR	frequency rate
HI PRESS FLUID	high pressure fluid
JOLT/JAR	jolting or jarring
LTI	lost time injury
LTIFR	lost time injury frequency rate
NOC	not otherwise classified
ON/OFF	on or off
OVER/STREN MOV	over-exertion or strenuous movements
PRESS	pressure
RWI	restricted work injury
S/AGAINST	struck against
S/BY	struck by
SLIP/TRIP	slip or trip
U/G	underground
U/G ACCESS/ HAUL	underground access, travelling or haulage ways
U/G PROD/DEV	underground production or development areas
VEH/MOB	vehicle or mobile equipment

EXPLANATORY NOTES

Introduction

The statistics published in this annual compilation mainly relate to accidents between 1 July 2015 and 30 June 2016 (2015-16) 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 2015-16 from injuries that occurred in 2015-16

ii) Recurrent injuries — days lost in 2015-16 through recurrences of injuries that occurred in 2015-16 and previous years

iii) Carry-over injuries — days lost in 2015-16 by persons continuously off work from injuries that occurred before 1 July 2015.

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 L and M.

Restricted work injuries are covered in the statistical summary, "Restricted work injuries" section and Appendices M, N and O.

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 Resources Safety 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 2015-16 received by the 14th of October 2016. It will not reflect any data received or changed after this date.

During the twelve months covered by this compilation, an average of 436 mines or groups of mines and 270 exploration companies reported to the SRS.

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

Charts

For clarity, most bar charts in this publication are restricted to 13 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 2015-16

Hira Rewita, 6 September 2015

Hira Rewita, an operator, was driving a dump truck loaded with waste rock from an open pit to the waste dump on a gold mine. He failed to negotiate a slight left hand bend and the truck's front and rear left tyres mounted a hard rock windrow, and the truck rolled over onto its right hand side. Mr Rewita fell about 3.75 m from the cab to the ground.

A vehicle examination showed the dump truck to be in full working order. The driver's seat belt was also deemed to be in good working order.

Related safety alert

Mines Safety Significant Incident Report No. 230 Dump truck roll-over – fatal accident

Adam Perttula, 16 November 2015

Adam Perttula, a jumbo offsider, collapsed while working underground at a gold mine on night shift and was taken to the surface. He initially received treatment from the mine medical staff and then from the Royal Flying Doctor Service but passed away during the early hours of the next day.

The work place was hot and humid and well-established controls for working in these conditions were not properly implemented.

Related safety alert

Mines Safety Significant Incident Report No. 232 Underground operator collapses underground – fatal accident

Benjamin White, 25 November 2015

Benjamin White, a scaffolder, died after falling into a process vessel at an alumina refinery. A bank of six digesters at the refinery had been off-line for maintenance and refurbishment work since July 2015. All pipework had been disconnected and scaffolding installed in August for refurbishment work inside the digesters. When the refurbishment work was almost complete, scaffolders began dismantling the scaffolding.

Mr White inadvertently entered a manway into an adjacent digester, from which the scaffold had already been removed, and fell about 12 metres. There was no device or guard on the open manway to prevent inadvertent access to the digester.

Related safety alert

Mines Safety Significant Incident Report No. 235 Scaffolder falls from height in a process vessel at a refinery – fatal accident

Lee Buzzard, 19 June 2016

Lee Buzzard, a fitter, was working on the deck of a blast-hole drill rig at an iron ore mine to replace a head slide that had fallen out of its bracket. The rig had not been powered down, nor was it isolated. When the initial attempt to fit the head slide failed, the drill head was raised to take weight off the drill head and align the head-slide bolt holes with the head bracket. While Mr Buzzard was checking the alignment of the head slide and bracket, the centraliser arm closed unexpectedly and he suffered fatal injuries.

It was found that the head slide could not be fitted from the rig's deck due to distortion and mechanical damage.

Related safety alerts

Mines Safety Significant Incident Report No. 243 Drill fitter crushed between drill head and rod centraliser arm – fatal accident

Mines Safey Significant Incident Report No. 247 Drill fitter crushed between drill head and rod centraliser arm – fatal accident – update

FATAL ACCIDENTS CONTINUED

Fatal injury incidence rate 1996-97 to 2015-16

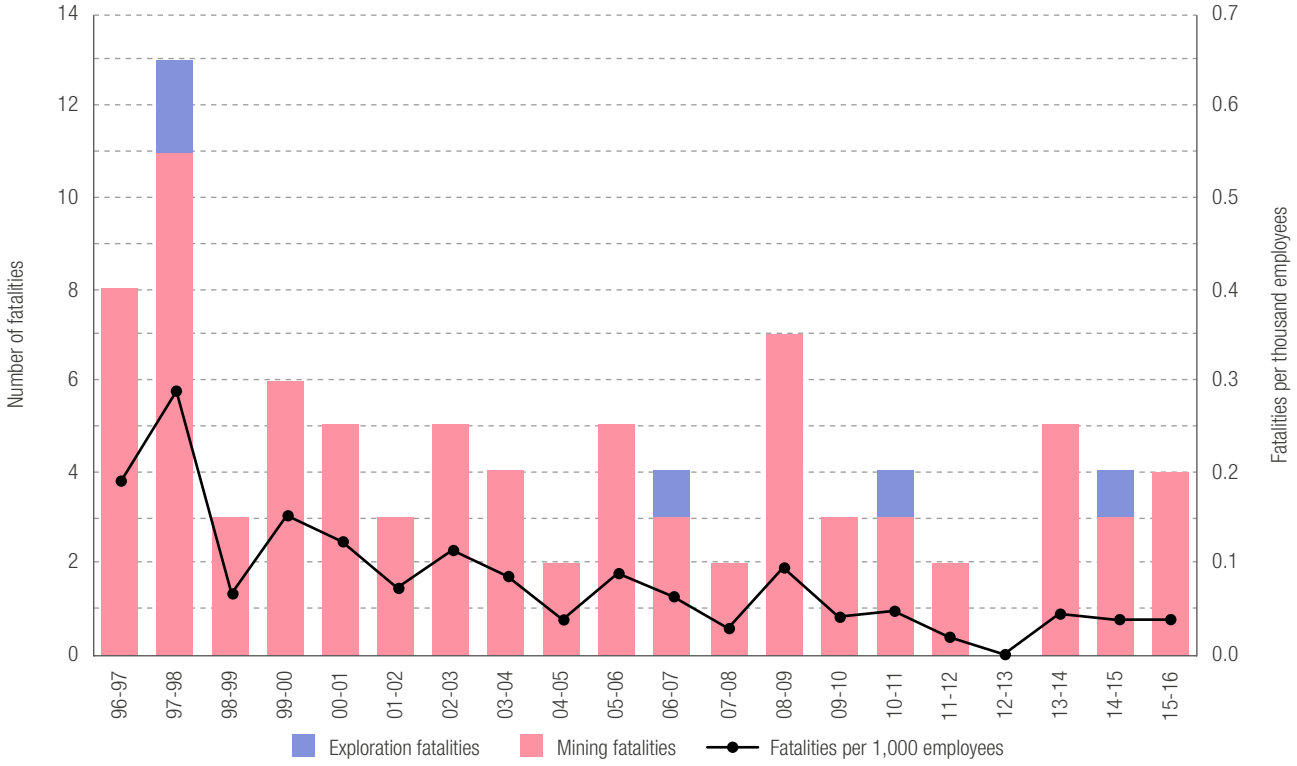
There were four fatal accidents in the Western Australian mineral industry during 2015-16. Of these three were on mining operations and one in a mining-related refinery. This resulted in a fatal injury incidence rate for 2015-16 of 0.038.

While there has been an overall decrease in the number of fatalities per thousand employees over the last 20 years (see Figure 1), the rate of improvement has slowed in recent years, with a fatal incidence rate of between zero and 0.1 over the last decade.

Resources Safety maintains the view that no fatal accident is acceptable, and a fatal injury incidence rate of zero is achievable.

The zero fatal incidence rate achieved for 2012-13 supports this view.

FIGURE 1 FATAL INJURY INCIDENCE RATE 1996-97 TO 2015-16



FATAL ACCIDENTS CONTINUED

Fatal injury incidence rate by mineral mined 2011-12 to 2015-16

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 4.6 times higher than the fatal injury incidence rate for surface operations.

Fatal injuries by type of accident 2011-12 to 2015-16

Table 2 indicates the type of accidents for the 15 fatalities in the mining industry (including exploration) over the past five years, with four underground, ten 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, fall from height and struck by vehicle or mobile equipment (two fatalities each) and vehicle or mobile plant rollover (one fatality).

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

TABLE 1 FATAL INJURY INCIDENCE RATE BY MINERAL MINED 2011-12 TO 2015-16

Category		Fatalities per thousand employees
Mineral	Base metals	0.075
	Gold	0.056
	Iron ore	0.019
	Bauxite and alumina	0.050
Underground		0.096
Surface		0.021
Exploration		0.077

TABLE 2 NUMBER OF FATALITIES BY TYPE OF ACCIDENT 2011-12 TO 2015-16

Category		Number of fatalities
Underground	Rockfall	2
	C/by machine	1
	Exposure to env heat	1
Surface	S/by object	3
	C/by between	2
	Fall from height	2
	S/by veh/mob	2
	Veh/mob rollover	1
Exploration	S/by object	1
Total		**15**

SERIOUS INJURIES

Review of serious injuries during 2015-16

There were 319 serious lost time injuries reported in the mining industry during 2015-16 (351 in 2014-15). Of these, 304 were in metalliferous mines and 15 were in coal mines. There were a further 8 serious lost time injuries reported for exploration (7 in 2014-15).

Some examples of serious injuries from 2015-16 are shown below:

A geotechnical contractor conducting ground support work on the wall of an open pit received multiple injuries to the legs, including fractures, when the telehandler-mounted elevated work platform (EWP) from which he was working became unbalanced and fell against the wall, trapping his legs. A rock had dislodged from the wall and struck the hydraulic check valve block on the right hand front jack, causing the jack to retract and the machine to tip to the side.

A fitter suffered a fractured ankle while climbing down from a forklift in the workshop when he stepped onto a bucket tooth pin that had been left on the ground, causing his ankle to roll and give way.

A store person in the truck loading area received crush injuries to the right thigh and knee. She was attempting to prevent a 2 tonne load from falling off a forklift's tynes when it became unstable and started to move. The load continued to fall forward towards the employee, pushing her backwards and striking her right leg.

The operator of a 30 tonne excavator loading a truck in an open pit suffered severe injuries including cracked ribs and partially deflated lungs when the ground beneath the excavator collapsed into an unidentified void under the pit floor. The machine fell into the void, confining the operator within the cabin as rock rilled into the cabin from height.

The operator of a dump truck being loaded reported whiplash and concussion symptoms after a large rock hit the back of the truck's tray, causing the cab and operator to be jolted.

A boilermaker sustained a 3-4cm deep laceration to his right hand below the thumb when the grinder that he was using to cut a piece of flat bar in the laydown yard slipped and kicked out of the work. Treatment required surgical repair of the extensor tendon and a branch of radial nerve.

An employee sitting in the side seat of an excavator experienced pain in the right shoulder and neck while reaching across and behind to lift and pull forward a backpack weighing approximately 7kg from behind the operator's seat.

A painter sustained a high pressure injection wound, requiring surgery to clean, while clearing spray painting equipment by running thinners through the spray lines and gun. The lines became blocked and the painter began undoing a coupling to disconnect the line from the pump. As the line was still pressurised this resulted in a sudden release of fluid, causing an injection wound to the webbing of his left hand.

A grader operator fell backwards onto the ground when a rubber section of the ladder on which he was standing tore. The operator landed on his back, sustaining fractures to both shoulder blades.

A process operator, working in a hut on top of a leach tank, has injured his shoulder while moving outside to get a better radio reception to respond to a two-way radio call. While exiting the hut, he lost his balance and fell, suffering injuries to his left shoulder.

An exploration driller's offsider received bruising and a possible hairline fracture of the spine when he dropped 5 -10 metres to the ground from a section of drill rig being moved by helicopter. One of his legs had become entangled in a fibre loop sling tag line, resulting in him being lifted with the load. The pilot reduced height when notified of the situation and the offsider, who had freed his leg, dropped to the ground.

The operator of a fully loaded triple roadtrain travelling on an access road sustained two compressed vertebrae when the truck hit a washed out section of road at a floodway. The operator was bounced in his seat and struck the roof of the truck cab twice, immediately experiencing lower back pain.

A cleaner tripped on a step and fell, fracturing her hip and causing serious pain, while exiting a crib room during cleaning operations. She was assisted by workmates and taken to hospital, then later transferred to the regional hospital by the Royal Flying Doctor for diagnosis and treatment.

A refinery process operator's duties over time resulted in the gradual onset of a rotator cuff tendinopathy condition to his left shoulder.

An operator in an underground access store received a strain injury to his shoulder while lifting a 23 kg tool bag off the tray of a light vehicle and up to shoulder height. The injury occured as he fitted the bag's carry strap to his shoulder.

SERIOUS INJURIES CONTINUED

Serious injury incidence rate by mineral mined 2011-12 to 2015-16

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 chart shows that the serious injury incidence rate for underground mining (5.0) was 43% higher than that for surface operations (3.5).

Of the major mining sectors, coal had the highest five-year average serious injury incidence rate (18.0), followed by silica-silica sand at 10.2. 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 2011-12 to 2015-16

Figure 3 shows that since 2014-15 the serious injury frequency rate deteriorated by 24% for underground operations but improved by 6% for surface metalliferous. Coal operations deteriorated by approximately 29% during 2015-16. This resulted in the overall serious injury frequency rate remaining unchanged from 2014-15.

FIGURE 2 SERIOUS INJURY INCIDENCE RATE 2011-12 TO 2015-16

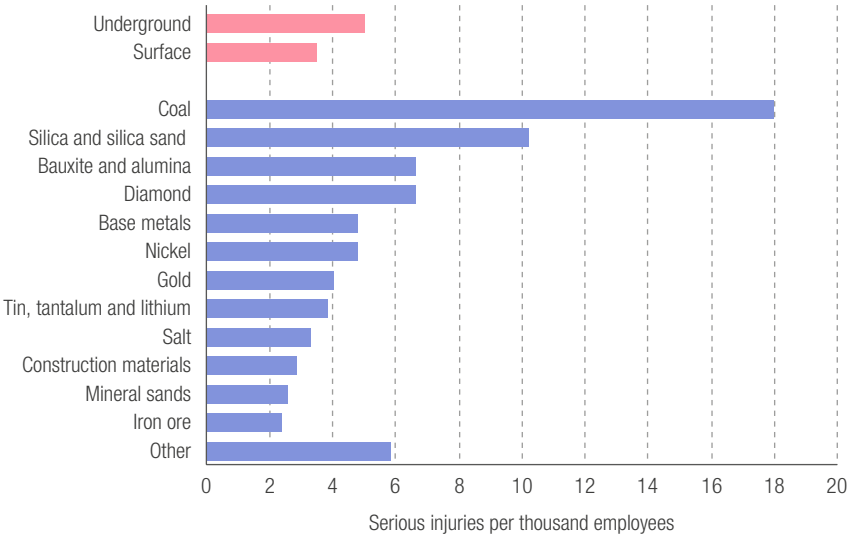
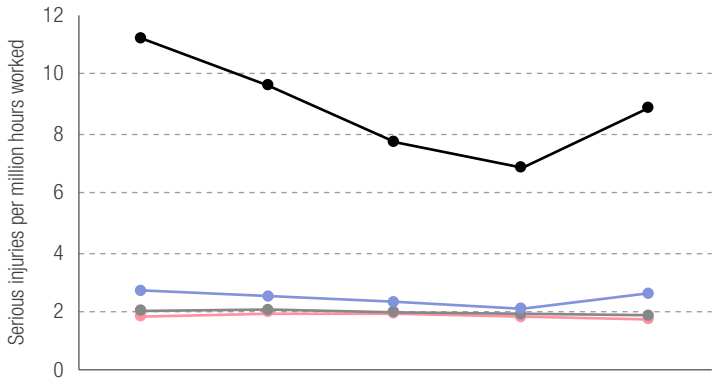


FIGURE 3 SERIOUS INJURY FREQUENCY RATES 2011-12 TO 2015-16



	11-12	12-13	13-14	14-15	15-16
Underground	2.7	2.5	2.3	2.1	2.6
Metalliferous surface	1.8	1.9	1.9	1.8	1.7
Coal	11.2	9.6	7.7	6.8	8.8
Total	2.0	2.0	2.0	1.9	1.9

Fast facts

- 85% of lost time injuries in 2015-16 were classed as serious, with the injured person unable to return to their regular job or hours within two weeks.
- 26% of serious injuries were to legs, most commonly as a result of stepping injuries, overexertion or strenuous activities, or slips and trips.
- 22% of serious injuries were to hands, most commonly as a result of being caught by or between objects or by contact with tools.
- While over half of serious injuries were sprain or strain, more than one in seven serious injuries resulted in a fracture.

Serious injury percentage breakdown for 2015-16

Appendices B and C 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 arms and legs each accounted for the largest proportion of serious injuries at 21%, followed by hand injuries at 16%, then injuries to back, multiple locations and trunk, each at approximately 11%. Of the serious leg injuries, 50% were to knees and 38% to ankles. Injuries to shoulders made up 88% of serious arm injuries.
- Surface: Injuries to legs accounted for the largest proportion of serious injuries at 27%, followed by hand injuries at 23%, arm injuries at 21% and back injuries at 13%. Of the serious arm injuries, 56% were to shoulders and 20% to elbows. Injuries to knees and to ankles accounted for 41% and 33% of serious leg injuries respectively.

Injuries by nature

- Underground: Sprain or strain represented the highest proportion by nature of injury (55%), followed by laceration (16%) and fracture (13%)
- Surface: Sprain or strain represented the highest proportion by nature of injury (51%). Fracture was the next highest (15%), followed by crushing and laceration at 9% and 8% respectively.

Injuries by location

- Underground: The largest proportion of serious injuries underground was in production and development areas (66%), followed by underground access and haulage ways (16%) then underground crushing and underground ore or waste dumping (each 5%).
- Surface: The largest proportion of serious injuries on the surface occurred in treatment plants (38%), followed by open pits at 21%, 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 29%, followed by stepping at 16% then caught by or between objects and slip or trip (each at 11%)
- Surface: The most common accident type associated with serious injuries on the surface was over-exertion or strenuous movements (26%), followed by stepping (15%) and slip or trip (13%).

