

# QUEENSLAND MINES AND QUARRIES SAFETY PERFORMANCE AND HEALTH REPORT

2018  
2019



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# BACKGROUND

<sup>1</sup> Including the 19 recognised standards published on the Business Queensland website at [www.business.qld.gov.au](http://www.business.qld.gov.au)

<sup>2</sup> Including the three guidelines published on the Business Queensland website at [www.business.qld.gov.au](http://www.business.qld.gov.au)

The Queensland Mines Inspectorate forms part of the Resources Safety and Health division of the Department of Natural Resources, Mines and Energy. The inspectorate is primarily responsible for enforcing the provisions of the *Coal Mining Safety and Health Act 1999*, *Coal Mining Safety and Health Regulation 2017*,<sup>1</sup> *Mining and Quarrying Safety and Health Act 1999* and *Mining and Quarrying Safety and Health Regulation 2017*.<sup>2</sup> The inspectorate also advises, mentors and educates the mining industry about safety and health.

This report analyses industry performance using accident and incident data collected from Queensland mines and quarries during 2018–19. The intent is to focus the attention on areas of safety and health priority and encourage implementation of strategies to further improve safety and health performance.

# A MESSAGE FROM THE CHIEF INSPECTORS

We are pleased to introduce the **Queensland mines and quarries safety performance and health report 2018–19**, covering incidents, trends and emerging safety and health issues in our mines and quarries for the 2018–19 financial year.

The Queensland Mines Inspectorate administers mining safety and health legislation and works with industry and unions to protect the safety and health of mine and quarry workers. This cooperative, tripartite approach is vital to improving safety and health in the mining and quarrying industries.

We are deeply saddened to report that five fatalities occurred in the Queensland mining and quarrying industries in 2018–19. We would like to express our sympathies to the families, friends and colleagues of these men. These incidents serve as a reminder that the safety and health of mine and quarry workers is paramount and we must remain vigilant if we are to ensure that every worker goes home safe and healthy every day.

The last 20 years has seen no significant improvement in the industry fatality rate which continues to be of major concern. This year has seen the commissioning of a fatality review by Dr Sean Brady, a forensic engineer, who will analyse the last 20 years of fatalities, serious incidents and high potential incidents to identify key causes and effects, and identify key focus areas for the industry to improve its performance over the next 20 years.

This report outlines the key safety and health performance of the mining and quarrying industries. More detailed information on high potential incidents, lost time injuries, mine and quarry dust levels, worker numbers and lost time data is available on our website.<sup>3</sup>

When reviewing the data and information from this report, there are a number of trends which we are concerned about.

Over the past five years, the overall number of serious accidents in mines and quarries has increased each year and the serious accident rate has almost doubled. The circumstances of many of these serious accidents are recognised hazards with known critical risk controls. Some of these accidents could have resulted in additional fatalities. This is a concerning long-term trend and we must ensure that the learnings from these events are shared and that mines make a concerted effort to put in place effective controls to prevent reoccurrence. These controls need to be incorporated into safety and health management systems along with measures to ensure that they remain effective at all times. Senior leaders and industry boards should renew their focus on critical control verifications.

In many of our investigations into fatalities, serious accidents and other incidents, supervision has been identified as a causal factor. Effective supervision is one of the key preventive factors in minimising workplace incidents and the industry must ensure that supervisors are competent and supported and that supervision is appropriate for the work being undertaken. A great deal of work has already gone into developing the means to measure effective supervision and inspectors will be paying particular attention to this in 2019–20.

<sup>3</sup> <https://www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/mining/accidents-incidents/safety-performance>

Contractor management has also been a long-term concern for the inspectorate. With an industry-wide move towards greater use of labour hire workers and contractors, we are growing increasingly concerned about how safety and health management systems at mines and quarries are accommodating this change and whether labour hire workers and contractors are being afforded the same level of safety as permanent employees.

One of the major incidents during 2018–19 was the spontaneous combustion event that occurred at North Goonyella coal mine resulting in the evacuation and sealing of the mine. This incident has illustrated the ongoing requirement for robust safety and health management systems with principal hazard management plans that are tested and verified.

On a positive note, we have seen a continued reduction in the exposure of coal mine workers to mine dust. The coal mine dust database shows that mines have in place effective controls which are limiting average coal dust levels to well below current occupational exposure limits and are keeping exceedances to a minimum. While there has been a slight rise in average respirable crystalline silica levels, the average exposures have been below the current occupational exposure limits and exceedances have also been reduced.

This year saw respirable crystalline silica levels in mineral mines and quarries being recorded and monitored in a dust database. Like coal mines, our mineral mines and quarries have been shown to be controlling average respirable crystalline silica levels to below the occupational exposure limit and exceedances have been reduced.

In addition, we recently implemented a program to support mineral mines and quarries to meet the requirements of the *Guideline for management of respirable crystalline silica in Queensland mineral mines and quarries (QGLo2)*. In total, 76 per cent of mines and quarries are now compliant with the guideline, representing 95 per cent of workers.

While these results are encouraging, it is important for the industry to continue to improve its efforts to reduce dust exposure in light of potential changes by Safe Work Australia to the occupational exposure limits for both coal dust and respirable crystalline silica. Our inspectors will continue to engage with industry to support further improvements and will be closely monitoring dust results to ensure compliance with any future changes to the exposure limits.

We encourage industry to use the information in this report, and the detailed data available for download from the website, to improve safety and health management systems, processes and performance. It is important to remember that these statistics, and the injuries they record, have consequences for real people, their families and friends.

**HERMANN FASCHING**  
CHIEF INSPECTOR OF MINES  
(MINERAL MINES AND QUARRIES)

**PETER NEWMAN**  
CHIEF INSPECTOR OF MINES  
(COAL)



**TABLE 1****COMPARISON OF  
KEY PERFORMANCE  
INDICATORS 2017–18  
AND 2018–19  
BY SECTOR<sup>4</sup>**

<sup>4</sup> The information in this report is sourced primarily from data returns submitted by mine and quarry operators. Data is collected in accordance with sections 198 and 279 of the *Coal Mining Safety and Health Act 1999* and section 195 and 259 of the *Mining and Quarrying Safety and Health Act 1999*. The data collection is approved by the Chief Inspector of Mines (Coal) under section 281 (CMSHA 1999) and the Chief Inspector of Mines (Mineral Mines and Quarries) under section 261 (MQSHA 1999). Due to publication deadlines, information received by the Department of Natural Resources, Mines and Energy on or before 31 August 2019 for the 2018–19 financial year is included in the report. Due to the cut-off date, there may be minor changes in data reported for previous years as each new annual report includes the finalised data.

Year	Fatalities		Serious accidents		Disabling Injuries		Permanent incapacities		Lost time injuries		High potential incidents		Serious accident frequency rate		High potential incident frequency rate		Disabling injury days*		Million hours worked	
	17–18	18–19	17–18	18–19	17–18	18–19	17–18	18–19	17–18	18–19	17–18	18–19	17–18	18–19	17–18	18–19	17–18	18–19	17–18	18–19
<b>Coal surface</b>	1	2	51	59	235	175	23	34	171	190	1360	1310	0.87	0.95	23.3	21.1	6645	5149	58.5	62.3
<b>Coal underground</b>	0	1	26	31	77	79	4	2	63	89	351	416	2.13	2.29	28.7	30.8	2772	2611	12.2	13.5
<b>All coal</b>	<b>1</b>	<b>3</b>	<b>77</b>	<b>90</b>	<b>312</b>	<b>254</b>	<b>27</b>	<b>36</b>	<b>234</b>	<b>279</b>	<b>1711</b>	<b>1726</b>	<b>1.09</b>	<b>1.19</b>	<b>24.2</b>	<b>22.8</b>	<b>9417</b>	<b>7760</b>	<b>70.7</b>	<b>75.8</b>
<b>Mineral surface</b>	0	0	8	3	63	78	1	0	33	30	178	182	0.43	0.17	9.5	10.6	2755	1865	18.8	17.2
<b>Mineral underground</b>	0	0	4	9	90	95	1	2	16	22	119	131	0.35	0.75	10.3	10.9	4535	5238	11.6	12.0
<b>All minerals</b>	<b>0</b>	<b>0</b>	<b>12</b>	<b>12</b>	<b>153</b>	<b>173</b>	<b>2</b>	<b>2</b>	<b>49</b>	<b>52</b>	<b>297</b>	<b>313</b>	<b>0.40</b>	<b>0.41</b>	<b>9.8</b>	<b>10.7</b>	<b>7290</b>	<b>7103</b>	<b>30.4</b>	<b>29.3</b>
<b>Quarries</b>	0	2	5	8	11	4	1	0	19	21	84	78	2.10	2.78	35.3	27.1	302	82	2.4	2.9
<b>All sectors</b>	<b>1</b>	<b>5</b>	<b>94</b>	<b>110</b>	<b>476</b>	<b>431</b>	<b>30</b>	<b>38</b>	<b>302</b>	<b>352</b>	<b>2092</b>	<b>2117</b>	<b>0.91</b>	<b>1.02</b>	<b>20.2</b>	<b>19.6</b>	<b>17,009</b>	<b>14,945</b>	<b>103.4</b>	<b>107.9</b>