LOST TIME INJURIES

Review of lost time injuries during 2015-16

In 2015-16, 17,697 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 2015-16 (8,596), recurrences of injuries sustained before 2015-16 and in 2015-16 (782), and LTIs and recurrences carried over into 2015-16 from accidents before July 2015 (8,319). A breakdown of work days lost in coal and metalliferous mining is given in Table 3.

During 2015-16, there were 377 LTIs in the State's mining industry. Of those, 357 were in metalliferous mines and 20 in coal mines. A breakdown of these data with performance indicators is given in Tables 4 and 5.

In addition to the initial injuries, there were 30 recurrences of previous injuries, resulting in 782 work days lost during 2015-16. A breakdown of recurrent injuries by calendar year of initial injury is given in Table 6.

One hundred and nine people who were still off work from injuries received before July 2015 lost 8,319 work days in 2015-16. A breakdown of these carry-over injuries is given in Table 7.

TABLE 3 DAYS LOST THROUGH INJURY DURING 2015-16

Mines	Initial injuries	Recurrent injuries	Carry-over injuries	Total
	Days lost			
Metalliferous	8,215	704	8,020	16,939
Coal	381	78	299	758
Total mining	**8,596**	**782**	**8,319**	**17,697**

TABLE 4 INITIAL LOST TIME INJURIES DURING 2015-16

Sector	No. of employees	No. of LTIs	Incidence rate	Frequency rate	Duration rate	Injury index	Days lost
Metalliferous surface	93,729	317	3.4	2.0	22.6	46	7176
Metalliferous underground	7,486	40	5.3	2.7	26.0	71	1,039
Metalliferous total	**101,215**	**357**	**3.5**	**2.1**	**23.0**	**48**	**8,215**
Coal total	**1,128**	**20**	**17.7**	**11.8**	**19.1**	**224**	**381**
Total mining	**102,343**	**377**	**3.7**	**2.2**	**22.8**	**50**	**8,596**
Exploration	**2,223**	**13**	**5.8**	**3.3**	**26.1**	**87**	**339**

TABLE 5 INJURIES BY MINERAL MINED DURING 2015-16

Mineral mined	No. of employees	No. of LTIs	Incidence rate	Frequency rate	Duration rate	Injury index	Days lost
Iron ore	53,099	127	2.4	1.4	22.7	32	2,881
Gold	23,509	89	3.8	2.3	26.1	60	2,326
Bauxite and alumina	7,234	54	7.5	4.1	11.9	49	643
Nickel	5,645	34	6.0	3.0	32.6	98	1,107
Base metals	2,358	10	4.2	2.5	13.3	34	133
Mineral sands	2,336	6	2.6	2.1	6.8	14	41
Construction materials	1,588	5	3.1	3.5	29.6	105	148
Coal	1,128	20	17.7	11.8	19.1	224	381
Diamonds	988	3	3.0	1.8	11.0	20	33
Salt	869	3	3.5	2.6	43.3	114	130
Manganese ore	335	0	0.0	0.0	0.0	0	0
Tin, tantalum and lithium	773	4	5.2	2.8	16.8	48	67
Other	2,481	22	8.9	6.8	32.1	217	706
Total mining	**102,343**	**377**	**3.7**	**2.2**	**22.8**	**50**	**8,596**

Note: Duration in Tables 4 and 5 does not take into consideration time lost after 30 June 2016 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 2015.

TABLE 6 RECURRENT INJURIES DURING 2015-16

Calendar year	Metalliferous mines		Coal mines		Total mining	
	No. of injuries	Days lost	No. of injuries	Days lost	No. of injuries	Days lost
2016*	5	73			5	73
2015	11	248	2	39	13	287
2014	7	303	2	39	9	342
2013	1	14			1	14
2012	1	17			1	17
2011	1	49			1	49
Total	**26**	**704**	**4**	**78**	**30**	**782**

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 2016*

LOST TIME INJURIES CONTINUED

TABLE 7 CARRY-OVER INJURIES DURING 2015-16

Calendar year	Metalliferous mines		Coal mines		Total mining	
	No. of injuries	Days lost	No. of injuries	Days lost	No. of injuries	Days lost
2015*	65	4,559	3	238	68	4,797
2014	26	1,669	1	61	27	1,730
2013	10	943			10	943
2012	3	587			3	587
2011	1	262			1	262
Total	**105**	**8,020**	**4**	**299**	**109**	**8,319**

** Covers period from 1 January to 30 June 2015*

Review of lost time injuries during 2015-16 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 Resources Safety'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 2015-16 (AS 1885.1:1990)

Sector	No. of employees	No. of LTIs	Injuries per hundred	Frequency rate	Duration rate	Days lost
Metalliferous surface	93,729	320	0.34	2.1	24.5	7,836
Metalliferous underground	7,486	41	0.55	2.8	30.7	1,259
Metalliferous total	**101,215**	**361**	**0.36**	**2.1**	**25.2**	**9,095**
Coal total	**1,128**	**20**	**1.77**	**11.8**	**19.1**	**381**
Total mining	**102,343**	**381**	**0.37**	**2.2**	**24.9**	**9,476**
Exploration	**2,223**	**13**	**0.58**	**3.3**	**26.1**	**339**

Note: Duration in Tables 8 and 9 does not take into consideration time lost after 30 June 2016 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 2015.

TABLE 9 INJURIES BY MINERAL MINED DURING 2015-16 (AS 1885.1:1990)

Mineral mined	No. of employees	No. of LTIs	Injuries per hundred	Frequency rate	Duration rate	Days lost
Iron ore	53,099	128	0.24	1.4	24.2	3,101
Gold	23,509	91	0.39	2.4	30.4	2,766
Bauxite and alumina	7,234	55	0.76	4.2	15.7	863
Nickel	5,645	34	0.60	3.0	32.6	1,107
Base metals	2,358	10	0.42	2.5	13.3	133
Mineral sands	2,336	6	0.26	2.1	6.8	41
Construction materials	1,588	5	0.31	3.5	29.6	148
Coal	1,128	20	1.77	11.8	19.1	381
Diamonds	988	3	0.30	1.8	11.0	33
Salt	869	3	0.35	2.6	43.3	130
Manganese ore	335	0	0.00	0.0	0.0	0
Tin, tantalum and lithium	773	4	0.52	2.8	16.8	67
Other	2,481	22	0.89	6.8	32.1	706
Total mining	**102,343**	**381**	**0.37**	**2.2**	**24.9**	**9,476**

WORKERS' COMPENSATION

Premium rates for the Western Australian mineral industry

The workers' compensation recommended premium rates determined by the Premium Rates Committee are published in a dedicated Western Australian Government Gazette, and are effective from 30 June in the year of issue.

Figure 4 indicates trends in workers' compensation costs for selected mineral groups for the ten-year period 2007-2008 to 2016-17.

Over this period, the coal mining compensation rate increased, by 2%, to 2.08% of payroll. The compensation rate for surface gold operations increased, by 3%, to 1.49% of payroll, and that for iron ore operations increased, by 83%, to 0.86% of payroll. The rate for underground gold operations decreased, by 20%, to 2.43% of payroll.

Figure 5 shows premium rates recommended in 2015-16 for the following year for a variety of mineral groups and other industries. Although premium rates in isolation are not necessarily reliable indicators of risk, they do represent a cost to industry and, in part, reflect past safety performance.

The average premium rate recommended in 2015-16 for the Western Australian mining industry for 2016-17 was 1.54% of payroll, a 9% decrease on the rate recommended in 2014-15 for 2015-16 (1.69% of payroll).

In 2015-16, apart from underground gold mining and coal, premium rates recommended for mining industry groups compared favourably with other industry groups such as structural steel fabrication and sheet metal product manufacturing, which had premium rates of 3.77% and 1.86% of payroll, respectively.

FIGURE 4 MINE WORKERS' COMPENSATION RATE TRENDS 2007-08 TO 2016-17

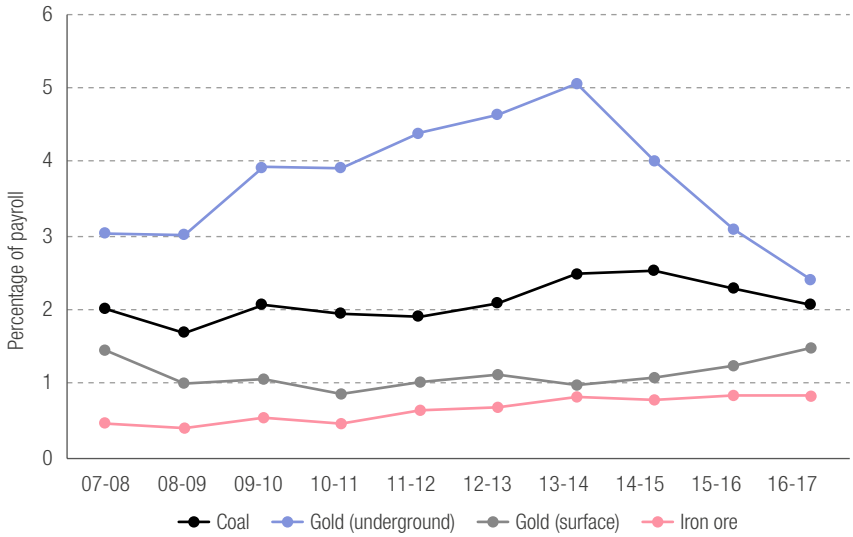
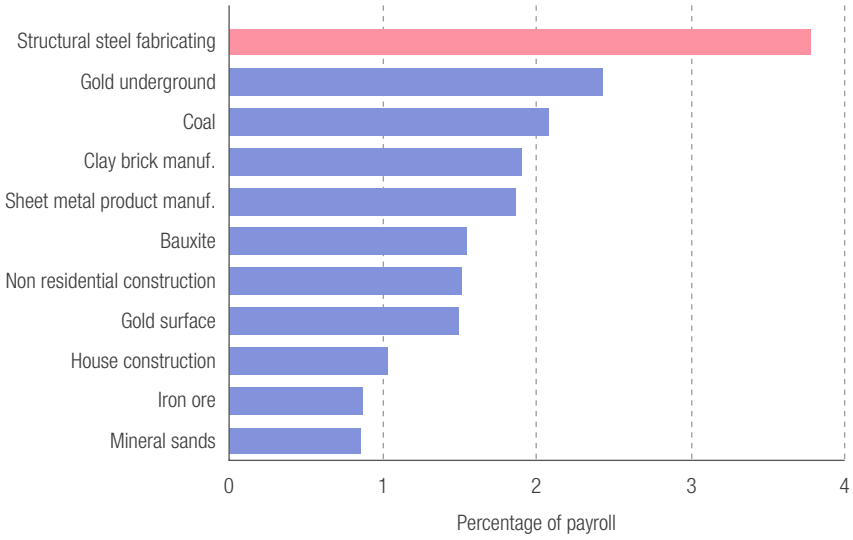


FIGURE 5 RECOMMENDED PREMIUM RATES 2016-17



INJURIES BY COMMODITIES

Metalliferous performance indicators

The performance indicators for the metalliferous mining sector show generally improving results for injuries occurring 2015-16, although with an increase in the average days lost per injury. Figures 6 to 9 depict the performance indicators of incidence, frequency, duration rates and injury index (see page 2 for definitions).

Performance indicator trends for metalliferous mining in 2015-16 are summarised below.

- The overall incidence rate improved by 8%, falling from 3.8 to 3.5. The surface incidence rate improved by 8% (from 3.7 to 3.0), although the underground incidence rate deteriorated by 4% (from 5.1 to 5.3).
- The overall frequency rate improved by 5%, falling from 2.2 to 2.1. The surface frequency rate improved by 5% (from 2.1 to 2.0), while the underground frequency rate deteriorated by 8% (from 2.5 to 2.7).
- The overall duration rate deteriorated by 20%, rising from 19.1 to 23.0. The surface duration rate deteriorated by 17%, rising from 19.3 to 22.6. The underground duration rate deteriorated significantly, by 53 % (rising from 17.0 to 26.0).
- The fall in the frequency rate combined with the larger rise in the duration rate resulted in the overall injury index deteriorating by 17%, from 41 to 48. The surface injury index deteriorated by 12% (from 41 to 46), while the underground injury index deteriorated by 65% (from 43 to 71).

Metalliferous injury percentage breakdown for 2015-16

Appendices D and E 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: Leg and arm injuries, each at 20%, accounted for the largest proportion of underground injuries. Hand injuries, at 15%, accounted for the next largest proportion. Injuries to shoulders made up 87% of arm injuries. Injuries to knees and ankles contributed 50% and 38% of leg injuries respectively.
- Surface: Leg injuries, at 25%, accounted for the largest proportion of surface injuries, followed by hand injuries (24%), arm injuries (19%) and back injuries (13%). Of the leg injuries, 38% were to knees, and 31% were to ankles. Of the arm injuries, 53% were to shoulders and 21% to elbows.

Injuries by nature

- Underground: Sprain or strain was the highest ranking nature of injury for underground injuries at 53%, followed by laceration, at 15%, and fracture at 13%.
- Surface: Sprain or strain was the highest ranking nature of injury for surface injuries at 45%, followed by fracture at 14% then crushing and laceration, at 9.5% and 9.1% respectively.

Injuries by location

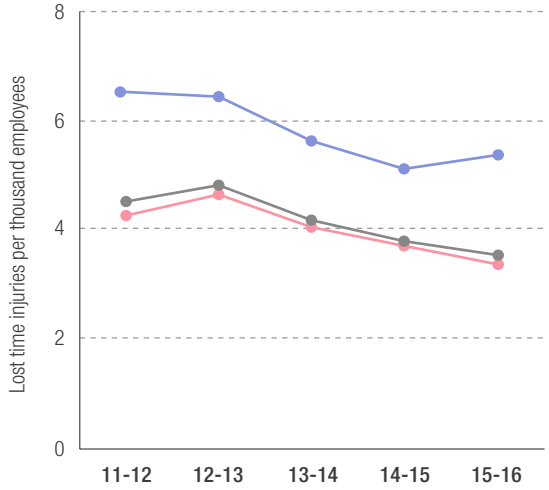
- Underground: The largest proportion of underground injuries occurred in production and development areas (68%), followed by underground access and haulage at 15%.
- Surface: The largest proportion of surface injuries occurred in treatment plants at 40%, followed by open pits at 18% then workshops at 17%.

Injuries by type of accident

- Underground: Over-exertion or strenuous movements was the most common accident type for underground injuries at 28%, followed by stepping at 15%. Caught by or between objects and slip or trip each accounted for 10%.
- Surface: The most common accident type for surface injuries was over-exertion or strenuous movements at 24%, followed by stepping, at 14%, and slip or trip at 13%.

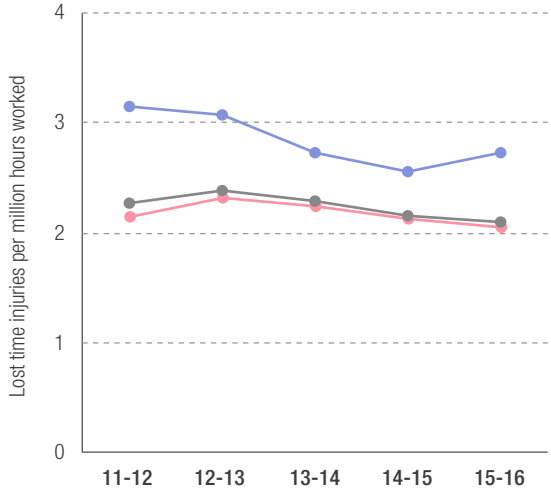
Metalliferous performance indicators 2011-12 to 2015-16

FIGURE 6 INCIDENCE RATE



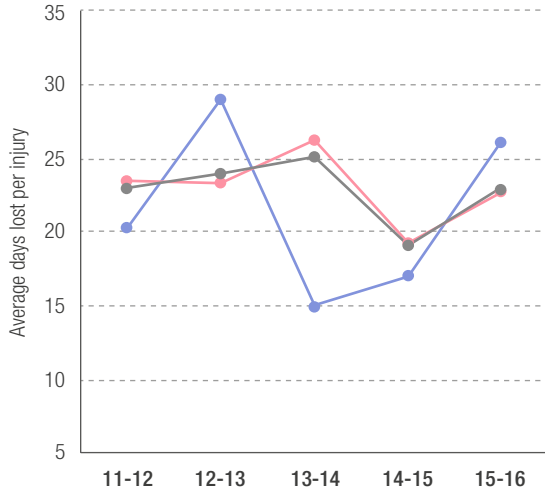
	11-12	12-13	13-14	14-15	15-16
Underground	6.5	6.4	5.6	5.1	5.3
Surface	4.3	4.6	4.0	3.7	3.0
Total	4.5	4.8	4.2	3.8	3.5

FIGURE 7 FREQUENCY RATE



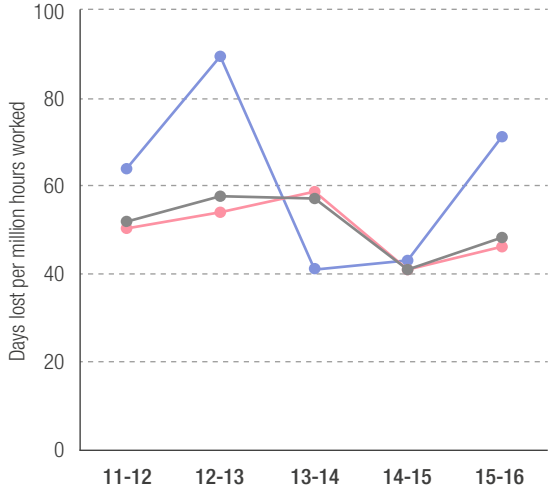
	11-12	12-13	13-14	14-15	15-16
Underground	3.2	3.1	2.7	2.5	2.7
Surface	2.1	2.3	2.2	2.1	2.0
Total	2.3	2.4	2.3	2.2	2.1

FIGURE 8 DURATION RATE



	11-12	12-13	13-14	14-15	15-16
Underground	20.3	28.9	15.1	17.0	26.0
Surface	23.5	23.2	26.1	19.3	22.6
Total	23.0	24.0	25.1	19.1	23.0

FIGURE 9 INJURY INDEX



	11-12	12-13	13-14	14-15	15-16
Underground	64	89	41	43	71
Surface	51	54	59	41	46
Total	52	57	57	41	48

INJURIES BY COMMODITIES CONTINUED

Gold performance indicators

The performance indicators for the gold sector were mixed during 2015-16. Figures 10 to 13 depict the performance indicators of incidence, frequency and duration rates, and injury index.

Performance indicator trends for the gold sector in 2015-16 are summarised below.

- The overall incidence rate improved by 14%, falling from 4.4 to 3.8. The surface incidence rate improved by 20% (from 4.6 to 3.7), although the underground incidence rate deteriorated by 8% (from 3.8 to 4.1).
- The overall frequency rate improved by 8%, falling from 2.5 to 2.3. The surface frequency rate improved by 11% (from 2.7 to 2.4), while the underground frequency rate deteriorated by 11%, rising from 1.9 to 2.1.
- The overall duration rate deteriorated by 33%, rising from 19.6 to 26.1. The surface duration rate deteriorated by 23%, rising from 19.3 to 23.8, and the underground duration rate deteriorated by 59% (from 20.7 to 33.0).
- The overall improvement in the frequency rate and the larger deterioration in the duration rate resulted in a 25% deterioration in the injury index, rising from 48 to 60. The surface injury index deteriorated by 10% (from 51 to 56), and the underground injury index deteriorated by 79% (from 39 to 70).

Gold injury percentage breakdown for 2015-16

Appendices F and G 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: Arm injuries, all of which were to shoulders, made up 22% of underground injuries. Injuries to legs and to trunk accounted for the next largest proportion of underground injuries, each at 17%. 75% of leg injuries were to knees.
- Surface: Leg and hand injuries, at 29% and 23% respectively, were the most common injuries, followed by arm injuries at 20% and back injuries at 12%. 46% of arm injuries were to shoulders and 23% were to elbows. 26% of leg injuries were to knees and 37% were to ankles.

Injuries by nature

- Underground: Sprain or strain was the highest ranking nature of injury for underground injuries at 48%, followed by fracture and laceration, each at 22%.
- Surface: Sprain or strain was the highest ranking nature of injury for surface injuries at 41%, followed by fracture (18%) and laceration (14%).

Injuries by location

- Underground: The largest proportion of underground injuries occurred in production and development (70%), followed by access and haulage ways at 21%.
- Surface: The largest proportion of surface injuries occurred in treatment plants (32%), followed by workshop and open pit, at 23% and 22% respectively.

Injuries by type of accident

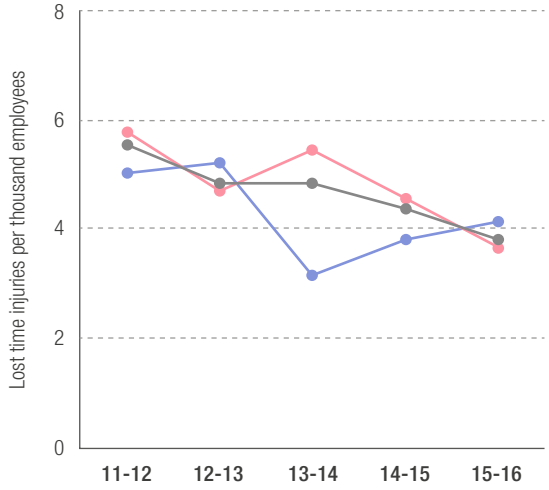
- Underground: Over-exertion or strenuous movements was the most common accident type for underground injuries at 26%, followed by rockfall, slip or trip and stepping, all at 13%.
- Surface: The most common accident type for surface injuries was over-exertion or strenuous movements at 21%, followed by slip or trip at 15%, then caught by or between object at 12%.

Fast facts

- 23% of people in the Western Australian mineral industry worked on gold operations in 2015-16, making it the second largest mineral sector.
- The rate of lost time injuries per million hours worked (LTIFR) for gold was 2.3, compared to 2.2 for all mining.
- Approximately 22% of injuries at gold operations were the type 'over-exertion / strenuous activity' – with most of these resulting in sprain or strain injuries to backs and legs.

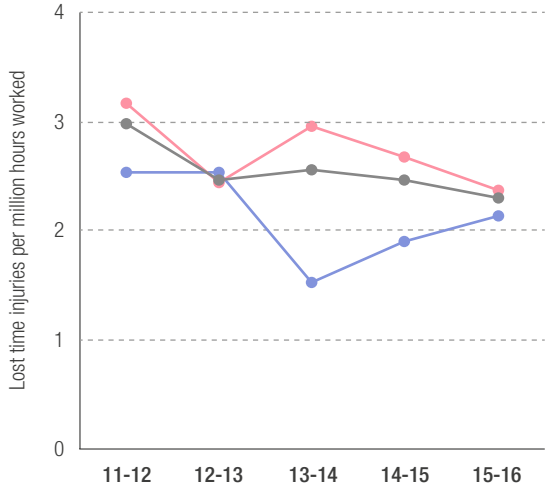
Gold performance indicators 2011-12 to 2015-16

FIGURE 10 INCIDENCE RATE



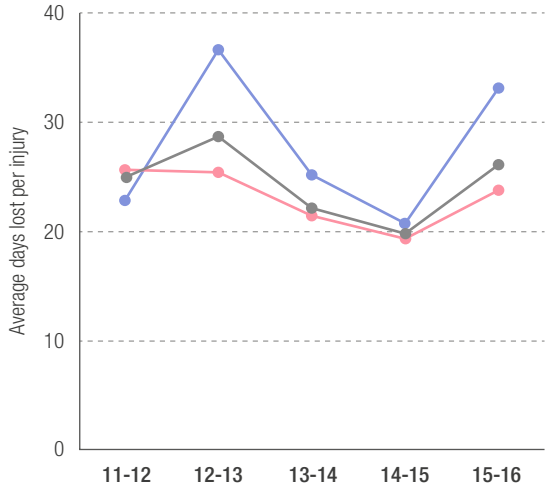
	11-12	12-13	13-14	14-15	15-16
Underground	5.0	5.2	3.2	3.8	4.1
Surface	5.8	4.7	5.4	4.6	3.7
Total	5.5	4.8	4.8	4.4	3.8

FIGURE 11 FREQUENCY RATE



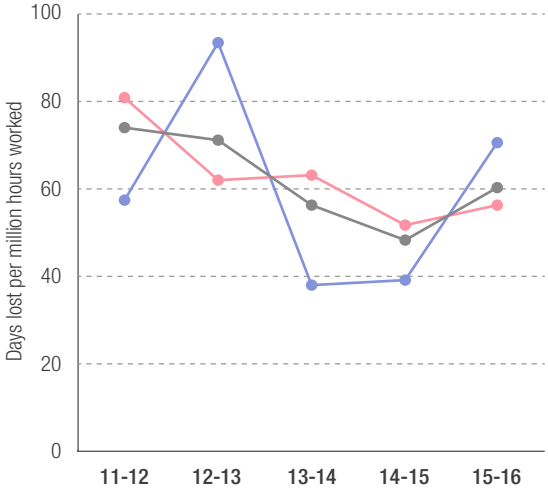
	11-12	12-13	13-14	14-15	15-16
Underground	2.5	2.5	1.5	1.9	2.1
Surface	3.2	2.4	3.0	2.7	2.4
Total	3.0	2.5	2.6	2.5	2.3

FIGURE 12 DURATION RATE



	11-12	12-13	13-14	14-15	15-16
Underground	22.7	36.7	25.1	20.7	33.0
Surface	25.5	25.4	21.4	19.3	23.8
Total	24.8	28.7	22.0	19.6	26.1

FIGURE 13 INJURY INDEX



	11-12	12-13	13-14	14-15	15-16
Underground	58	93	38	39	70
Surface	81	62	63	51	56
Total	74	71	56	48	60

INJURIES BY COMMODITIES CONTINUED

Iron ore performance indicators

The performance indicators for the iron ore sector showed an overall deterioration during 2015-16. Figures 14 to 17 depict the performance indicators of incidence, frequency and duration rates, and injury index.

Performance indicator trends for the iron ore sector in 2015-16 are summarised below.

- The incidence rate deteriorated by 9%, rising from 2.2 to 2.4.
- The frequency rate deteriorated by 8%, rising from 1.3 to 1.4.
- The duration rate deteriorated by 17%, rising from 19.4 to 22.7.
- The rise in both the frequency rate and the duration rate resulted in a deterioration of 33% in the injury index (from 24 to 32).

Iron ore injury percentage breakdown for 2015-16

Appendix H 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 27%, accounted for the largest proportion of injuries, followed closely by leg injuries at 26%. Arm injuries, at 16%, contributed the next highest proportion.
- Of the leg injuries, 45% were to ankles and 30% were to knees. 50% of arm injuries were to shoulders.

Injuries by nature

- Sprain or strain was the highest ranking nature of injury at 41%.
- Fracture was the second highest ranking nature of injury at 14%, followed by crushing at 11%.

Injuries by location

- The largest proportion of injuries occurred in treatment plants, which accounted for 32%. The second largest proportion occurred in open pits at 24%, followed by workshops at 21%.

Injuries by type of accident

- Over-exertion or strenuous movement was the most common type of accident resulting in injury, at 21%.
- Stepping, at 19%, was the next most common type of accident, followed by slip or trip at 12%, then struck by object at 10%

Fast facts

- 52% of people in the Western Australian mineral industry worked on iron ore operations in 2015-16.
- The rate of lost time injuries per million hours worked (LTIFR) for iron ore was 1.4, compared to 2.2 for all mining.
- Iron ore had the lowest LTIFR of the 10 highest-employing mining sectors.
- More than one in five of injuries at iron ore operations were the type 'over-exertion / strenuous activity' – with most of these resulting in sprain or strain injuries to arms, backs and legs.

Iron ore performance indicators 2011-12 to 2015-16

FIGURE 14 INCIDENCE RATE

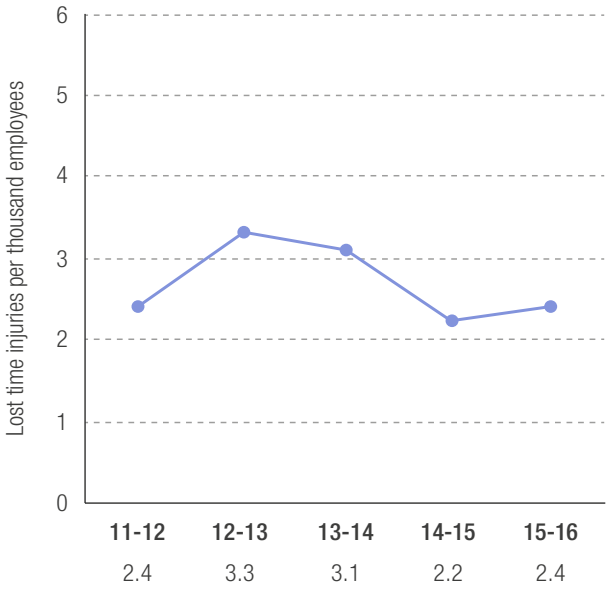


FIGURE 15 FREQUENCY RATE

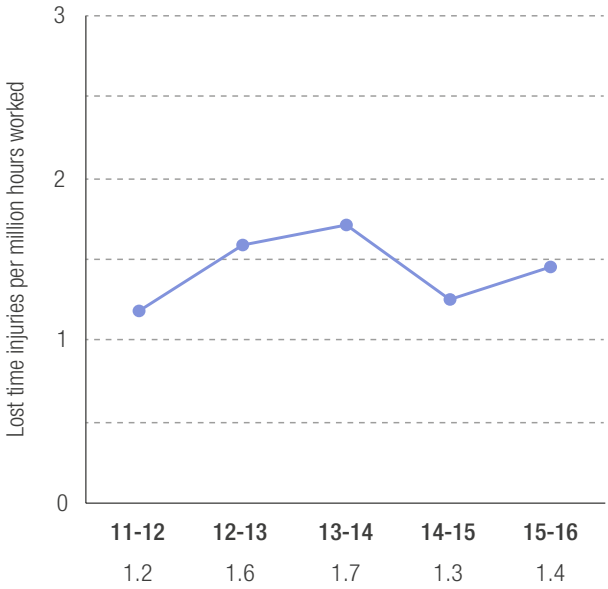


FIGURE 16 DURATION RATE

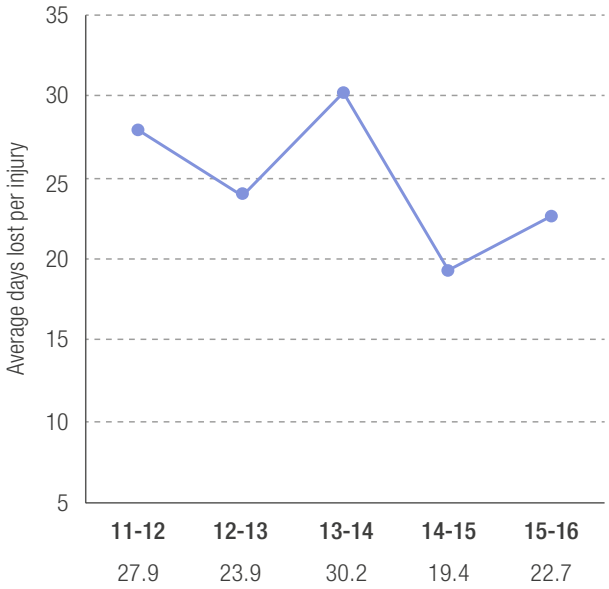
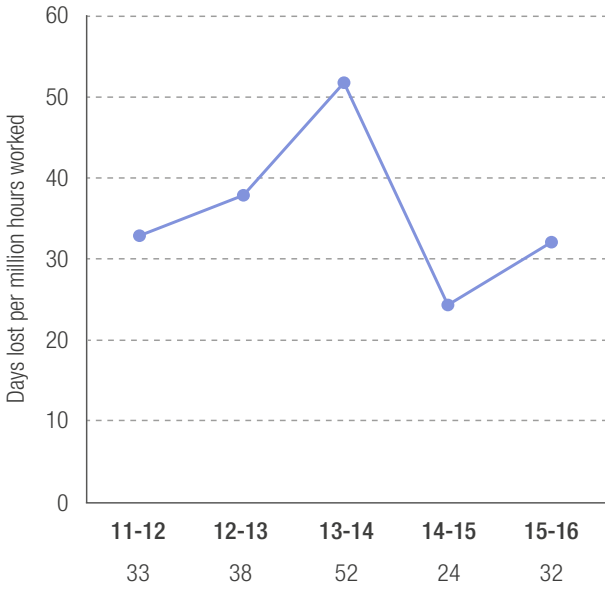


FIGURE 17 INJURY INDEX



INJURIES BY COMMODITIES CONTINUED

Bauxite and alumina performance indicators

The performance indicators for the bauxite and alumina sector improved in 2015-16. Figures 18 to 21 depict the performance indicators of incidence, frequency and duration rates, and injury index.

Performance indicator trends for the bauxite and alumina sector in 2015-16 are summarised below.

- The incidence rate remained unchanged from 2014-15, at 7.5.
- The frequency rate deteriorated by 2%, rising from 4.0 to 4.1.
- The duration rate improved by 34%, falling from 18.0 to 11.9.
- The slight deterioration in the frequency rate combined with the strong improvement in the duration rate resulted in the injury index improving by 32%, falling from 72 to 49.

Bauxite and alumina injury percentage breakdown for 2015-16

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

- Arm injuries accounted for the largest proportion of injuries at 30%. Of these arm injuries, 75% were to shoulders.
- Leg injuries were the next highest proportion of injuries, at 24%, followed by hand injuries and back injuries, at 22% and 9% respectively. 69% of leg injuries were to knees.

Injuries by nature

- Sprain or strain was the highest ranking nature of injury at 57%.
- Laceration was the second highest ranking nature of injury at 13%, followed by crushing and effects of chemicals or fumes, both at 7%.

Injuries by location

- The largest proportion of injuries occurred in treatment plants, accounting for 72%.
- The next largest proportion of injuries occurred in workshops (11%), followed by general surface areas (9%).

Injuries by type of accident

- Over-exertion or strenuous movements was the most common type of accident resulting in injury (35%).
- Stepping, at 13%, contributed the next highest proportions of injury, followed by caught by or between objects and contact with tool, both at 11%.

Fast facts

- 7% of people in the Western Australian mineral industry in 2015-16 worked on bauxite or alumina operations, the third largest employer in the mineral industry.
- The rate of lost time injuries per million hours worked (LTIFR) for bauxite/alumina was 4.1, compared to 2.2 for all mining.
- Bauxite/alumina had the second highest LTIFR of the 10 highest-employing mining sectors, after coal.
- 35% of injuries at bauxite/alumina operations were the type 'over-exertion / strenuous activity', predominantly resulting in sprain or strain injuries to arms.