\* Number of disabling injury days include days on alternative duties

# CHAPTER 1 OVERVIEW OF SAFETY OUTCOMES



# FATAL ACCIDENTS IN 2018–19

## There were five fatal accidents in the Queensland mining industry in 2018–19.<sup>5</sup>

Three of the fatalities occurred at coal mines (two at surface mines and one at an underground mine) and two occurred at quarries. The Queensland Mines Inspectorate investigates all fatal accidents. Full details of the safety alerts issued relating to these incidents can be found on the Business Queensland website.<sup>6</sup>



**DAVID ROUTLEDGE**  
26 June 2019

### Fatality—26 June 2019 (Coal surface)

David Routledge, a 55 year old excavator operator, was fatally injured on 26 June 2019 at Middlemount coal mine when a pit wall suddenly failed and engulfed the excavator he was operating.

In response to the incident, the inspectorate issued a newsflash alerting all surface coal mine site senior executives to the incident. The inspectorate also issued directives to the mine site senior executive to ensure the incident site was secured and to suspend all activities in or near excavations until geotechnical reviews were completed and controls reviewed to ensure the risk to people from geotechnical hazards were within acceptable limits and as low as reasonably achievable.

*Mine safety alert 364* was issued on 9 July 2019 which included seven recommendations for all operations with open cut excavations.



**BRADLEY HARDWICK**  
20 February 2019

### Fatality—20 February 2019 (Coal underground)

Bradley Hardwick, a 48 year old grader operator, was fatally injured on 20 February 2019 at Moranbah North coal mine.

The grader being operated by Mr Hardwick collided with a personnel transporter after it rolled down the production and equipment drift. After the collision, Mr Hardwick was found lying unresponsive further up the drift and away from where the vehicles collided. Four mine workers travelling in the personnel transporter were taken to hospital for medical treatment and later released.

In response to the incident, the inspectorate issued a newsflash alerting site senior executives to the incident. The inspectorate also issued a directive to the Moranbah North mine site senior executive to quarantine a second similar grader at the mine pending further investigation. A further directive was issued to the site senior executive directing the mine to review and confirm that the grader equipment safety file dossier schematics match the as-built machines.

*Mine safety bulletin 182* was issued on 20 May 2019. The bulletin highlighted four recent incidents which had resulted in fatalities or serious injuries where the investigation, engineering and maintenance of braking systems were identified as contributing factors. However, it is noted that not all factors identified in the safety bulletin relate to this incident.



**ALLAN HOUSTON**  
31 December 2018

### Fatality—31 December 2018 (Coal surface)

Allan Houston, a 49 year old dozer operator, was fatally injured on 31 December 2018 at Saraji coal mine when the bulldozer he was driving went over the crest of a bench and rolled downwards approximately 20 metres.

The bulldozer being driven by Mr Houston was tramping along a bench to a park up area when it went over the bench's crest and came to rest on its roof in an area of mud and water approximately two metres deep.

*Mine safety alert 362* was issued on 8 January 2019. A further update to the safety alert was issued on 1 March 2019. On 17 January 2019, the inspectorate issued directives to the Saraji mine site senior executive to suspend all bulk dozer push operations associated with dragline bench preparation and working in close proximity to crests and slopes. The activities were suspended until the safety and health management system was reviewed to ensure it provided for an acceptable level of risk for bulk dozer push operations.



**CONNOR-SHAYE  
CAMPBELL MILNE**  
15 November 2018

### Fatality—15 November 2018 (Quarry)

Connor-Shaye Campbell Milne, a 21 year old loader operator, was fatally injured on 15 November 2018 at Fairfield Quarry when he was entangled in the tail pulley of a conveyor.

At the time of the accident, Mr Milne and another quarry worker were removing rocks from the return side of a conveyor belt. They removed a guard and used their hands to clear rocks from the tail pulley while the conveyor was operating. While clearing the loose material, Mr Milne's arm was caught in the conveyor tail pulley and he was entangled.

The initial investigation identified a number of factors that contributed to the incident including a failure to isolate plant prior to removing guards, and the implementation of the safety and health management system as it related to adequate site procedures, training of workers, supervision of workers and maintenance of plant.

*Mine safety alert 359* was issued on 22 November 2018 with five recommendations regarding conveyor operations and maintenance.



**ADAM MALONE**  
29 July 2018

### Fatality—29 July 2018 (Quarry)

Adam Malone, a 25 year old earthmoving plant operator, was fatally injured on 29 July 2018 at Jacks Quarry when the articulated dump truck he was operating hit an embankment and turned over on a haul road.

Mr Malone failed to negotiate the turn into the intersection and hit an embankment further down the haul road. The truck rolled, spilling the load before coming to rest with the engine cab on its side, partially pinning the operator.

The investigation identified a number of factors that contributed to the incident. These included deficiencies in three of the four truck braking systems, worker training and assessment, and maintenance of mobile plant.

*Mine safety alert 358* was issued on 29 August 2018 with four recommendations related to the use and maintenance of machinery.

<sup>5</sup> The number of fatalities that have occurred in Queensland mines since 1900 is provided in Appendix 1.

<sup>6</sup> <https://www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/mining/alerts-notice>

## Mining fatality review

In 2018–19, Resources Safety and Health initiated a review of all fatalities in Queensland mines and quarries from 2000 to 2019 since the introduction of the current mining safety and health legislation.

Forensic structural engineer Dr Sean Brady was engaged to examine the coal mining, mineral mining and quarrying incident and injury reporting data for this period to better understand the causes of fatalities, serious injuries, high potential incidents and other incidents reported by industry over the past two decades; how industry can use these findings to improve safety and health; and where the industry should focus its resources to prevent further fatalities.

It is anticipated that the review will be completed before the end of the 2019 calendar year and a report will then be tabled in the Queensland Parliament.

# GAS MANAGEMENT

As Queensland's underground coal mines have become deeper over recent years, and longwall production rates have increased, coal mines must be more vigilant in controlling the concentration of methane in the longwall return roadways.

Under the *Coal Mining Safety and Health Act 1999* and the *Coal Mining Safety and Health Regulation 2017*, if methane concentration is equal to or greater than 2.5 per cent, then the underground mine is considered dangerous and workers must be withdrawn from the mine. Methane is explosive between 5 per cent and 15 per cent.

In 2017–18, the inspectorate conducted compliance audits and requested gas monitoring data from all longwall mines to conduct a detailed analysis of methane management in underground coal mines.

The audits revealed that gas monitoring systems at all mines complied with the *Coal Mining Safety and Health Act 1999*. However, a review of gas data indicated that some mines were not reporting all incidents where general body concentrations of methane equal to or greater than 2.5 per cent occurred and did not have adequate monitoring to detect methane levels in close proximity to the longwall face in the longwall tailgate return airway. Modelling of ventilation and methane emissions showed that in some cases explosive mixtures of methane were present in the atmosphere flowing into the longwall tailgate.

Following the issuing of directives and substandard conditions or practice (SCP) notices, five mines introduced additional gas monitoring in the longwall tailgate with the capability of stopping the longwall machinery from operating in response to increasing general body concentrations of methane.

Analysis of methane concentrations during longwall operations has shown that if there is a 2.5 per cent general body concentration of methane in the longwall tailgate roadway, then there is a higher level of methane in the airway adjacent to the longwall face at the tailgate intersection. The operating position of the longwall equipment, in particular the shearer, is potentially at the location of the highest risk of an ignition source for methane in the longwall. As a result, it is critical that the percentage of methane is maintained at a safe level in this area.

In determining the general body methane concentrations that may be flowing in their operations, mine management must consider the total gas reservoir for the seam being extracted and adjacent seams that can contribute to this gas make. They also need to consider the amount of air deflected around the longwall tailgate equipment flushing out goaf gases due to the ventilation quantity and velocity; impacts from adjacent goaf and rib emissions; and lag times and calibration variability of methane monitors. The recently released Australian Coal Association Research Program *Gas management and risk mitigation strategies for longwalls* report<sup>7</sup> provides detailed technical guidance on how to achieve this.