Bauxite and alumina performance indicators 2011-12 to 2015-16

FIGURE 18 INCIDENCE RATE

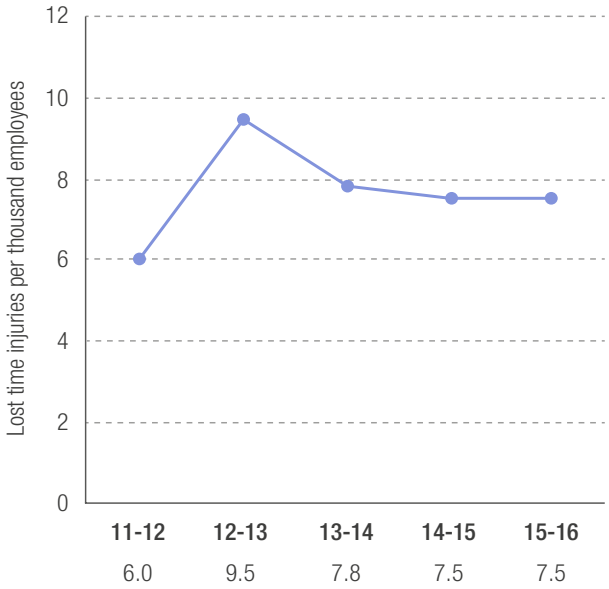


FIGURE 19 FREQUENCY RATE

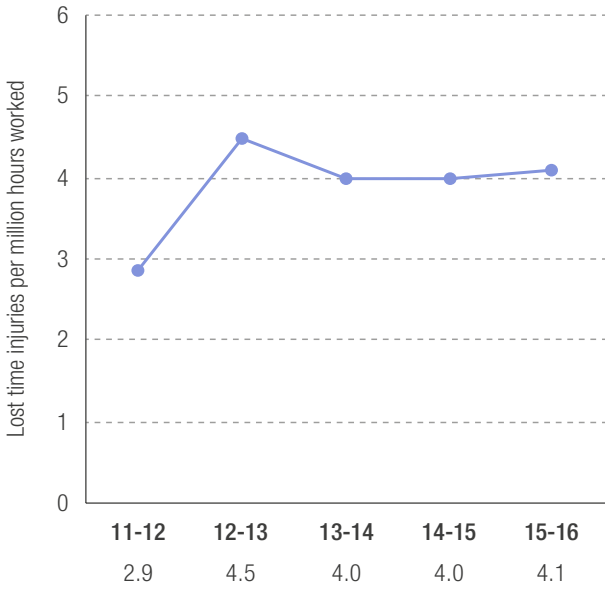


FIGURE 20 DURATION RATE

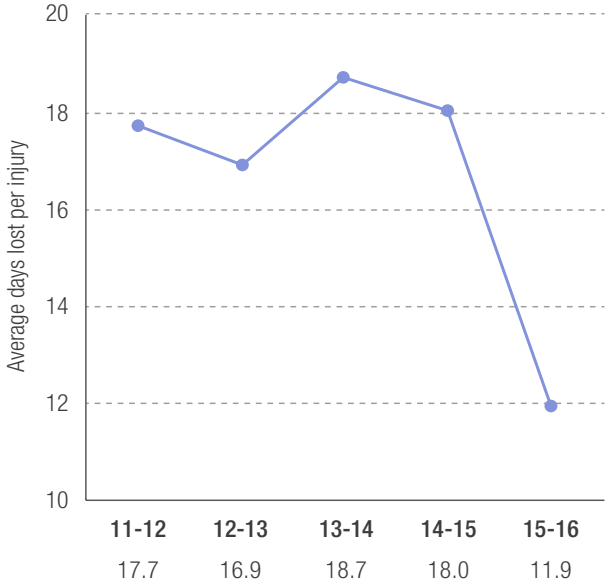
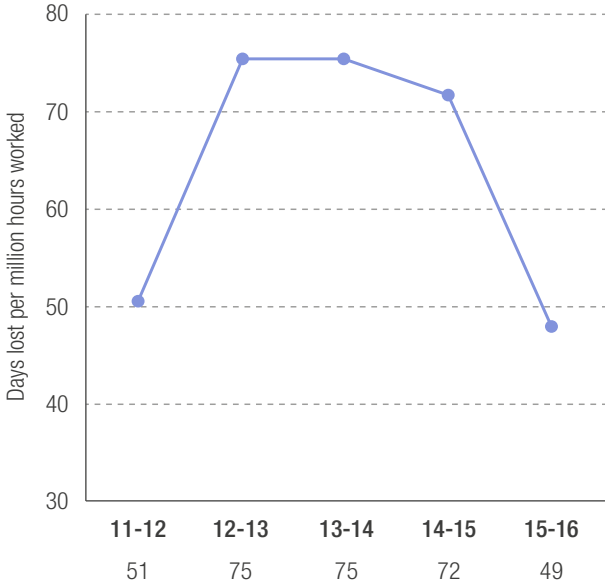


FIGURE 21 INJURY INDEX



INJURIES BY COMMODITIES CONTINUED

Nickel performance indicators

The performance indicators for the nickel sector showed an overall deterioration for 2015-16. Figures 22 to 25 depict the performance indicators of incidence, frequency and duration rates, and injury index.

Performance indicator trends for the nickel sector in 2015-16 are summarised below.

- The overall incidence rate improved by 3%, falling from 6.2 to 6.0. The surface incidence rate improved by 5%, (from 5.6 to 5.3), while the underground incidence rate deteriorated by 16%, (from 8.8 to 10.2).
- The overall frequency rate improved by 9%, falling from 3.3 to 3.0. The surface frequency rate improved by 10% (from 3.0 to 2.7), while the underground frequency rate deteriorated by 12% (from 4.3 to 4.8).
- The overall duration rate deteriorated strongly by 90%, rising from 17.2 to 32.6. The surface duration rate deteriorated by 83% (from 20.0 to 36.5), while the underground duration rate deteriorated by 114% (from 9.3 to 19.9).
- The fall in frequency rate was offset by the large rise in duration rate, resulting in a deterioration of 75% in the injury index, rising from 56 to 98. The surface injury index deteriorated by 65% (from 60 to 99), and the underground injury index deteriorated by 140% (from 40 to 96).

Nickel injury percentage breakdown for 2015-16

- Appendices J and K 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: Back, hand and leg injuries together accounted for six of the eight underground injuries reported, with two injuries or 25% of the total each.
- Surface: Leg injuries, at 31%, accounted for the largest proportion of the twenty-six surface injuries, followed by arm injuries at 27% and back at 19%. Of the leg injuries knee and ankle injuries each accounted for 25%.

Injuries by nature

- Underground: Sprain or strain was the highest ranking nature of injury for underground injuries at 62.5%, followed by crushing and pain, at 25% and 12.5% respectively.
- Surface: Sprain or strain was the highest ranking nature of injury for surface injuries at 50%, followed by fracture at 27%.

Injuries by location

- Underground: The largest proportion of underground injuries occurred in production and development areas (87.5%), with the remaining injury occurring in an underground workshop (12.5%).
- Surface: The largest proportion of surface injuries occurred in treatment plants (54%), followed by general surface areas at 15%.

Injuries by type of accident

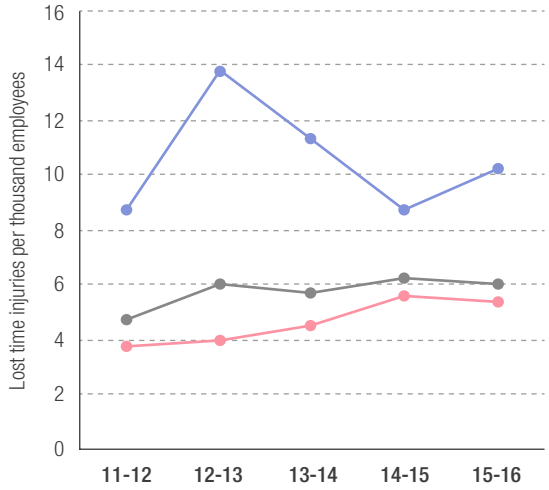
- Underground: Caught by or between objects, over-exertion or strenuous movements and stepping were equally the most common accident type for underground injuries at 25% or 2 injuries each, followed by fall getting on or off and struck against object, each at 12.5%.
- Surface: The most common accident type for surface injuries was over-exertion or strenuous movements at 27%, followed by slip or trip and stepping, each at 15%.

Fast facts

- 6% of people in the WA mineral industry in 2015-16 worked on nickel operations, the fourth largest employer in the mineral industry.
- The rate of lost time injuries per million hours worked (LTIFR) for nickel was 3.0, compared to 2.2 for all mining.
- Over-exertion / strenuous activity at 26% of accidents, was the most common type for nickel and resulted in sprain and strain injuries, mostly to the back and arms.
- Stepping resulted in 18% of injuries for nickel, leading to strain and sprain injuries of the legs, especially to knees.

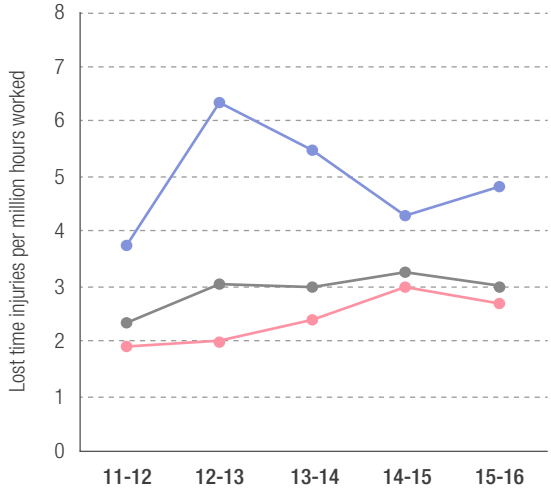
Nickel performance indicators 2011-12 to 2015-16

FIGURE 22 INCIDENCE RATE



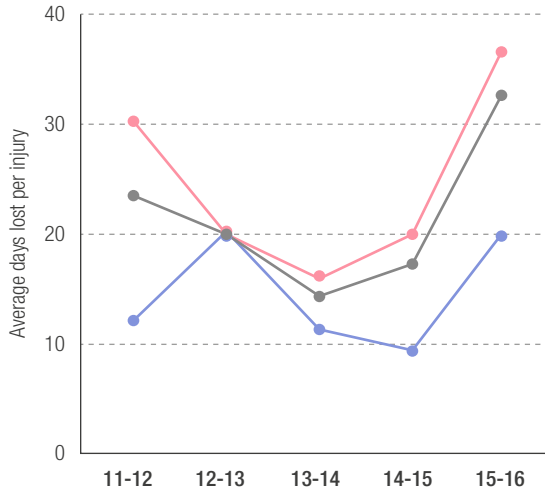
	11-12	12-13	13-14	14-15	15-16
Underground	8.7	13.8	11.3	8.8	10.2
Surface	3.7	4.0	4.5	5.6	5.3
Total	4.7	6.0	5.7	6.2	6.0

FIGURE 23 FREQUENCY RATE



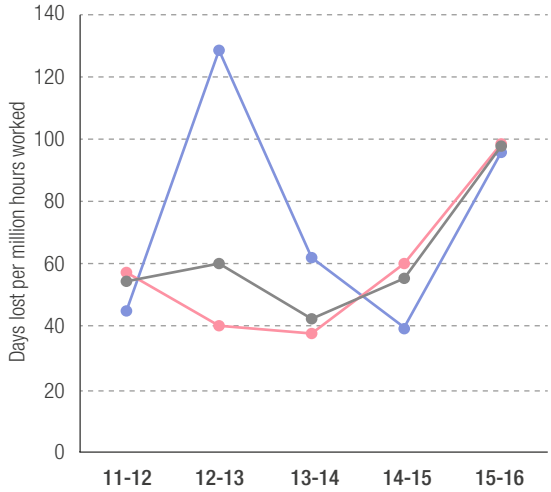
	11-12	12-13	13-14	14-15	15-16
Underground	3.7	6.4	5.5	4.3	4.8
Surface	1.9	2.0	2.4	3.0	2.7
Total	2.3	3.0	3.0	3.3	3.0

FIGURE 24 DURATION RATE



	11-12	12-13	13-14	14-15	15-16
Underground	12.1	20.1	11.4	9.3	19.9
Surface	30.2	19.8	15.9	20.0	36.5
Total	23.6	20.0	14.3	17.2	32.5

FIGURE 25 INJURY INDEX



	11-12	12-13	13-14	14-15	15-16
Underground	45	128	63	40	96
Surface	58	40	38	60	99
Total	55	60	43	56	98

EXPLORATION INJURIES

Exploration performance indicators

The performance indicators for the mineral exploration sector showed an overall deterioration for 2015-16. Figures 26 to 29 depict the performance indicators of incidence, frequency and duration rates, and injury index.

Performance indicator trends for the exploration sector in 2015-16 are summarised below.

- The incidence rate deteriorated by 26%, rising from 4.6 to 5.8.
- The frequency rate deteriorated by 32%, rising from 2.5 to 3.3.
- The duration rate deteriorated by 76%, rising from 14.8 to 26.1.
- The rise in both duration rate and frequency rate resulted in a deterioration of 136% in the injury index, rising from 37 to 87.

Exploration injury percentage breakdown for 2015-16

Appendix L 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 and leg injuries, at 23% each, accounted equally for the largest proportion of the thirteen exploration injuries, followed by back, foot and toes, and general injuries, each at 15%.

Injuries by nature

- Fracture was the highest ranking nature of injury for surface injuries at 31%, followed equally by exposure to heat, laceration and sprain or strain, each at 15%.

Injuries by location

- The largest proportion of surface injuries occurred in exploration areas (92%), with one injury, or 8%, occurring in an administration area.

Injuries by type of accident

- The most common accident types for injuries were caught by machine, exposure to environmental heat and fall from height, each contributing 15%.

Fast facts

- 2,223 people worked in exploration operations in 2015-16, approximately 2% of the total number of people working in mining and exploration.
- The most commonly reported nature of injury was fracture, contributing 4 of the 13 exploration lost time injuries. Two of the fractures were to legs, one to foot and toes, and one to the spine.
- The lost time injury frequency rate (LTIFR) for exploration was 3.3. This is higher than the mining average of 2.2, but comparable to that of nickel or construction material mining operations (3.0 and 3.5 respectively).

Exploration performance indicators 2011-12 to 2015-16

FIGURE 26 INCIDENCE RATE

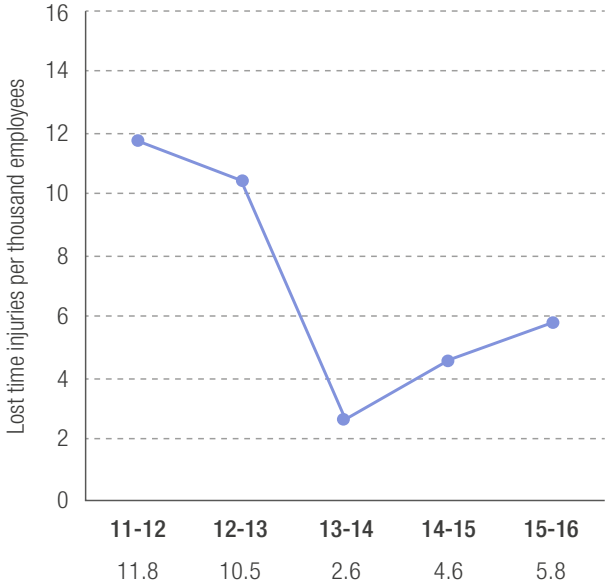


FIGURE 27 FREQUENCY RATE

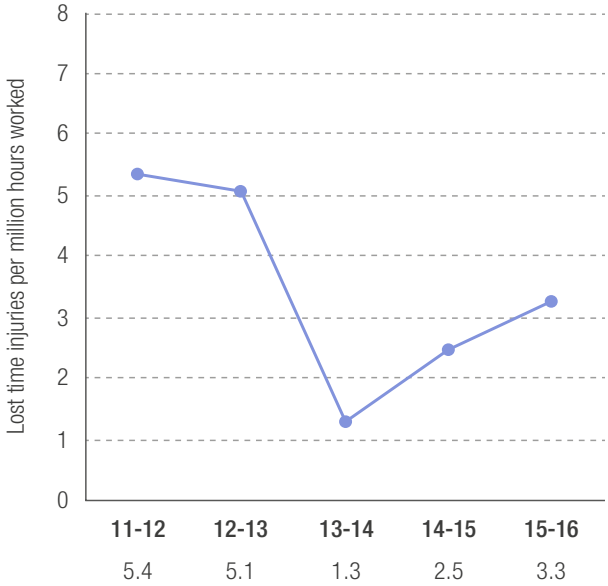


FIGURE 28 DURATION RATE

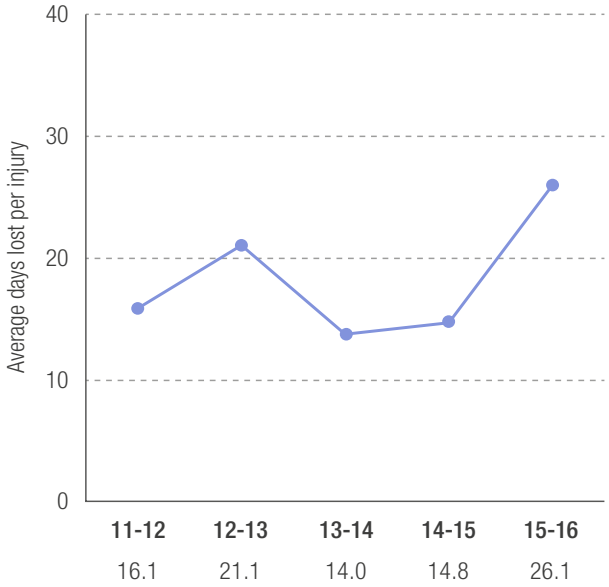
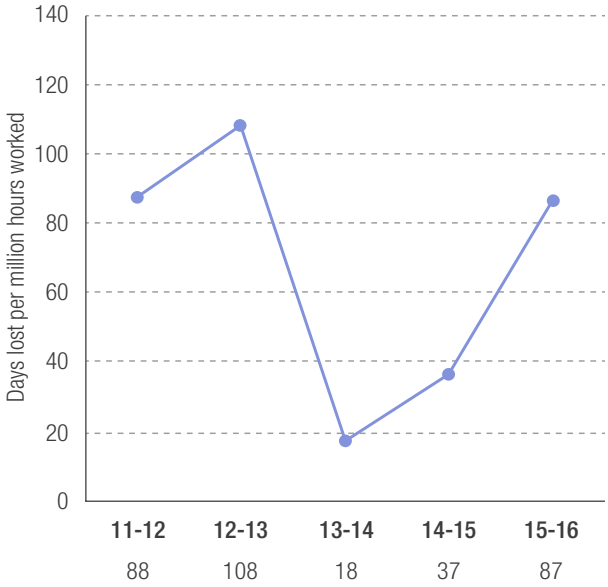


FIGURE 29 INJURY INDEX



RESTRICTED WORK INJURIES

Review of restricted work injuries during 2015-16

In addition to the 377 mining LTIs in 2015-16, there were 752 restricted work injuries (RWIs) reported (742 in metalliferous mines and 10 in coal mines), bringing the total number of mining reportable injuries to 1,129. In 2015-16 there were also 13 exploration LTIs and 18 exploration RWIs reported, resulting in 31 reportable injuries. A breakdown of these data with performance indicators is shown in Tables 10 and 11.