The inspectorate expects all underground coal mines to have effective gas monitoring systems to prevent explosive accumulations of methane in areas where it could be ignited. It has recently released the *Methane management in underground coal mines best practice and recommendations guide*<sup>8</sup> and is also finalising proposed amendments to the legislation to clarify and confirm minimum methane monitoring requirements at relevant locations in an underground coal mine.

<sup>7</sup> <https://www.acarp.com.au/abstracts.aspx?repld=C25066>

<sup>8</sup> [https://www.dnrme.qld.gov.au/\\_\\_data/assets/pdf\\_file/0004/1449121/methane-management-in-underground-coal-mines.pdf](https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0004/1449121/methane-management-in-underground-coal-mines.pdf)

# INCIDENT AT NORTH GOONYELLA

On 1 September 2018, Peabody Energy, operator of North Goonyella coal mine, made a safety-based decision to remove all personnel from the underground mine following a methane exceedance greater than 2.5 per cent. The mine had just completed extraction of a longwall block and was in the process of recovering shields from the face line.

During the four days prior to 1 September, the mine had safely withdrawn all personnel from the underground workings on two occasions when triggers were exceeded for methane and explosibility.

While coal mine workers were withdrawn from the mine on 1 September, a further trigger for spontaneous combustion was activated. Efforts to control the spontaneous combustion occurring underground continued during September. Continued evidence of escalating spontaneous combustion and subsequent fire that spread into the main mine workings resulted in the sealing of the mine in late September and early October.

The inspectorate has been actively involved in monitoring site activities and providing advice to North Goonyella mine personnel to ensure the risk to workers is at an acceptable level. This extends to having inspectors on site since the spontaneous combustion event in September last year and throughout the more recent process of reviewing the operator's risk management activities ahead of mine re-ventilation and re-entry to zone A.

On 28 June 2019, the inspectorate granted the underground mine manager consent to re-enter zone A of the mine after it had been shown that an acceptable level of risk had been achieved and documented in the mine-re-entry management plan.

The inspectorate commenced investigations into:

- ▶ events leading up to the withdrawal of coal mine workers from the underground working on 1 September 2018
- ▶ the ongoing serious spontaneous combustion event after 1 September 2018.

The inspectorate started gathering relevant information in November 2018 and formally commenced an investigation in January 2019 after the underground environment was stabilised. The purpose of the investigation was to analyse events leading up to the incident, with a focus on any events that could have created an unacceptable level of risk to coal mine workers.

The first three months of the investigation involved gathering mine documents and requesting further data where gaps were identified. As part of its investigation, the inspectorate has reviewed more than 11,300 files, including ventilation records, gas data and the mine's safety and health management system.

The preliminary observations from the investigation were published on 9 August 2019. Although the inspectorate's investigation is ongoing, the following preliminary observations may be relevant to the nature and cause of the incident:

- ▶ A review of the mine's records suggest that gas trends were not given sufficient consideration. This may have impacted the way in which relevant *trigger action response plans* were applied and actioned.
- ▶ Some key reports relating to the mine's ventilation plan, gas alarm system and explosion risk zone controls do not appear to have been reviewed or countersigned by key personnel, as required under the mine's safety and health management system.
- ▶ There is evidence that some boreholes located deep within the 9N goaf region were insufficiently sealed, allowing ingress of oxygen into active goafs, with the potential to escalate conditions for spontaneous combustion.
- ▶ There is evidence to suggest that the gas drainage system was being operated to focus on management of methane instead of the potential spontaneous heating event that was occurring underground.
- ▶ There is evidence to suggest the mine did not follow its own procedures relating to major ventilation changes.

It is important to note that these are preliminary observations and not conclusive findings. As the inspectorate's investigation continues, these observations will be reviewed and formal findings and recommendations will be published.

# IMPACT OF COMPLIANCE ACTIVITY

## The Queensland Mines Inspectorate continuously reviews and refines its compliance program based on analysis of industry data and emerging risk.

In addition to regular compliance activities, the inspectorate focusses on issues identified through the analysis of industry safety and health performance data.

### Mineral mines and quarries focus areas

In 2018–19, mineral mines and quarries inspectors have maintained a focus on:

- ▶ falls
- ▶ collisions
- ▶ respirable dust
- ▶ uncontrolled pressure release.
- ▶ entanglement

In all instances where unacceptable levels of risk have been identified, compliance action has been taken.

In 2018–19, the number of high potential incidents reported by mineral mines and quarries increased to 391, up from 381 in 2017–18.

### Campaign for Change

In March 2019, the inspectorate implemented a major inspection and education campaign which targeted three key areas for action in order to improve the controls which manage these identified risks. The *Campaign for Change* focusses on guarding, mobile equipment and isolation and aims to ensure industry has a clear understanding that it is unacceptable to:

- ▶ operate plant without effective guarding in place
- ▶ use mobile equipment that is not maintained and inspected in accordance with original equipment manufacturer requirements
- ▶ allow workers to operate mobile equipment without being appropriately trained and competent
- ▶ conduct work on plant that is not correctly isolated and locked out.

The campaign was communicated to mine and quarry sites by regional mines inspectors in March 2019 and further information was communicated to site senior executives by the Chief Inspector of Mines in May 2019. The campaign message has been reinforced at a number of mining and quarrying industry conferences, seminars and forums across the state.

In 2018–19, as a result of targeted Campaign for Change inspections, 41 directives were issued to suspend operations. The campaign will continue into 2019–20 and will include an assessment of its impact on safety and health in the industry.



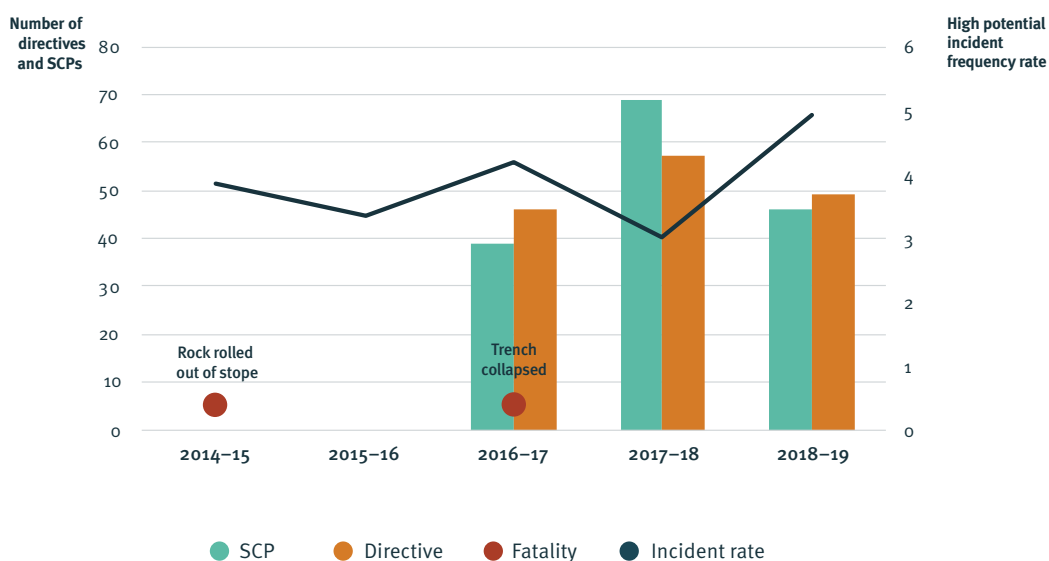
Incidents involving people falling from structures or into vertical openings, being struck by falling objects or rocks and entering voids while operating mobile equipment have featured in 13 fatalities since 2000.

The high potential incident frequency rate for falls in mineral mines and quarries increased from 3.0 in 2017–18 to 4.9 in 2018–19. In comparing the data between the two years, the increase is attributed to an additional 68 incidents being reported over the previous year. Over the two years, the number of worker hours has not altered by any significant quantity.

The largest contributory area was associated with the fall of equipment. The number has doubled from the previous year and is at a five-year high. While a number of workers were hit by falling objects, there were more near misses with people being exposed to falling material, bracketry and objects not secured in location above where a worker may pass. On average, a fall of ground is reported each week. These are not confined to underground mineral mines, but also include surface mines and quarries.

## FIGURE 1

### HPI FREQUENCY RATE FOR FALLS AGAINST DIRECTIVES, SCPS AND FATALITIES



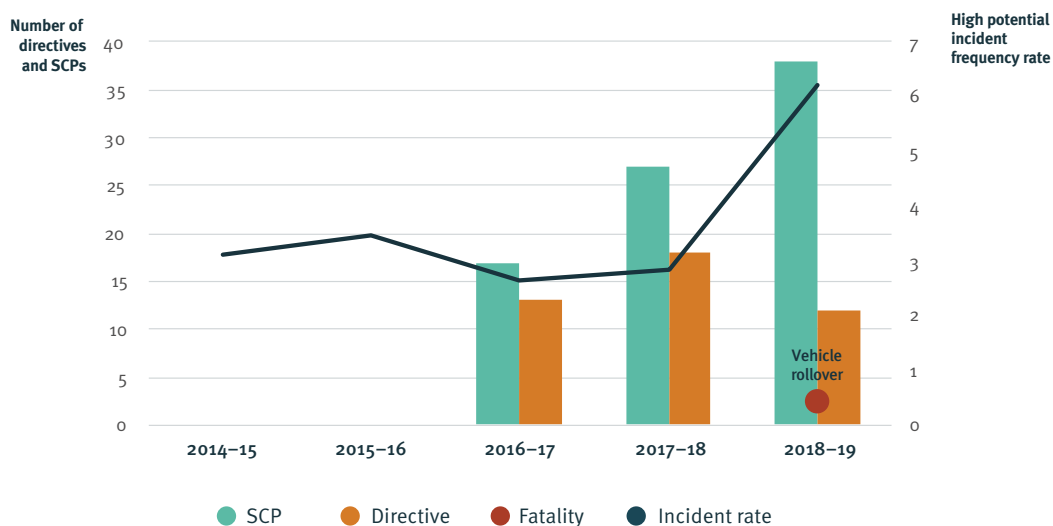
In 2018–19, incidents involving vehicle interactions or collisions resulted in one fatality in a mineral mine or quarry. Incidents involving vehicle interactions or collisions have resulted in six fatalities in the Queensland mining and quarrying industry since 2000.

Vehicle interactions with people, infrastructure, or other vehicles have remained a focus for mineral mines and quarries inspectors who have found some safety and health management systems to be lacking in identifying what controls can prevent an unwanted interaction.

The high potential incident frequency rate for collisions in mineral mines and quarries increased from 2.8 in 2017–18 to 6.2 in 2018–19.

## FIGURE 2

### HPI FREQUENCY RATE FOR COLLISIONS AGAINST DIRECTIVES AND SCPs



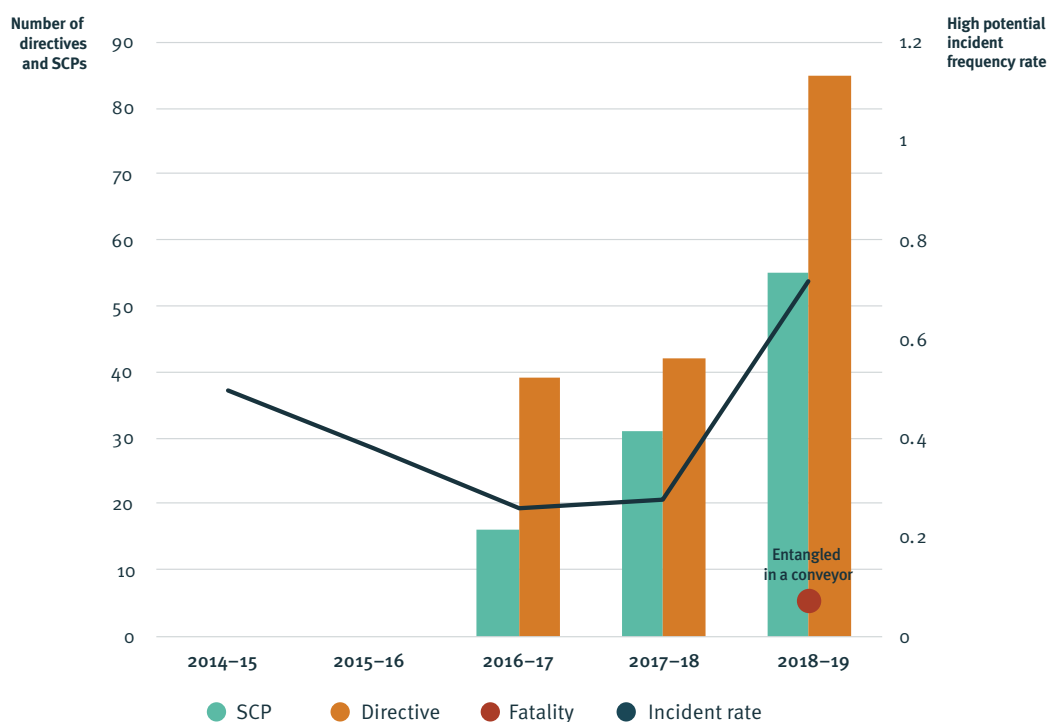
The high potential incident frequency rate for entanglement in mineral mines and quarries increased from 0.3 in 2017-18 to 0.7 in 2018-19. Of concern to the inspectorate is that the number of workers being exposed to nip points has doubled over the previous year.

In 2018-19, incidents involving entanglement resulted in one fatality in a quarry.

In response to ongoing incidents in this area, the inspectorate introduced the Campaign for Change with a zero tolerance approach to ineffective guarding and isolation. It is through this campaign that there has been an increase in the number of directives and SCPs that have been issued to industry, including stopping of plant or operations.

## FIGURE 3

### HPI FREQUENCY RATE FOR ENTANGLEMENT AGAINST DIRECTIVES AND SCPs



## Coal mines focus areas

In 2018–19, coal mines inspectors have maintained a focus on:

- ▶ gas management
- ▶ lifting and slinging
- ▶ supervision.

In all instances where unacceptable levels of risk have been identified, compliance action has been taken.

In recent years, the inspectorate has identified the safe management of flammable gases within surface and underground coal mines and associated exploration areas as a critical focus area.

In 2017, the Chief Inspector of Mines (Coal) issued two letters to industry clarifying legislative requirements for methane management. This resulted in an increase in the reporting of incidents relating to methane exceedances. Total reported incidents<sup>9</sup> increased from 63 in 2016–17 to 155 in 2017–18. In 2018–19, a total of 130 incidents relating to methane exceedances were reported.

It should be noted that the reduction in reported methane exceedances and the gas incident frequency rate in 2018–19 was potentially influenced by the fact that North Goonyella mine, which had been experiencing exceedances, was evacuated and sealed for nine months of the year due to an ongoing spontaneous combustion event.

Approximately 80 per cent of all HPIs related to gas management are reported by four underground coal mines. Continued efforts to implement preventive and mitigating controls to manage methane exceedances is required by senior management to ensure there is a renewed focus on this key safety metric.

Following targeted audits in 2017–18, and the issuing of directives and SCP notices, mines introduced additional gas monitoring in the longwall tailgate with a trip level for methane of two per cent. It must be noted that, as a result of a detailed methane data analysis, the inspectorate has observed an underreporting of methane exceedances and is exploring further corrective actions.

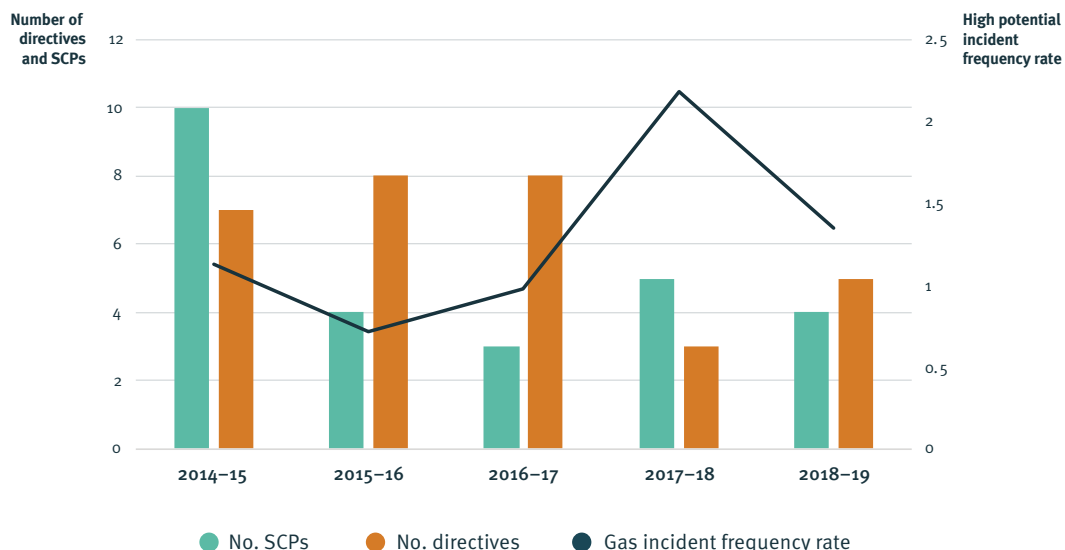
Based on the analysis of mine gas data and a review of gas management practices the inspectorate published the *Methane management in underground coal mines best practice and recommendations* guide<sup>10</sup> in 2019.