Of the restricted work injuries, 555 mining and 11 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 2015-16

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	93,729	641	6.8	4.1	958	10.2	6.2
Metalliferous underground	7,486	101	13.5	6.9	141	18.8	9.6
Metalliferous total	**101,215**	**742**	**7.3**	**4.4**	**1,099**	**10.9**	**6.5**
Coal total	**1,128**	**10**	**8.9**	**5.9**	**30**	**26.6**	**17.7**
Total mining	**102,343**	**752**	**7.3**	**4.4**	**1,129**	**11.0**	**6.6**
Exploration	**2,223**	**18**	**8.1**	**4.6**	**31**	**13.9**	**7.9**

TABLE 11 RESTRICTED WORK INJURIES BY MINERAL MINED 2015-16

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	53,099	269	5.1	3.0	396	7.5	4.4
Gold	23,509	209	8.9	5.4	298	12.7	7.7
Bauxite and alumina	7,234	134	18.5	10.1	188	26.0	14.2
Nickel	5,645	84	14.9	7.5	118	20.9	10.5
Base metals	2,358	20	8.5	5.1	30	12.7	7.6
Mineral sands	2,336	9	3.9	3.2	15	6.4	5.3
Construction materials	1,588	3	1.9	2.1	8	5.0	5.7
Coal	1,128	10	8.9	5.9	30	26.6	17.6
Diamonds	988	2	2.0	1.2	5	5.1	3.0
Salt	869	2	2.3	1.8	5	5.8	4.4
Manganese ore	335	3	9.0	4.8	3	9.0	4.8
Tin, tantalum and lithium	773	3	3.9	2.1	7	9.1	5.0
Other	2481	4	1.6	1.2	26	10.5	8.0
Total mining	**102,343**	**752**	**7.3**	**4.4**	**1,129**	**11.0**	**6.6**

RESTRICTED WORK INJURIES CONTINUED

Restricted work injury performance indicators

The restricted work injury performance indicators for the mining sector deteriorated during 2015-16. Figures 30 to 33 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 deteriorated by 3%, rising from 7.1 to 7.3. The surface incidence rate deteriorated by 6% (from 6.5 to 6.9), while the underground incidence rate improved by 12% (from 15.4 to 13.5). The incidence rate for exploration deteriorated by 76%, rising from 4.6 to 8.1.
- The overall frequency rate deteriorated by 10%, rising from 4.0 to 4.4. The surface frequency rate deteriorated by 11%, rising from 3.7 to 4.1, and the underground frequency rate improved by 10%, falling from 7.7 to 6.9. The frequency rate for exploration deteriorated by 84%, rising from 2.5 to 4.6.
- The average days off per restricted work injury deteriorated by less than 0.4%, rising from 47.0 to 47.2. The days off per surface restricted work injury improved by 4% (from 48.6 to 46.8), and the days off per underground restricted work injury deteriorated by 31% (from 37.9 to 49.6). Average days off per restricted work injury for exploration improved by 46%, falling from 59.6 to 32.3.
- The rise in both the frequency rate and days off per restricted work injury resulted in a deterioration of 8% in the overall days off per million hours worked for mining, from 190 to 206. The days off per surface million hours worked deteriorated by 7% (from 181 to 194), and the days off per million hours worked underground deteriorated by 17% (from 292 to 342). Exploration days off per million hours worked deteriorated by 1%, rising from 148 to 149.

Restricted work injury percentage breakdown for 2015-16

Appendices M, N and O 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: Arm and leg injuries equally accounted for the largest proportion of underground injuries, at 23% each, followed by hand injuries at 22% and back injuries at 19%. The largest proportions of arm injuries were to shoulders (39%) and elbows (17%), while injuries to ankles and knees contributed the largest proportions of leg injuries (at 52% and 35% respectively).
- Surface: Hand injuries accounted for the largest proportion of surface restricted work injuries at 25%, followed closely by arm injuries at slightly less than 25%, leg injuries at 20% and back injuries at 18%. Of the arm injuries, 40% were to shoulders, 22% were to wrists and 21% were to elbows. Of the leg injuries, 46% were to knees and 37% were to ankles.
- Exploration: Hand injuries accounted for 44% of RWIs, followed by arm and leg injuries, each at 17%.

Injuries by nature

- Underground: Sprain or strain was the highest ranking nature of injury for underground restricted work injuries at 55%, followed by laceration at 10% and fracture at 8%.
- Surface: Sprain or strain was the highest ranking nature of injury for surface restricted work injuries at 54%, followed by laceration at 11%, then pain at 10%.
- Exploration: Sprain or strain, at 39%, contributed the highest proportion of injuries, followed by crushing (22%) and laceration (17%).

Injuries by location

- Underground: The largest proportion of underground injuries occurred in production and development areas (75%), followed by access and haulage ways at 14% then underground workshop, at 6%.
- Surface: The largest proportion of surface injuries occurred in treatment plants (40%) followed by open pits (20%), and workshops (19%).
- Exploration: 89% of RWIs were in general exploration areas, while a further 11% were in the core workshops.

Injuries by type

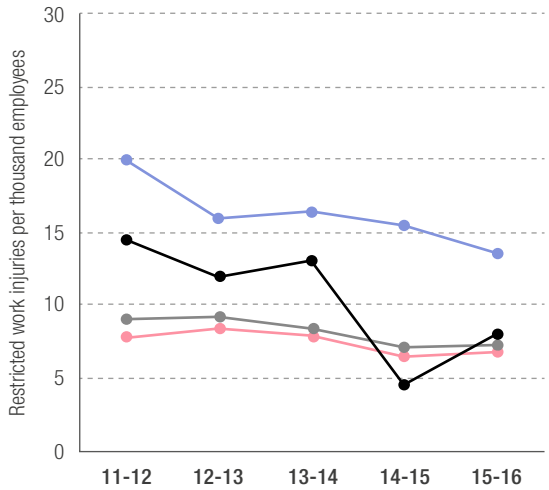
- Underground: Over-exertion or strenuous movement at 35% was the most common accident type for underground injuries, followed by stepping at 16%, then struck by object at 15%
- Surface: The most common accident type for surface injuries was over-exertion or strenuous movements at 36%, followed by stepping at 12% and caught by or between objects, at 10%.
- Exploration: Caught by or between objects, at 39%, was the most common type of accident, followed by over exertion or strenuous movement at 22%.

Fast facts

- There were 752 mining and 18 exploration restricted work injuries (RWIs) in 2015-16.
- RWIs resulted in 19,977 days of restricted work or hours being performed.
- LTIs resulted in a further 11,678 restricted work days from people returning from time off but not yet able to work their previous tasks or hours.
- 1,160 lost time and restricted work injuries (together referred to as 'reportable injuries' in this publication) resulted in 8,995 days lost and 31,655 days of restricted work, a total of 40,650 days.

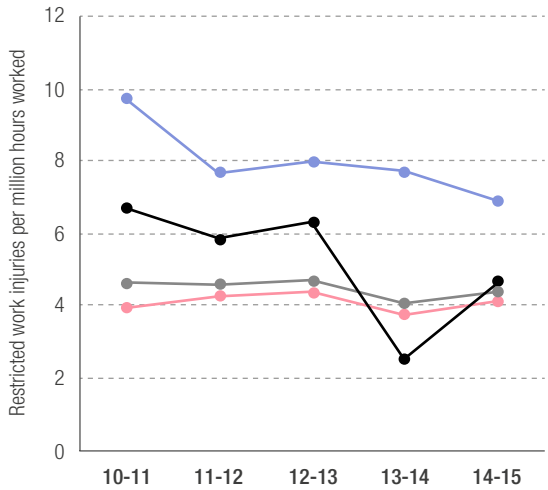
Restricted work injury performance indicators 2011-12 to 2015-16

FIGURE 30 INCIDENCE RATE



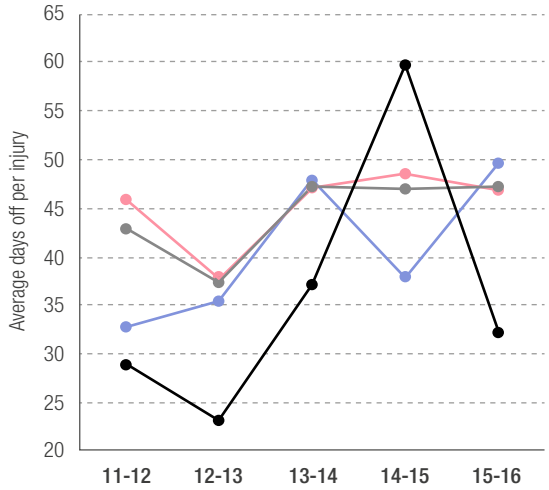
	11-12	12-13	13-14	14-15	15-16
Underground	20.0	15.9	16.4	15.4	13.5
Surface	7.8	8.5	7.9	6.5	6.9
Total mining	9.1	9.2	8.5	7.1	7.3
Exploration	14.5	11.9	13.0	4.6	8.1

FIGURE 31 FREQUENCY RATE



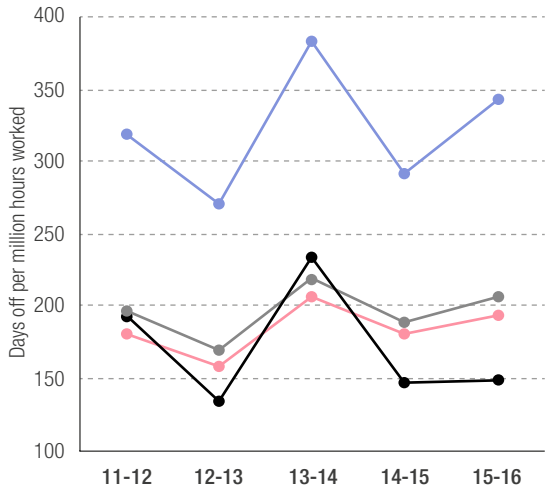
	10-11	11-12	12-13	13-14	14-15
Underground	9.7	7.6	8.0	7.7	6.9
Surface	4.0	4.2	4.4	3.7	4.1
Total mining	4.6	4.6	4.7	4.0	4.4
Exploration	6.7	5.8	6.3	2.5	4.6

FIGURE 32 DURATION RATE



	11-12	12-13	13-14	14-15	15-16
Underground	32.8	35.4	48.0	37.9	49.6
Surface	46.0	37.8	47.1	48.6	46.8
Total mining	42.9	37.4	47.2	47.0	47.2
Exploration	28.8	23.1	37.1	59.6	32.3

FIGURE 33 INJURY INDEX



	11-12	12-13	13-14	14-15	15-16
Underground	318	271	383	292	342
Surface	182	160	207	181	194
Total mining	197	171	220	190	206
Exploration	193	135	234	148	149

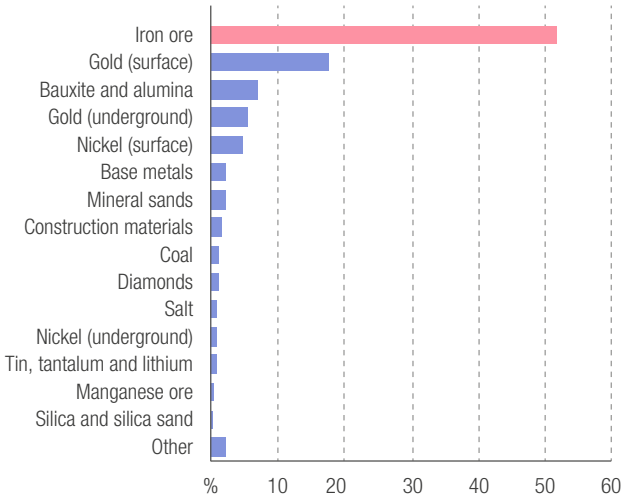
APPENDICES

APPENDIX A

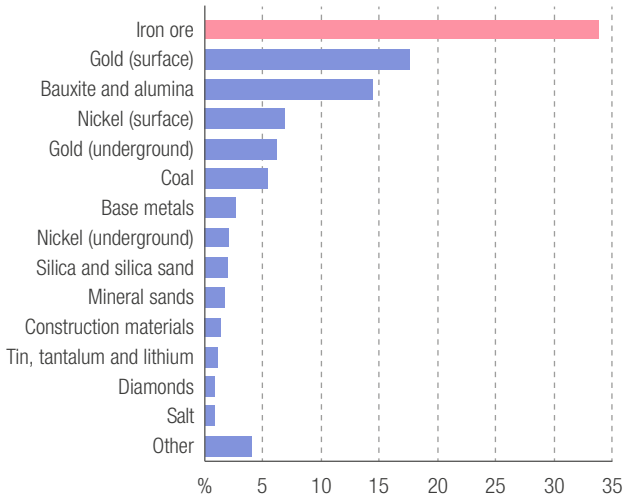
WESTERN AUSTRALIAN MINES 2015-16

377 lost time injuries

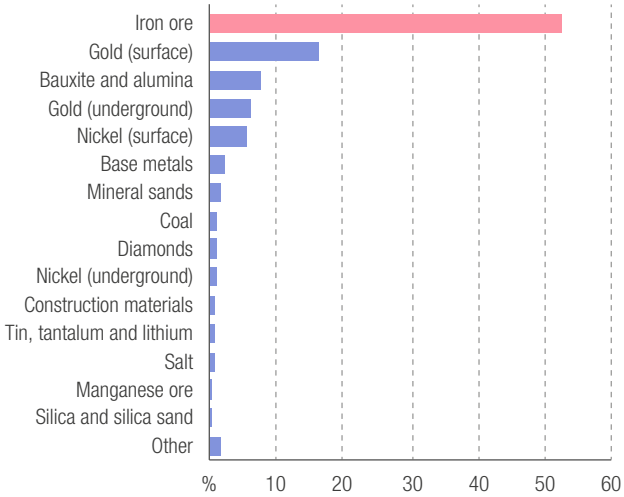
PERCENTAGE OF EMPLOYEES



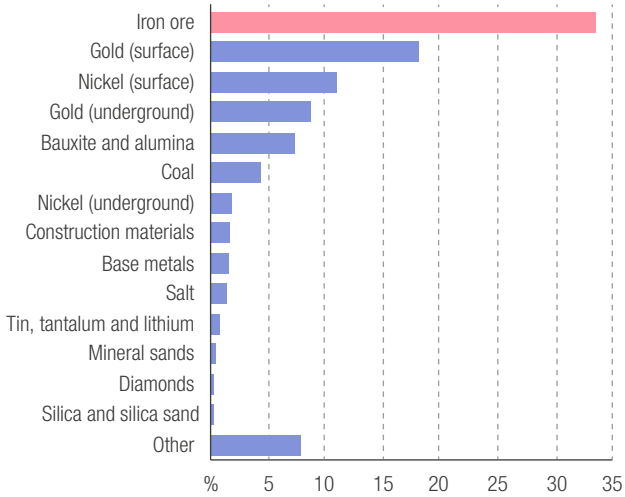
PERCENTAGE OF INJURIES



PERCENTAGE OF HOURS WORKED



PERCENTAGE OF WORK DAYS LOST

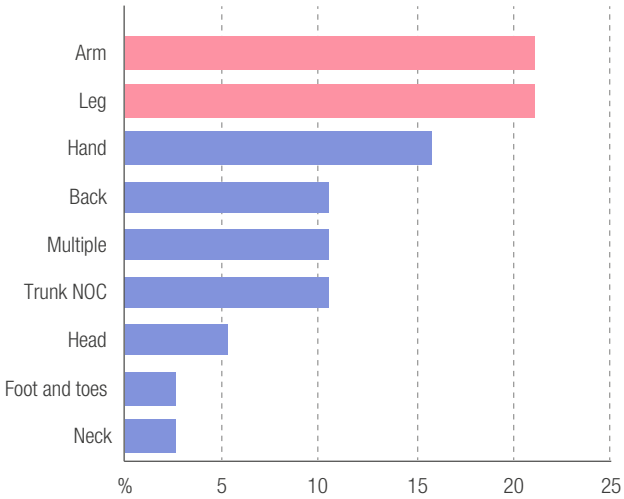


APPENDIX B

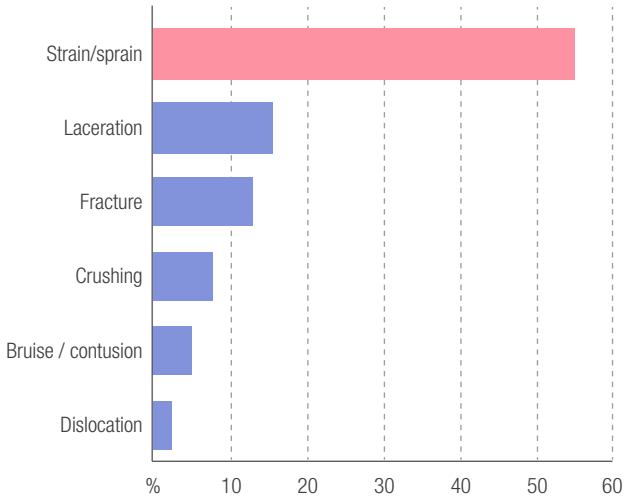
SERIOUS INJURIES UNDERGROUND 2015-16

38 lost time injuries

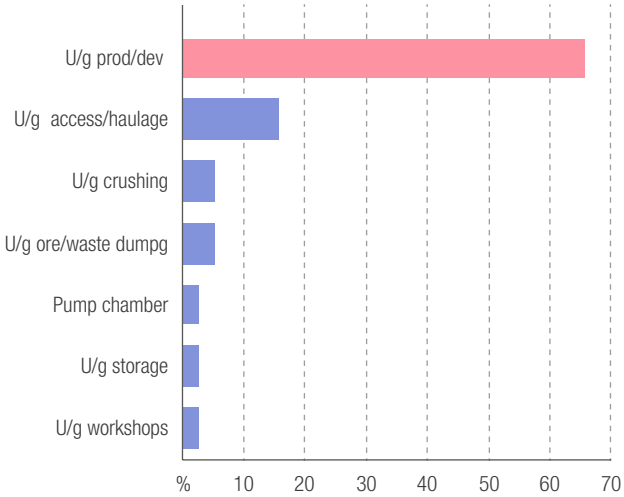
PART OF BODY



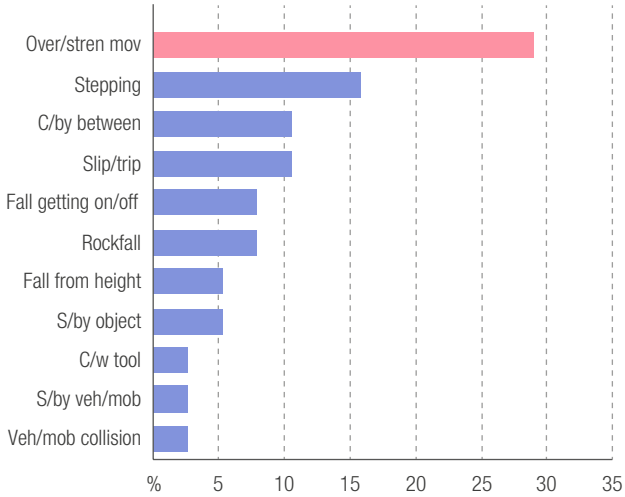
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