<sup>9</sup> Including non-reportable incidents.

<sup>10</sup> [https://www.dnrme.qld.gov.au/\\_data/assets/pdf\\_file/0004/1449121/methane-management-in-underground-coal-mines.pdf](https://www.dnrme.qld.gov.au/_data/assets/pdf_file/0004/1449121/methane-management-in-underground-coal-mines.pdf)

## FIGURE 4

### HPI FREQUENCY RATE FOR GAS EXCEEDANCES AGAINST DIRECTIVES AND SCPs (UNDERGROUND AND SURFACE)



A review of serious accident data highlighted a rise in serious accidents with causal factors related to cranes, lifting and slinging. Mines inspectors also noted non-compliant lifting equipment and poor lifting practices during mine site inspections.

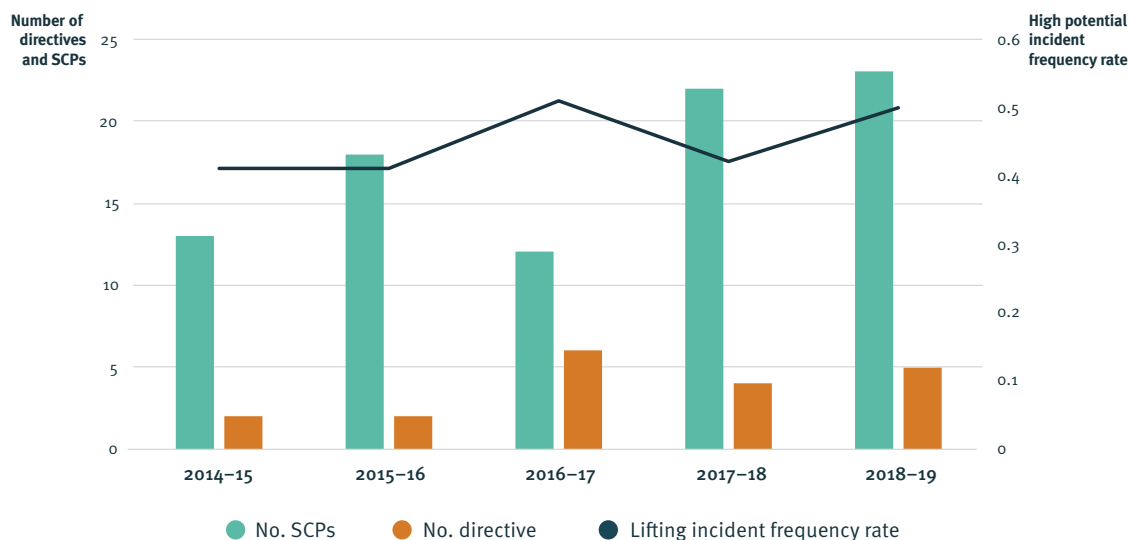
In 2018–19, 41 lifting and/or slinging incidents were reported, up from 30 in 2017–18.

Observations related to lifting and slinging practices were noted in 178 mine record entries made during 2018–19. The number of SCPs issued increased from 22 in 2017–18 to 23 in 2018–19. Despite the increased focus on lifting standards, the lifting incident rate continues to rise.

The inspectorate raised concerns related to lifting at industry briefings including the annual industry leaders' forum and forums for mechanical engineers. The inspectorate also issued *Mines safety bulletin 179* and *Mines safety bulletin 181* which were aimed at addressing lifting and slinging issues.

## FIGURE 5

### HPI FREQUENCY RATE FOR LIFTING AGAINST DIRECTIVES AND SCPs



### Supervision

The findings of investigations and the observations of inspectors show that frontline supervision continues to be a prevalent factor in all categories of incidents.

The top five causal factors related to supervision identified by the inspectorate include:

1. Lack of relevant competencies held by supervisors.
2. The span of control of supervisors being too large to effectively manage tasks under their control.
3. Lack of supervisor visibility and interaction with workforce.
4. Acceptance of risk assessments with minimal task detail and assessment of hazards
5. Poor job planning.

The ongoing importance of supervision in creating and maintaining a safe workplace continues to be a critical component in any safety and health management system. Supervision includes the front line supervisor, senior management team on site, and the corporate leadership team that sets the organisational culture.

# RESPIRABLE DUST HAZARD

## **Controlling and monitoring respirable dust exposures is critical to minimising the risk to mine and quarry workers from mine dust lung disease.**

The likelihood of a mine or quarry worker developing a mine dust lung disease is dependent on the amount, frequency and duration of the dust exposure. It is important for mines and quarries to implement control strategies to reduce dust levels on site and to undertake monitoring to ensure that those controls are effective.

### **Coal mines**

Since 1 January 2017, all Queensland coal mines have been required to provide all personal respirable dust monitoring data to the Chief Inspector of Mines. This data is stored in the Department of Natural Resources, Mines and Energy exposures database which now holds more than 43,000 respirable dust records for all coal mines from 2000.

The collected data shows a major improvement in measured respirable dust levels, driven by:

- ▶ increased industry focus on respirable dust following the re-identification of coal workers' pneumoconiosis in 2015
- ▶ the introduction of recognised standards for dust control and monitoring
- ▶ significant industry effort to trial and implement more effective engineering controls
- ▶ regulatory changes requiring the reporting of respirable dust data, including single sample exceedances
- ▶ a coordinated and focused enforcement regime by the inspectorate including audits against the recognised standard for dust monitoring and inspections focused on dust control
- ▶ industry workshops on respirable dust management
- ▶ mandatory training for people carrying out dust sampling at mines
- ▶ mandatory qualifications for people reviewing and approving dust monitoring programs.

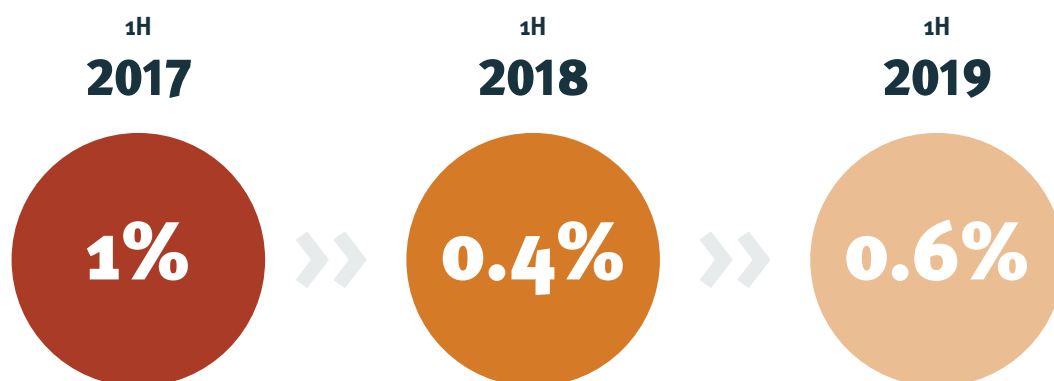
### **Respirable dust**

The single exceedance rate for respirable dust in coal mines has remained consistently at or below one per cent since the introduction of regulatory reforms to respirable dust monitoring at coal mines.

A single exceedance refers to a personal monitoring sample collected during a single shift that exceeds the regulatory limit. This provides a clear signal to the mine and the regulator that attention is required to review the circumstances that led to the exceedance. This must involve undertaking an investigation to verify existing controls, as well as considering additional controls, with the objective of preventing further exceedances during similar tasks. The mine must then undertake further monitoring (resample) to ensure that the source of dust exposure has been controlled.

**FIGURE 6**

**RESPIRABLE DUST  
SINGLE EXCEEDANCE  
RATE FOR OPEN CUT  
AND UNDERGROUND  
COAL MINES  
2017 TO 2019**



<sup>11</sup> On 1 November 2018, the exposure standard for respirable coal dust was reduced to 2.5 mg/m<sup>3</sup>. All SEGs in all coal mines remain below this revised limit.

Research shows that the type of work undertaken by a worker may increase their risk of developing a mine dust lung disease if effective controls are not in place. All coal mines must establish a risk-based monitoring program by following the methodology outlined in *Recognised standard 14—Monitoring respirable dust in coal mines*. Recognised standard 14 requires mines to allocate coal mine workers to a similar exposure group (SEG) and determine the risk (exposure) profile for each SEG. More personal monitoring is required for those SEGs with a higher risk profile.

The SEGs with the highest level of risk in Queensland's underground coal mines are the longwall and development workgroups. Mines with these workgroups are required to monitor workers at least every quarter under the Coal Mining Safety and Health Regulation 2017.

Figures 7 and 8 highlight that average respirable dust exposures across the most high-risk SEGs are well below the occupational exposure limit<sup>11</sup> and are in compliance with the Regulation. In addition to the exposure standard of 2.5 mg/m<sup>3</sup>, the figures below show the shift-adjusted standard of 2.4 mg/m<sup>3</sup>.

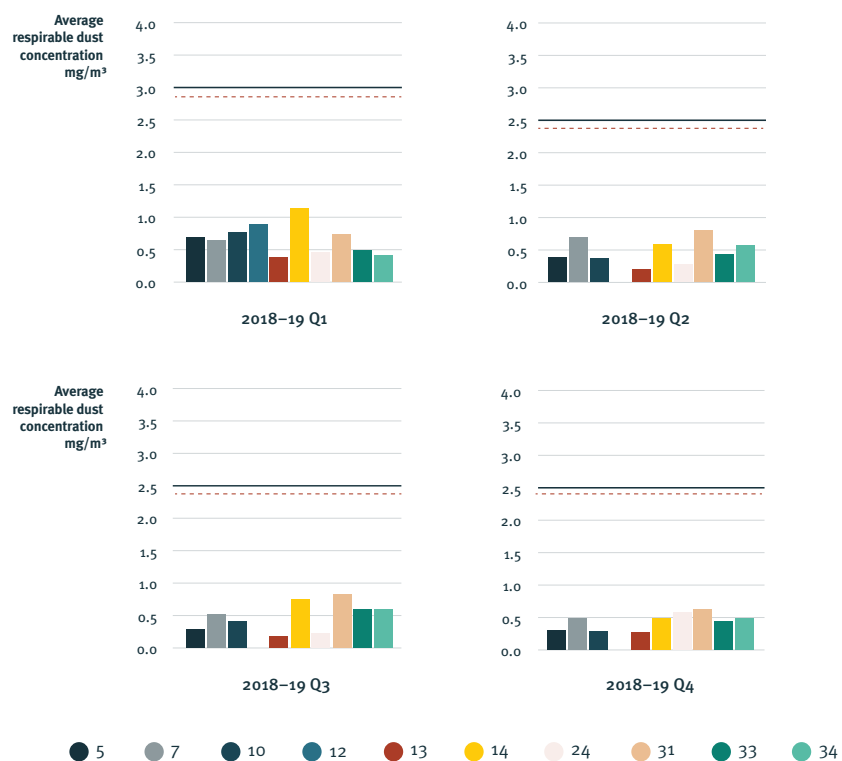
## FIGURE 7

### AVERAGE RESPIRABLE DUST EXPOSURES FOR LONGWALL WORKERS SEG AT UNDERGROUND SITES



## FIGURE 8

### AVERAGE RESPIRABLE DUST EXPOSURES FOR DEVELOPMENT WORKERS SEG, UNDERGROUND SITES



### Respirable crystalline silica (quartz)

Coal mines are also required to monitor and report worker exposure to respirable crystalline silica. Like respirable dust, exposure to respirable crystalline silica can lead to the development of mine dust lung disease, including silicosis.

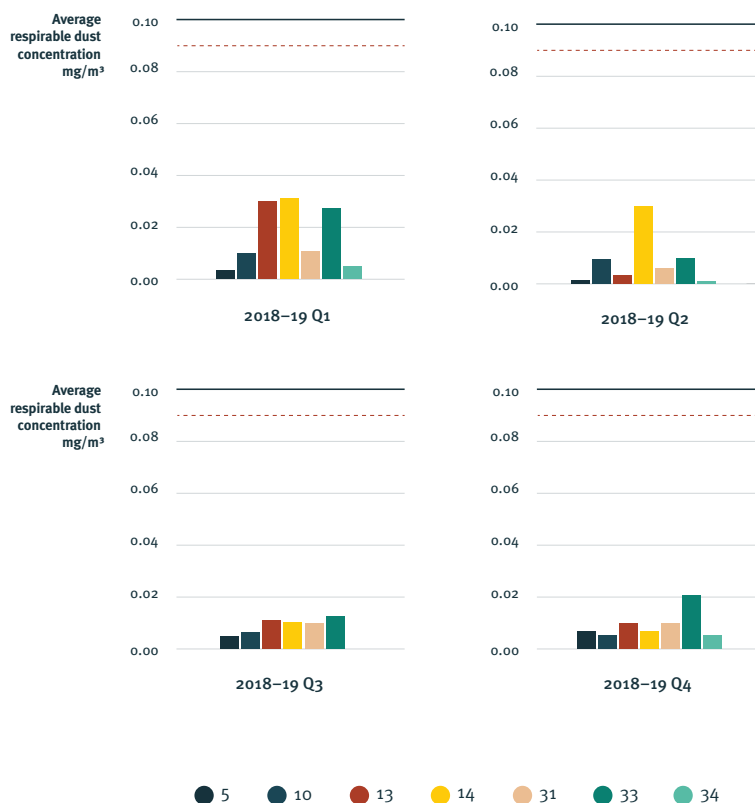
Respirable crystalline silica can be generated during drilling, blasting, crushing, cutting and mining activities. Exposure to respirable crystalline silica represents a risk to surface and underground coal mine workers. The SEGs with the highest level of risk in underground coal mines are the longwall and development workgroups and the SEGs with the highest level of risk for surface mines are the blast driller and blast crew workgroups.

Respirable crystalline silica remains a major focus for surface mines due to the volume of silica-rich overburden handled during mining activities. Since January 2017, respirable crystalline silica accounted for approximately 70 per cent of all single sample exceedances reported by surface coal mines.

Figures 9–11 show monitoring results for the high-risk SEGs for underground and surface sites. In addition to the exposure standard of 0.1 mg/m<sup>3</sup>, the figures also show a typical shift-adjusted exposure standard of 0.09 mg/m<sup>3</sup> for mine workers who work extended shift lengths or alternate rosters that equate to an average of more than 40 hours per week.

## FIGURE 9

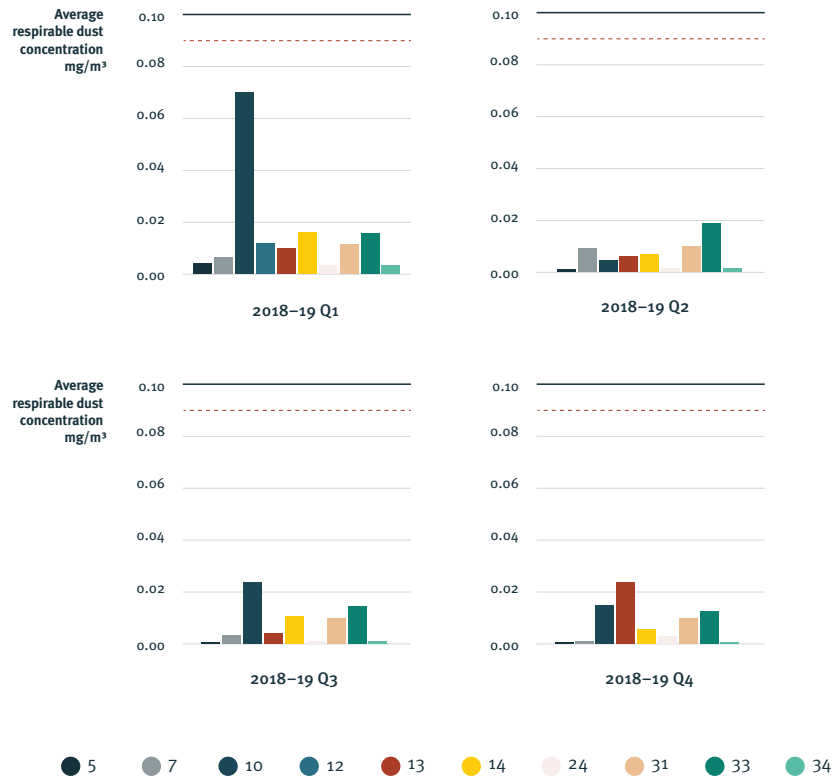
### AVERAGE RESPIRABLE CRYSTALLINE SILICA EXPOSURES FOR LONGWALL WORKERS SEG, UNDERGROUND SITES