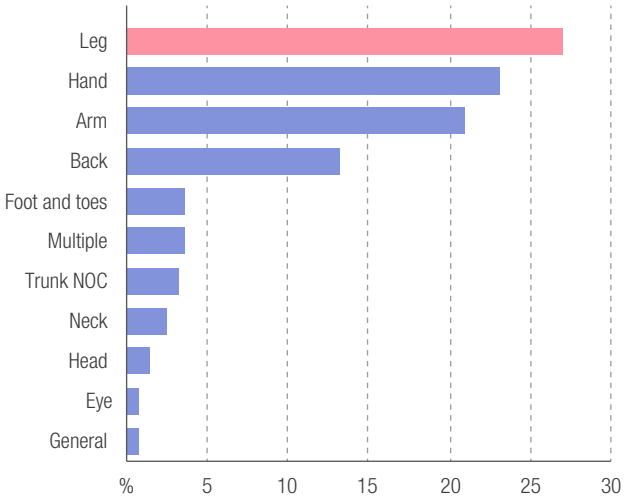


APPENDIX C

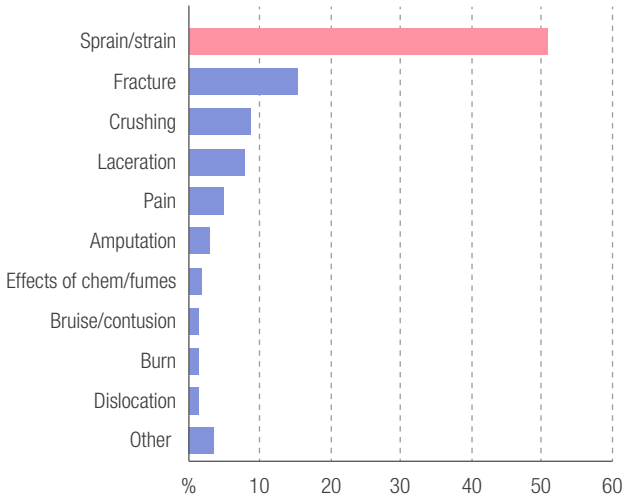
SERIOUS INJURIES SURFACE 2015-16

281 lost time injuries

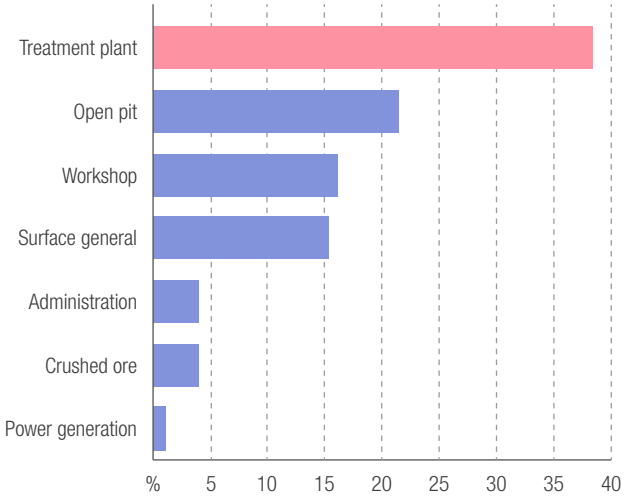
PART OF BODY



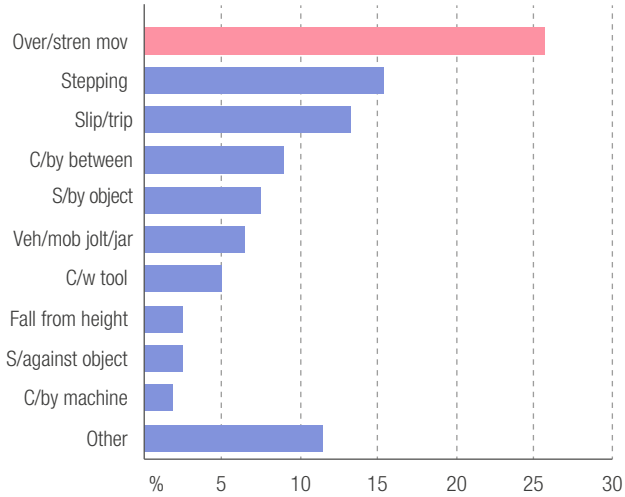
NATURE OF INJURY



LOCATION OF ACCIDENT



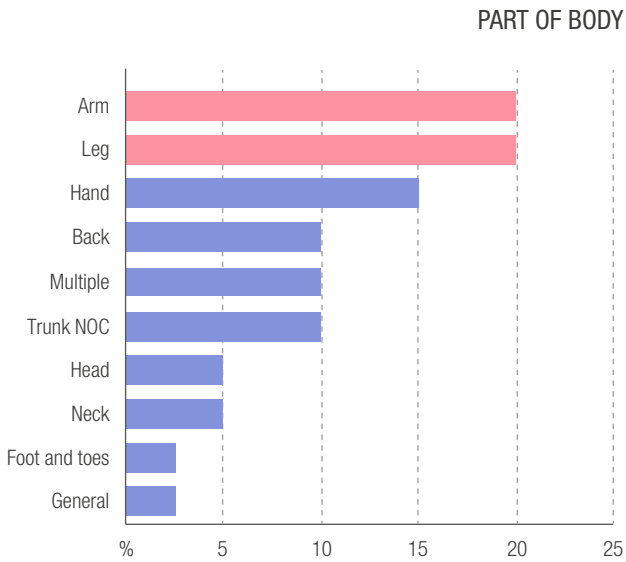
TYPE OF ACCIDENT

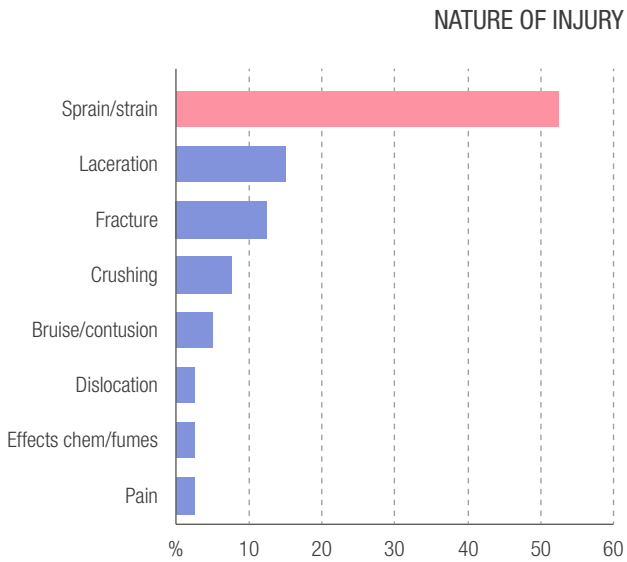


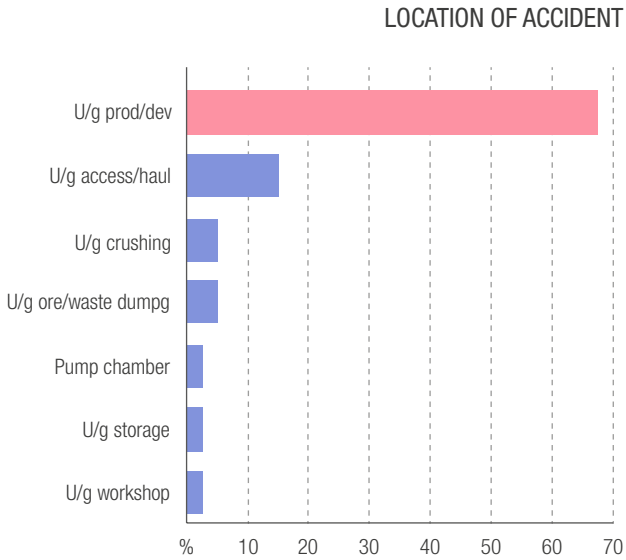
APPENDIX D

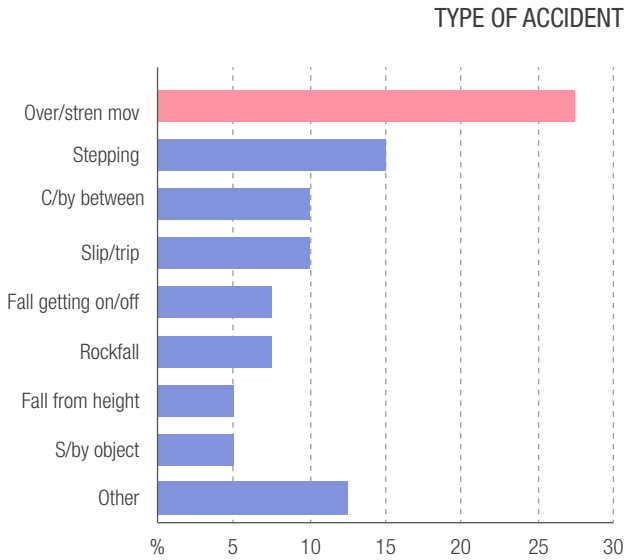
METALLIFEROUS UNDERGROUND INJURIES 2015-16

40 lost time injuries







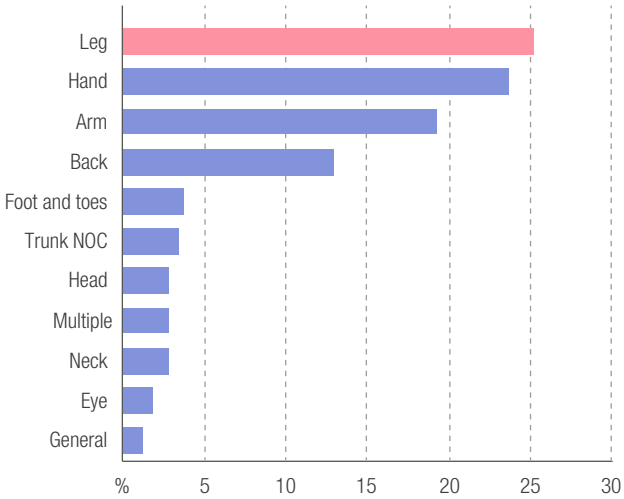


APPENDIX E

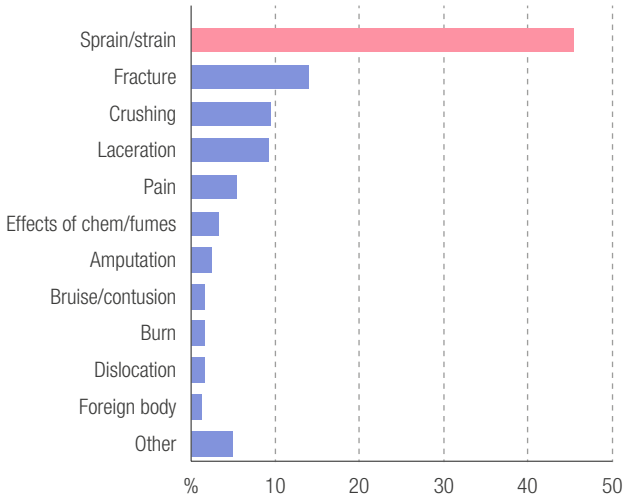
METALLIFEROUS SURFACE INJURIES 2015-16

317 lost time injuries

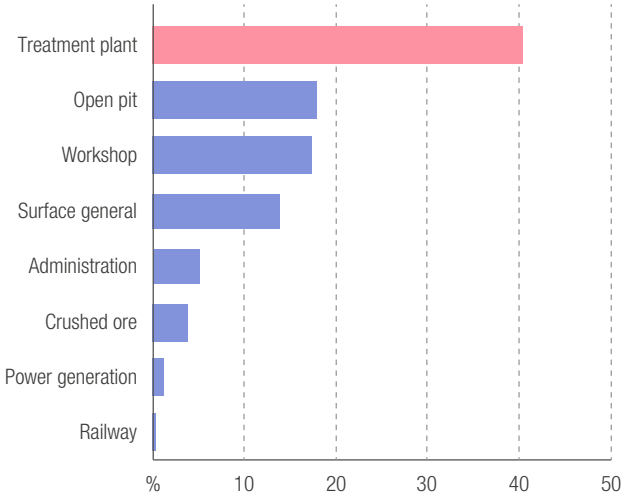
PART OF BODY



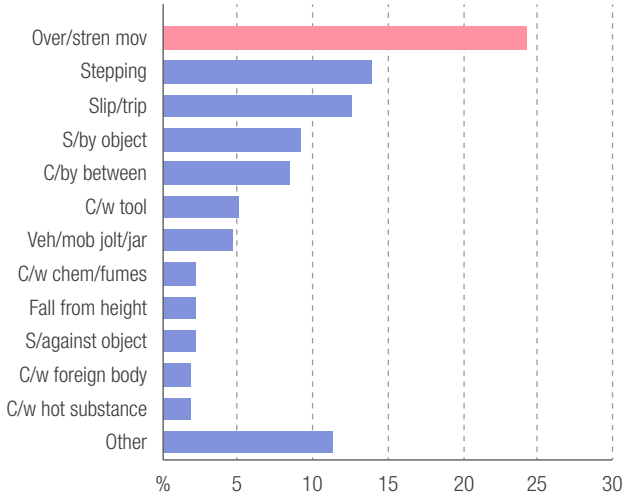
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

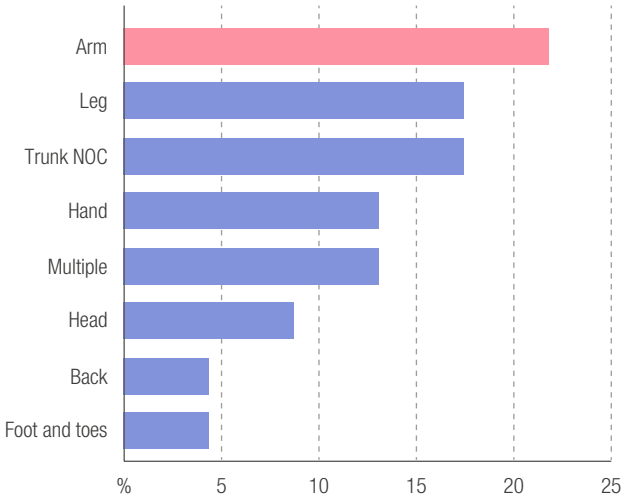


APPENDIX F

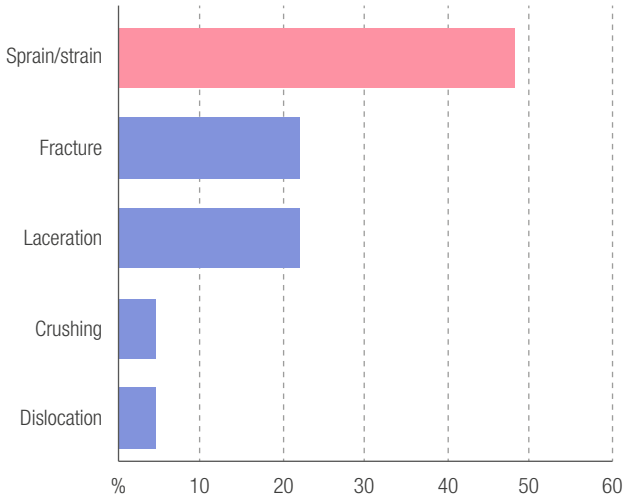
GOLD UNDERGROUND INJURIES 2015-16

23 lost time injuries

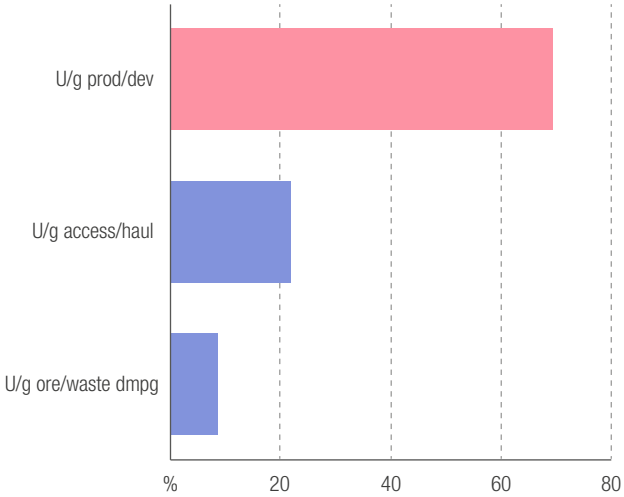
PART OF BODY



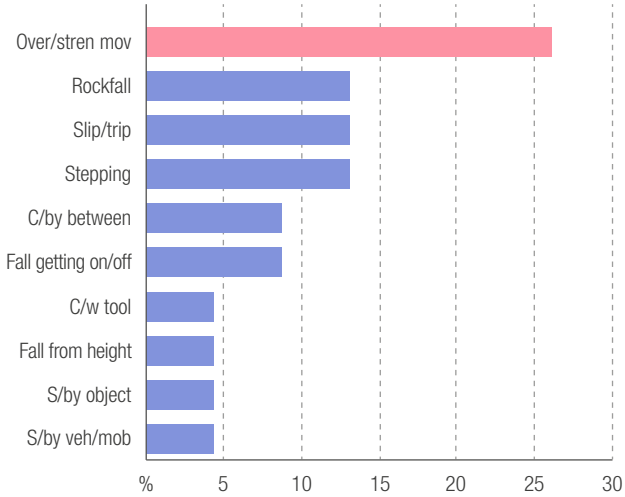
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