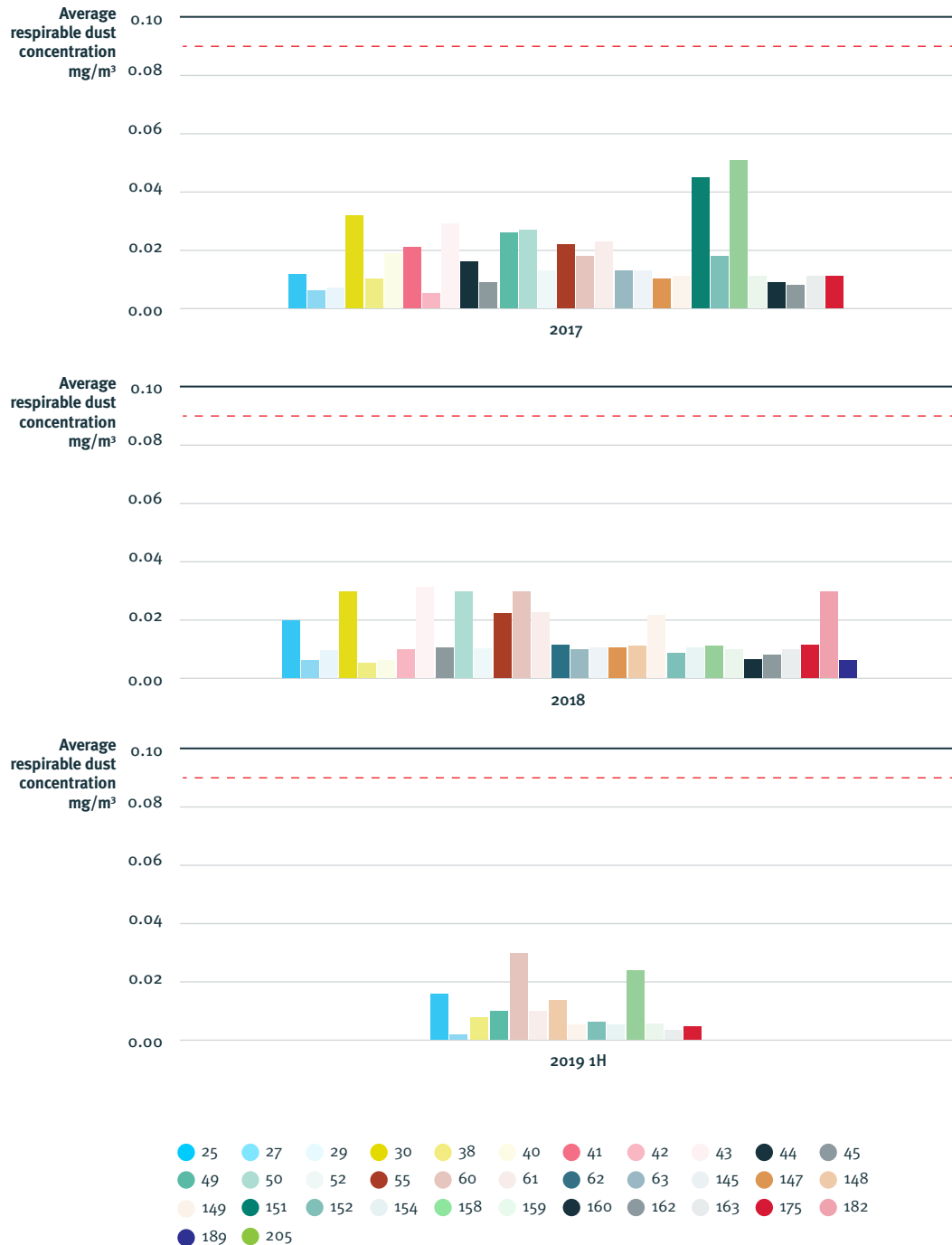
## FIGURE 10

### AVERAGE RESPIRABLE CRYSTALLINE SILICA EXPOSURES FOR DEVELOPMENT WORKERS SEG, UNDERGROUND SITES



### FIGURE 11

#### AVERAGE RESPIRABLE SILICA EXPOSURES FOR BLAST DRILLERS SEG, OPEN CUT SITE

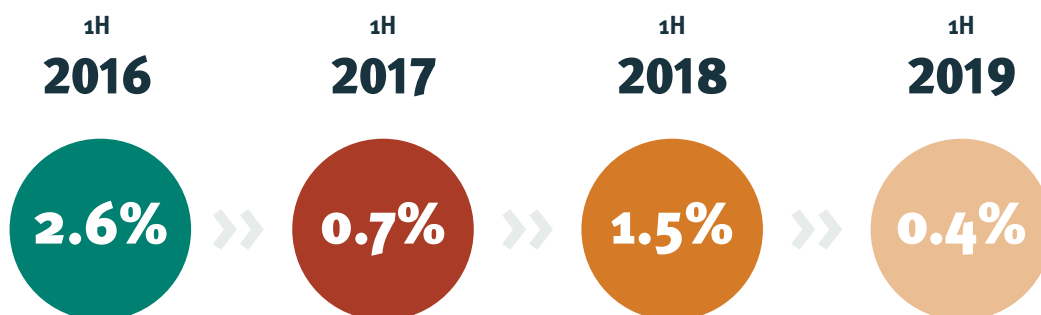


There was a considerable reduction in the single exceedance rate for respirable crystalline silica for surface and underground coal mines in the first half of 2019 as compared to the first half of 2018. Average exposures across surface and underground coal mines remains compliant with the occupational exposure limit.

Safe Work Australia reviewed and proposed a reduction of the occupational exposure limit for respirable crystalline silica in 2018–19 to 0.5 mg/m<sup>3</sup>. Coal mines need to consider the impacts of any likely reduction in the exposure standard and continue to control exposures to as low as reasonably achievable.

## FIGURE 12

RESPIRABLE  
CRYSTALLINE SILICA  
SINGLE EXCEEDANCE  
RATE OPEN CUT AND  
UNDERGROUND COAL  
SITES 2016 TO 2019



### Mineral mines and quarries

In August 2017, the inspectorate published *QGLo2 Guideline for management of respirable crystalline silica in Queensland mineral mines and quarries*.<sup>12</sup> The guideline states ways that mines may achieve an acceptable level of risk in managing respirable crystalline silica.

Since 1 July 2018, all Queensland mineral mines and quarries have been required to provide all personal dust monitoring data to the Chief Inspector of Mines. This change was effected when version 2 of QGLo2 was published in May 2018. This improvement has enabled the inspectorate to populate the dust exposures database with all respirable dust and respirable crystalline silica dust monitoring results. This data is used to monitor industry performance.

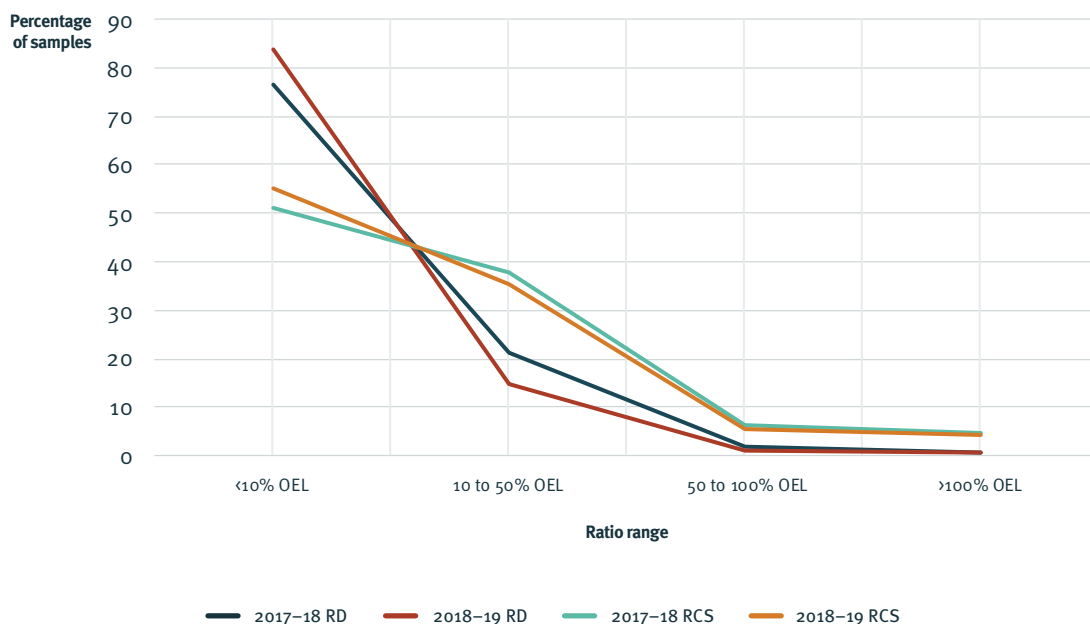
In 2017–18, 25 per cent of operational mineral mines and quarries achieved compliance with QGLo2. However, in 2018–19, the number of sites achieving compliance almost doubled with an additional 51 per cent achieving compliance.