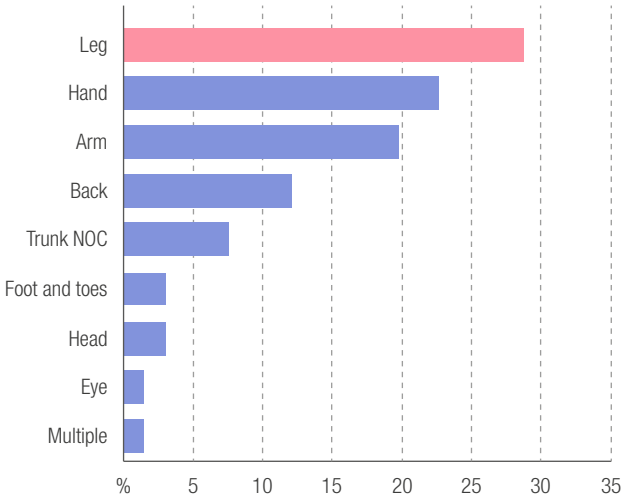


APPENDIX G

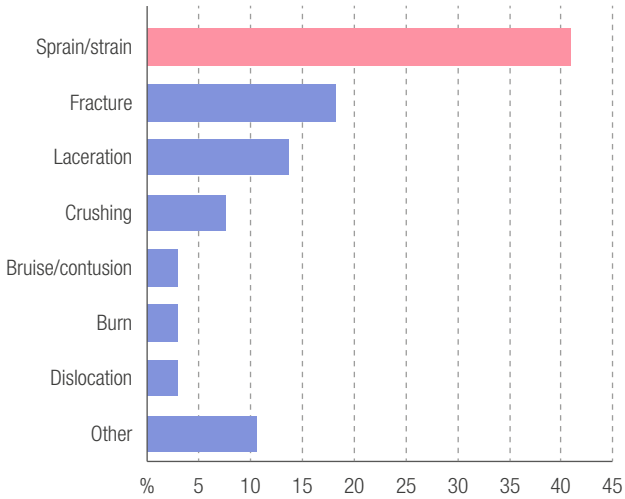
GOLD SURFACE INJURIES 2015-16

66 lost time injuries

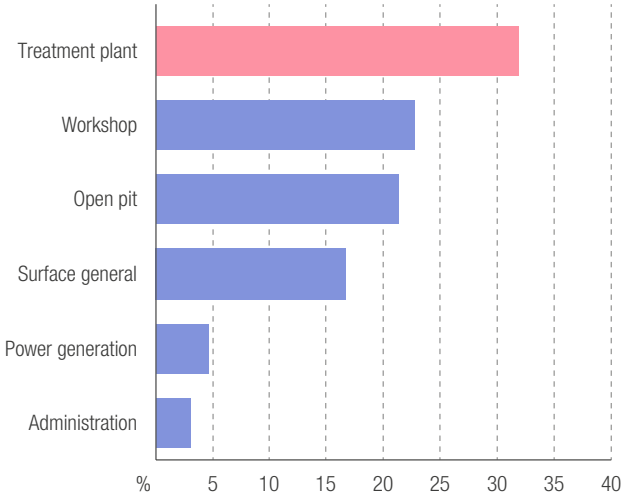
PART OF BODY



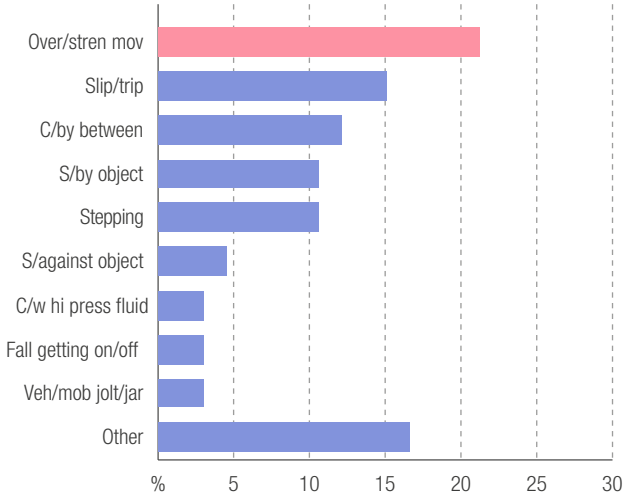
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

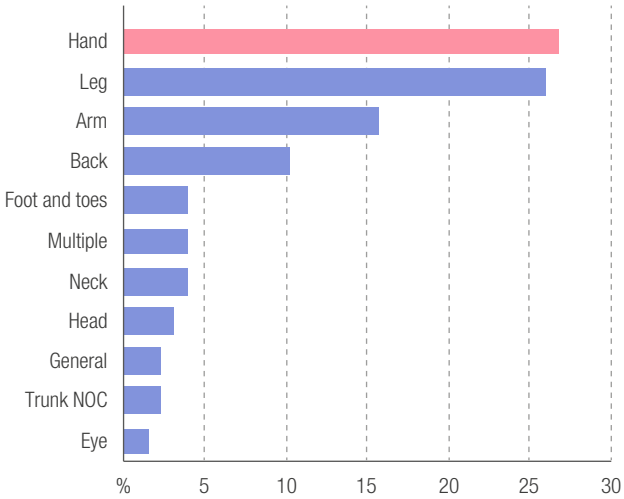


APPENDIX H

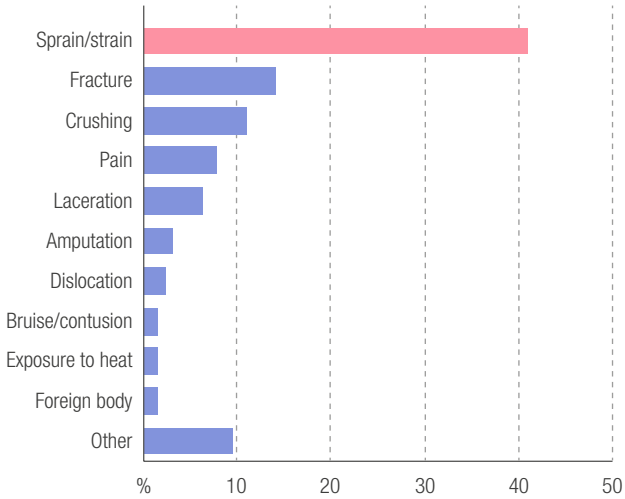
IRON ORE INJURIES 2015-16

127 lost time injuries

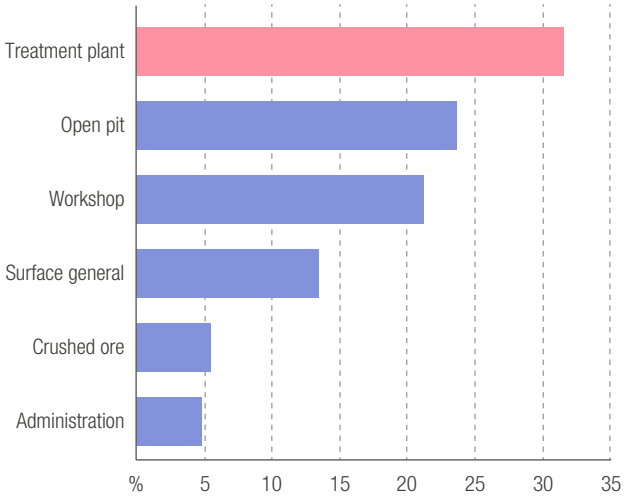
PART OF BODY



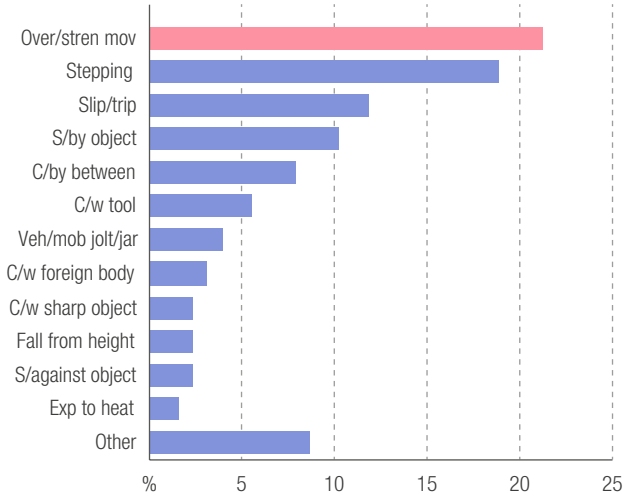
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

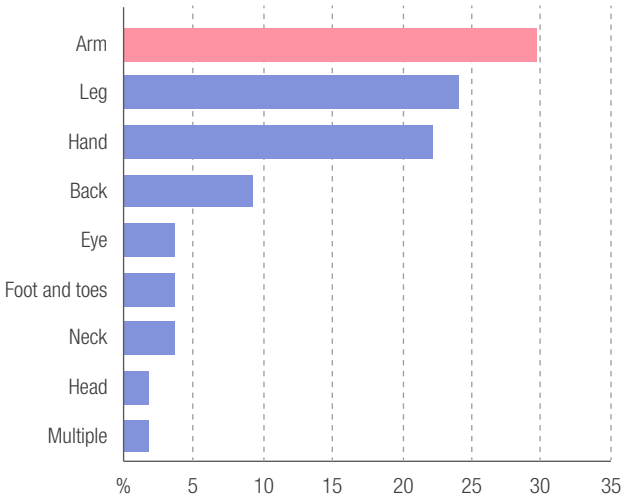


APPENDIX I

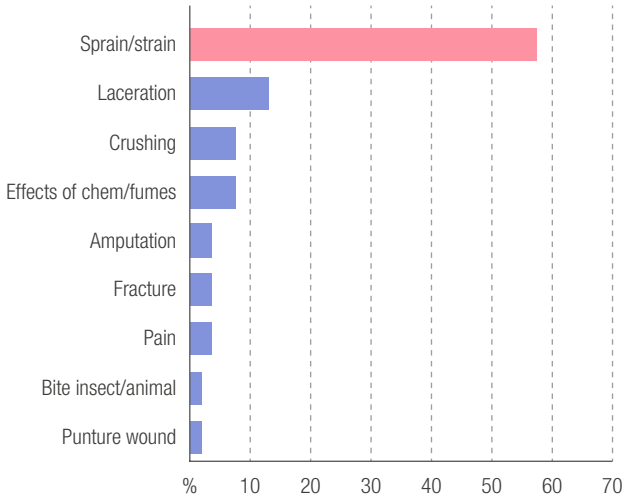
BAUXITE AND ALUMINA INJURIES 2015-16

54 lost time injuries

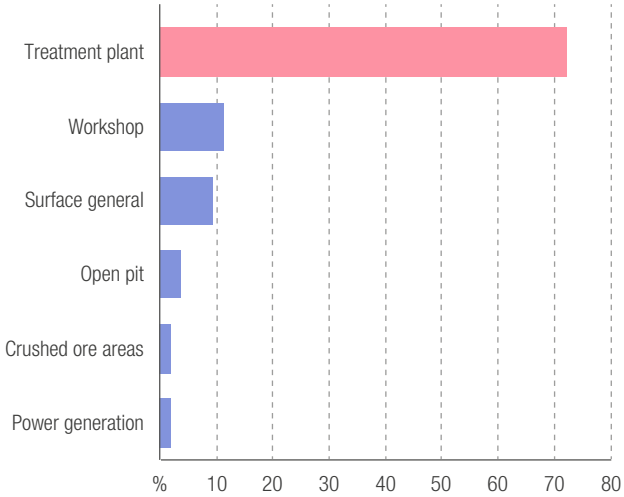
PART OF BODY



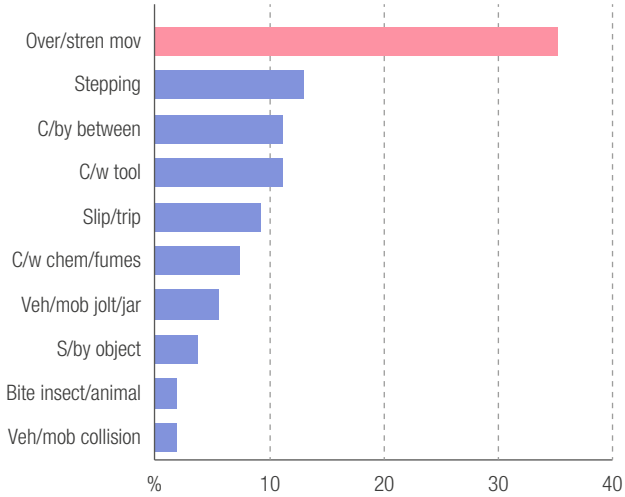
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

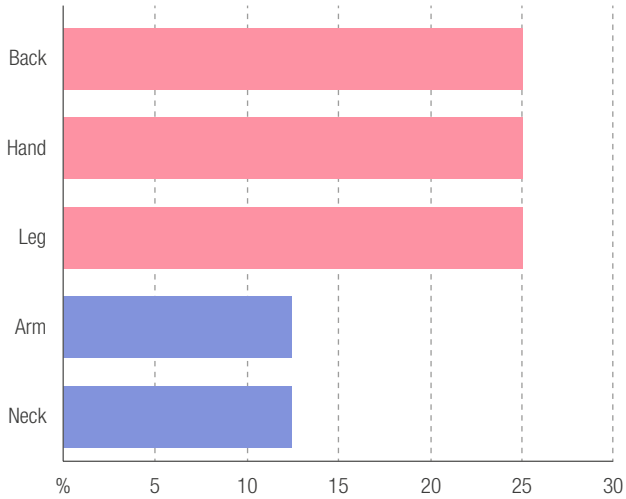


APPENDIX J

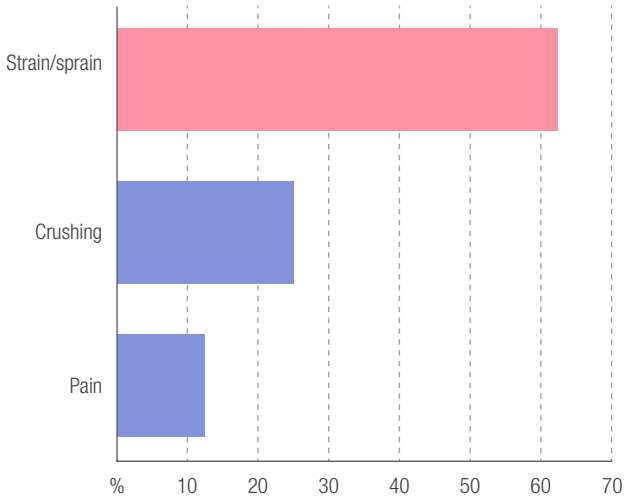
NICKEL UNDERGROUND INJURIES 2015-16

8 lost time injuries

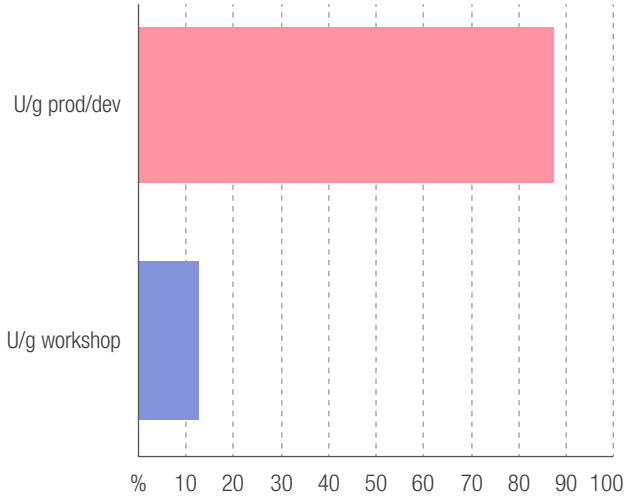
PART OF BODY



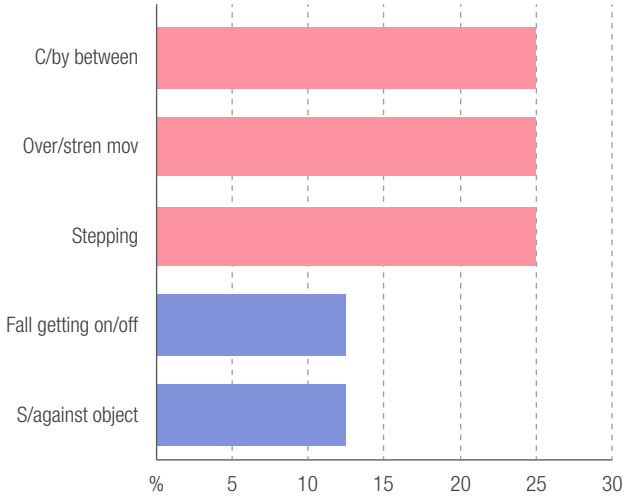
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

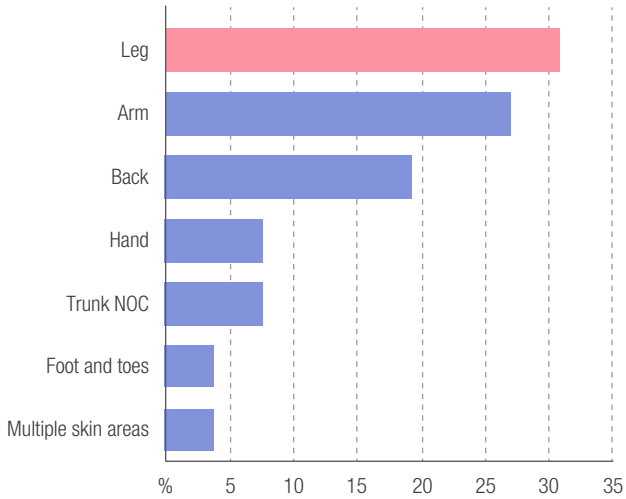


APPENDIX K

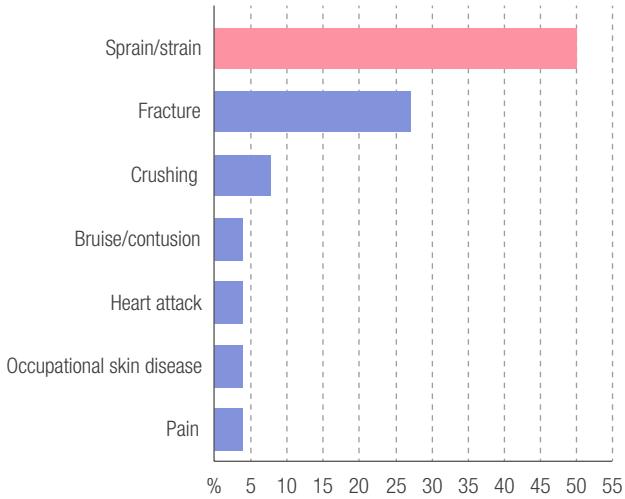
NICKEL SURFACE INJURIES 2015-16

26 lost time injuries

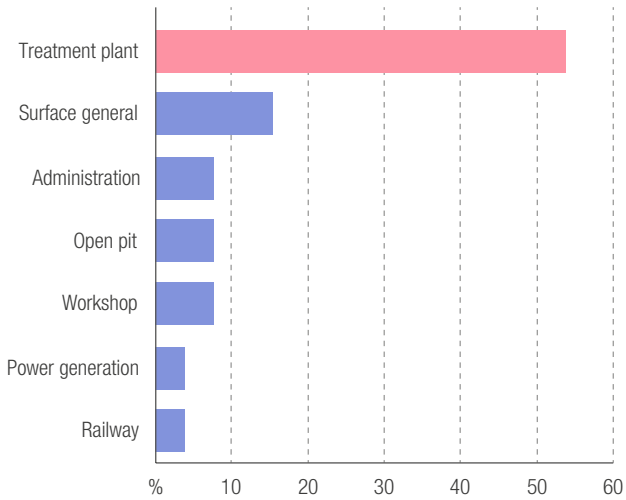
PART OF BODY



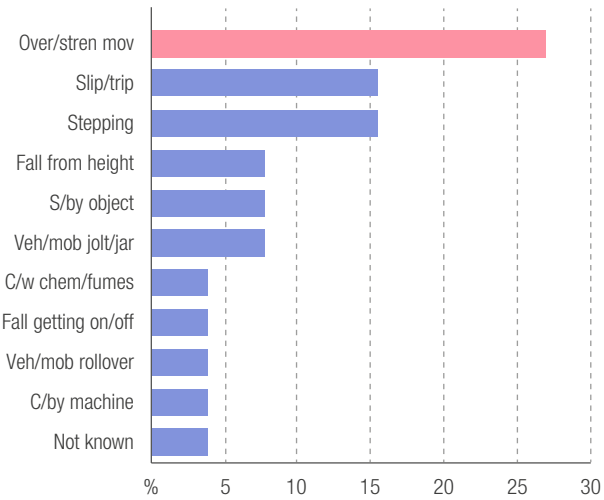
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

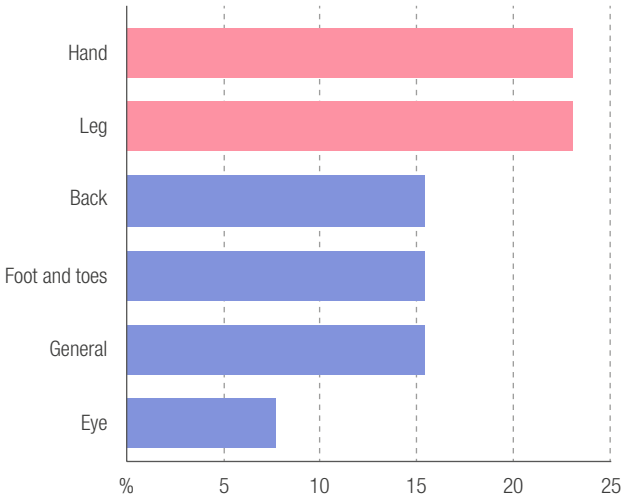


APPENDIX L

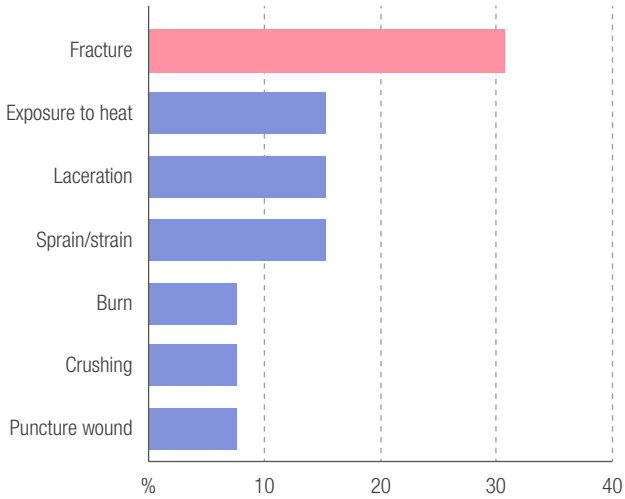
EXPLORATION INJURIES 2015-16

13 lost time injuries

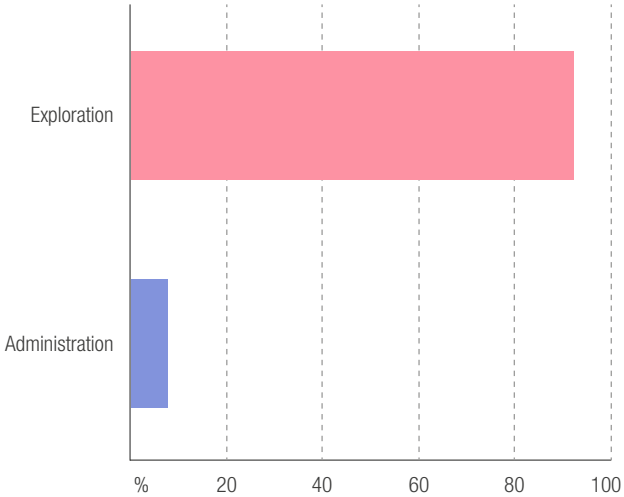
PART OF BODY



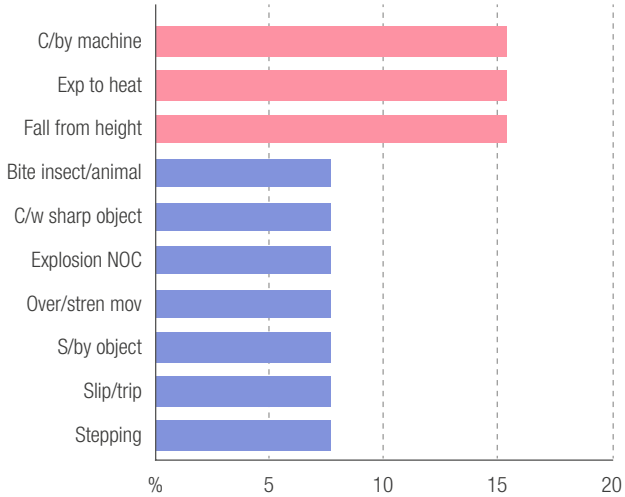
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

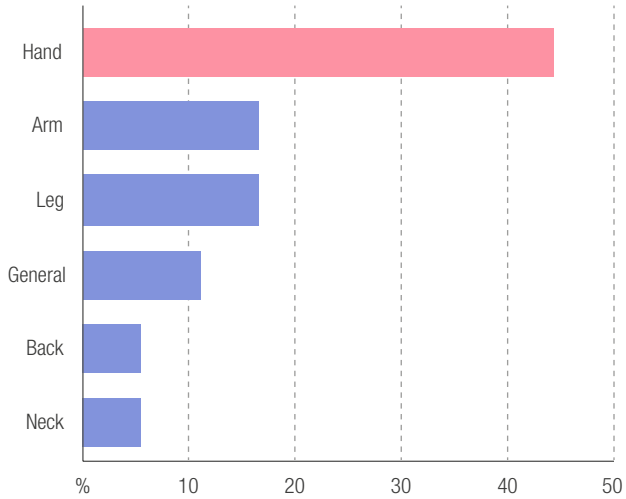


APPENDIX M

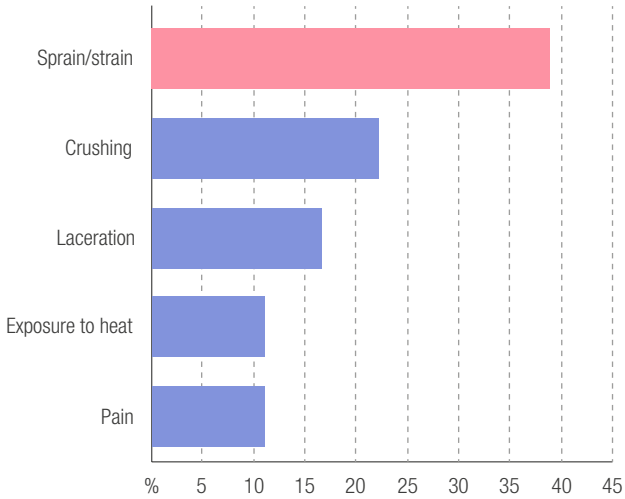
EXPLORATION RESTRICTED WORK INJURIES 2015-16

18 restricted work injuries

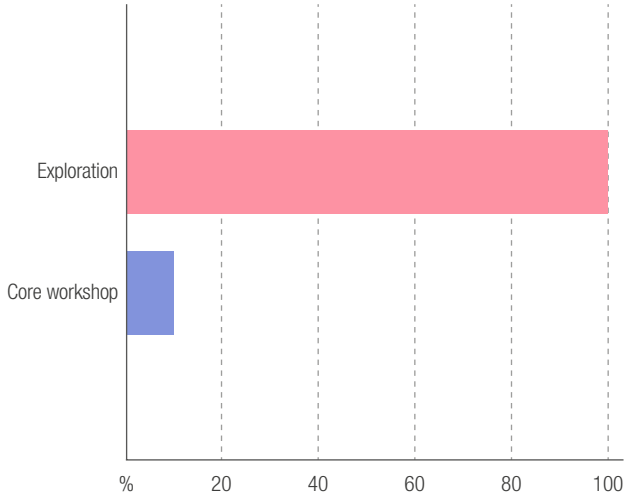
PART OF BODY



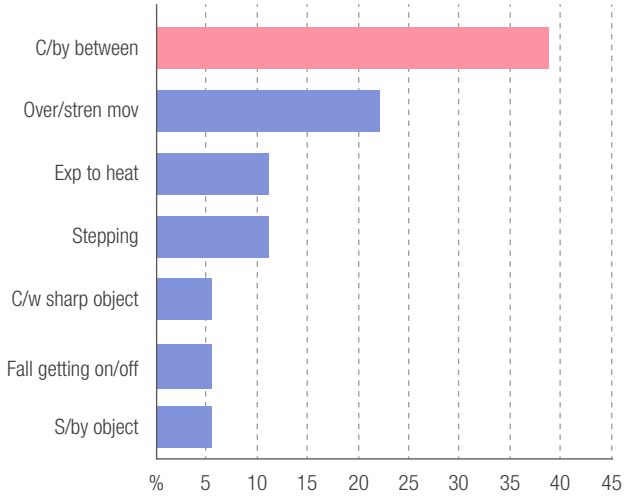
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

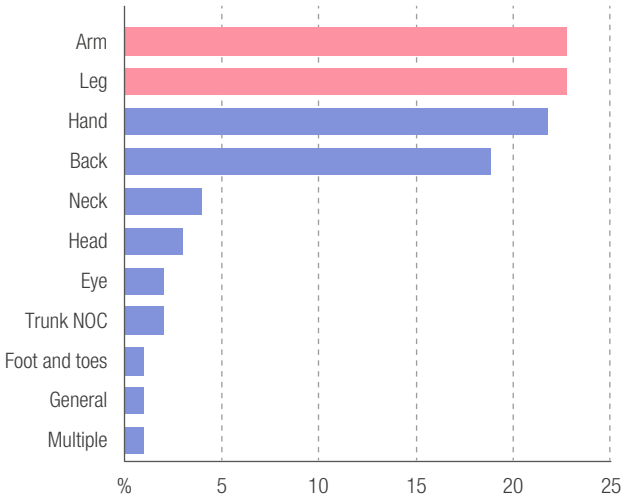


APPENDIX N

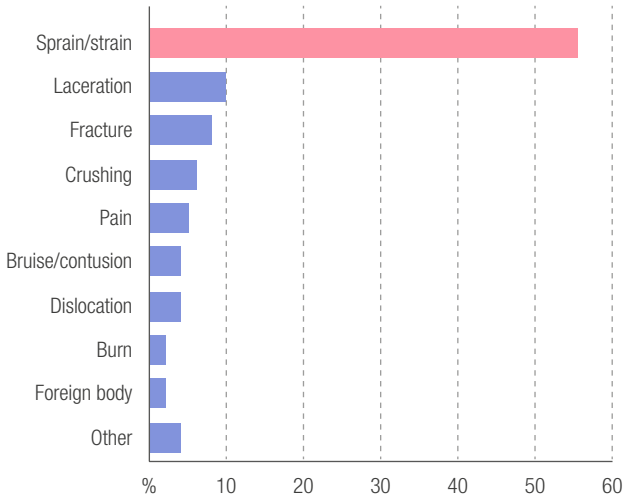
RESTRICTED WORK INJURIES UNDERGROUND 2015-16

101 restricted work injuries

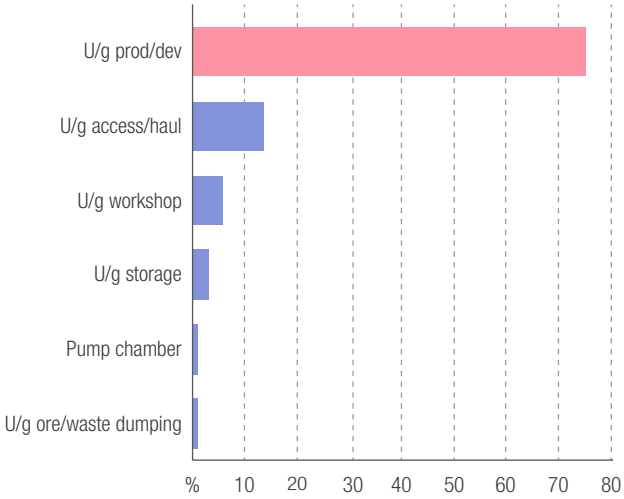
PART OF BODY



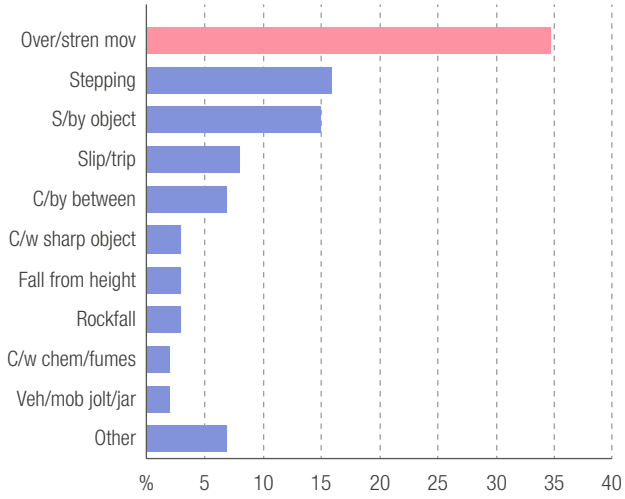
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT

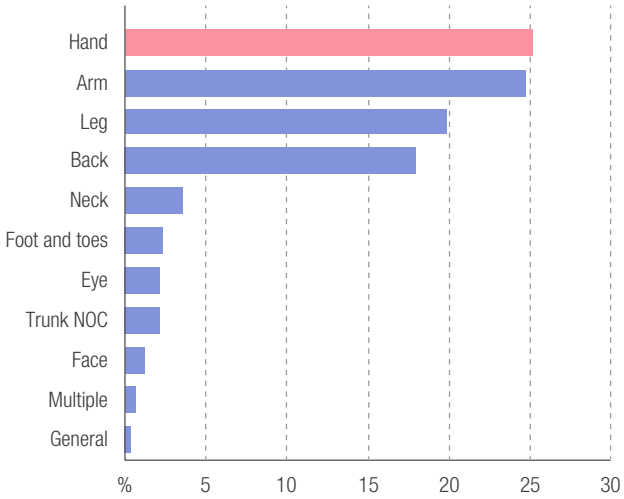


APPENDIX 0

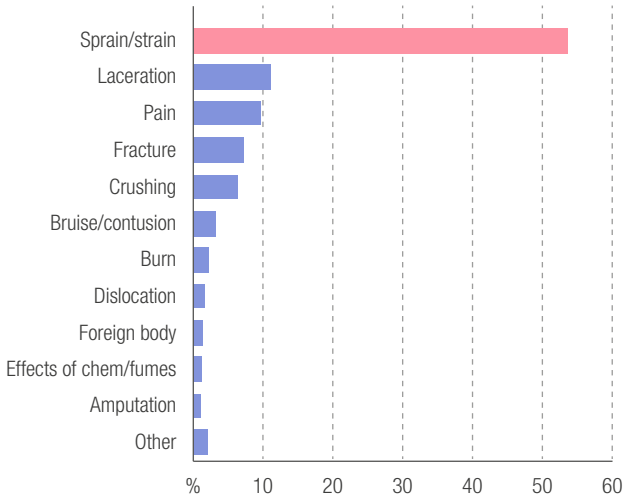
RESTRICTED WORK INJURIES SURFACE 2015-16

651 restricted work injuries

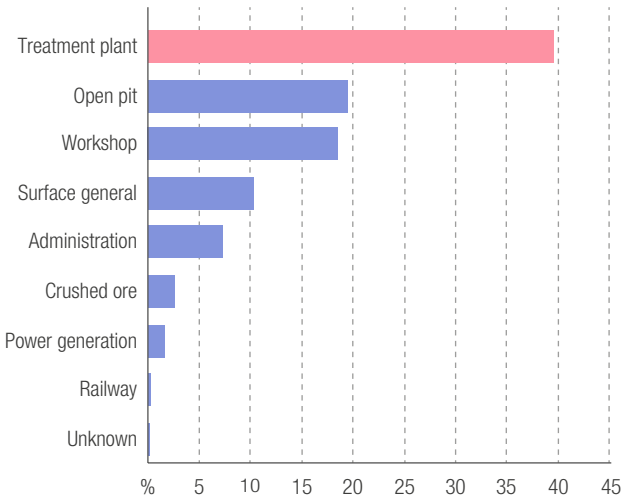
PART OF BODY



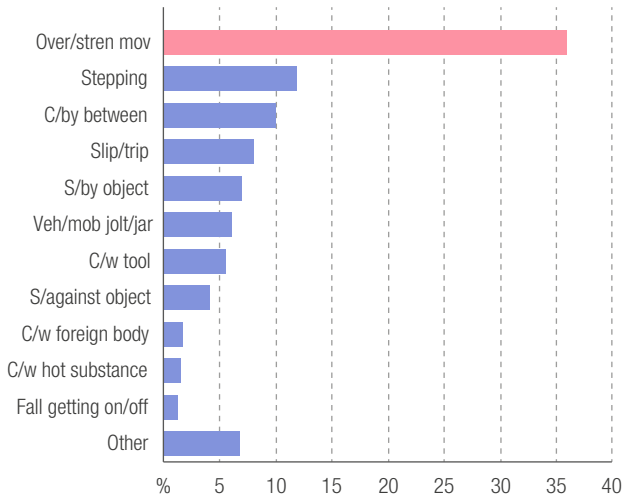
NATURE OF INJURY



LOCATION OF ACCIDENT



TYPE OF ACCIDENT



APPENDIX P

DESCRIPTIONS OF COMMONLY USED TERMS FOR 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 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

Government of **Western Australia**
Department of **Mines and Petroleum**
Resources Safety

Resources Safety

Mineral House, 100 Plain Street
East Perth WA 6004

Telephone +61 8 9358 8002
Facsimile +61 8 9358 8000
Email ResourcesSafety@dmp.wa.gov.au
www.dmp.wa.gov.au/ResourcesSafety

RSDDec16_937