#### Dust monitoring results

The dust monitoring data collected in the past two years shows an overall downward trend for exposure to respirable dust and respirable crystalline silica in mineral mines and quarries. Figure 13 shows exposure ratio groupings as required by QGLo2. The data shows that both respirable dust and respirable crystalline silica exposure has been reduced across all sites.

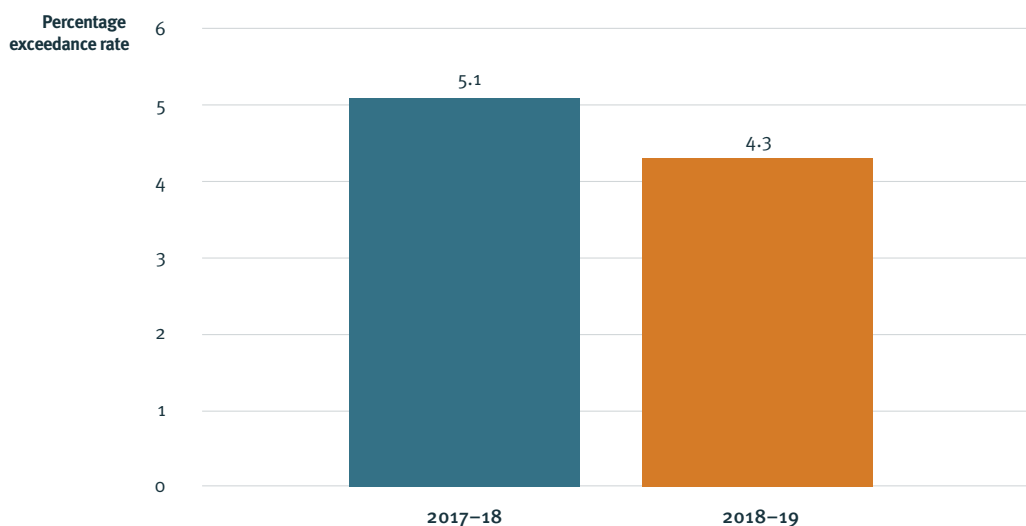
As the management of dust is improved, the sampling burden on sites is significantly reduced, with an increased focus on dust controls and their ongoing maintenance and improvement. When workers are measured as being less exposed to dust, the requirement to periodically sample is lower. If workers are exposed to less than 10 per cent of the occupational exposure limit, then the required sampling frequency rate may change to only every three years, whereas exposure above the occupational exposure limit will require quarterly sampling.

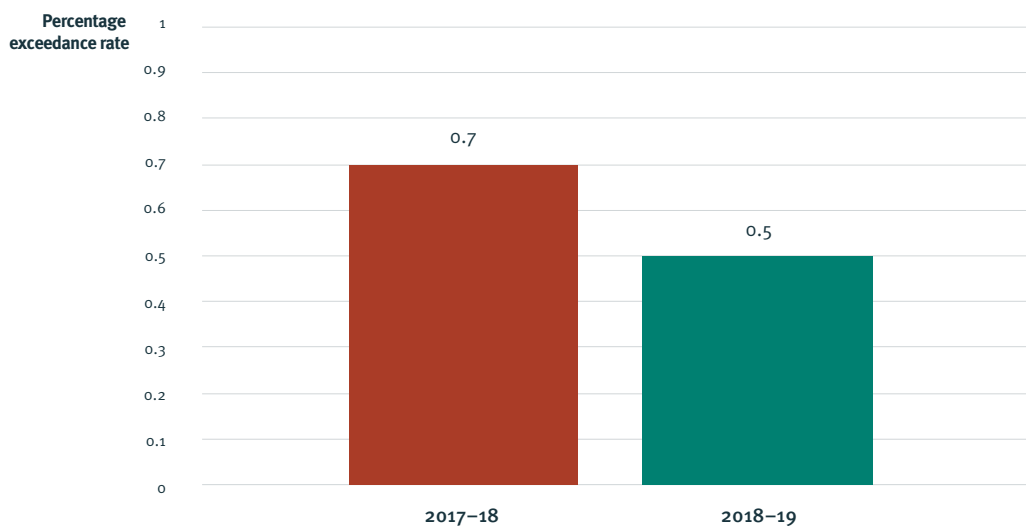
<sup>12</sup> [https://www.dnrme.qld.gov.au/data/assets/pdf\\_file/0006/1263669/qglo2-guideline-mines-quarries.pdf](https://www.dnrme.qld.gov.au/data/assets/pdf_file/0006/1263669/qglo2-guideline-mines-quarries.pdf)

**FIGURE 13****EXPOSURE RATIO  
FOR RESPIRABLE  
CRYSTALLINE SILICA  
AND RESPIRABLE  
DUST IN MINERAL  
MINES AND QUARRIES**

The industry exceedance rate for respirable crystalline silica fell from 5.1 per cent in 2017–18 to 4.3 per cent in 2018–19. Similarly, the exceedance rate for respirable dust fell from 0.7 per cent to 0.5 per cent.

Safe Work Australia reviewed and proposed a reduction of the occupational exposure limit for respirable crystalline silica in 2018–19 to 0.5 mg/m<sup>3</sup>. While there has currently been no legislative changes, a reduction in the occupational exposure limit will require all mines and quarries to review their safety and health management systems and target resources towards risk control to manage dust to as low as reasonably achievable and below the occupational exposure limit.

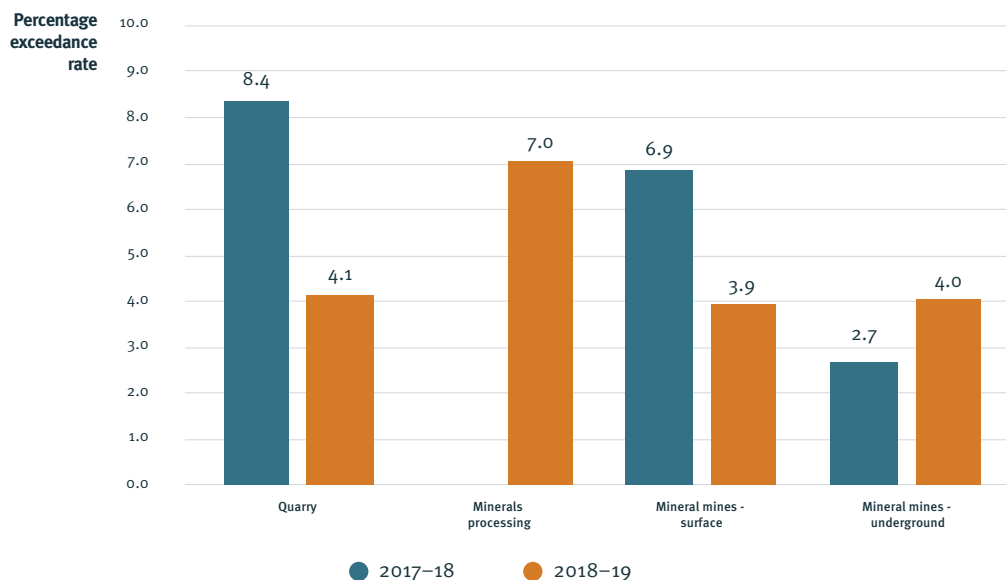
**FIGURE 14****INDUSTRY RESPIRABLE  
CRYSTALLINE SILICA  
EXCEEDANCE RATE  
FOR MINERAL MINES  
AND QUARRIES**

**FIGURE 15****INDUSTRY RESPIRABLE  
DUST EXCEEDANCE  
RATE FOR MINERAL  
MINES AND QUARRIES**

Figures 16 and 17 compare the percentage of respirable crystalline silica and respirable dust exceedances for each category of operation for 2017-18 and 2018-19.

Quarries show the greatest improvement where exceedance rates have more than halved across both respirable crystalline silica and respirable dust. The data shows a 60 per cent increase in sample numbers as well as decreased exceedance numbers reported contributing to this decrease. Surface mineral mines also saw a significant reduction in respirable crystalline silica exceedances likely due to doubling in the number of samples and lower exposures. Although mineral processing sites reported no exceedances in 2017-18, a small number of exceedances reported in 2018-19 equated to a seven per cent exceedance rate due to low sample numbers. Underground mineral mines reported an increase in the exceedance rate with lower sample numbers in 2018-19 but a similar number of exceedances. Quarries reported the largest amount of sampling data.

QGLo2 requires all exceedances to be investigated on sites. The investigation must identify the cause of the exceedance and the control measures or action that will be taken to prevent or eliminate further exceedances.

**FIGURE 16****EXCEEDANCE  
PERCENTAGE  
FOR RESPIRABLE  
CRYSTALLINE SILICA  
IN MINERAL MINES  
AND QUARRIES**

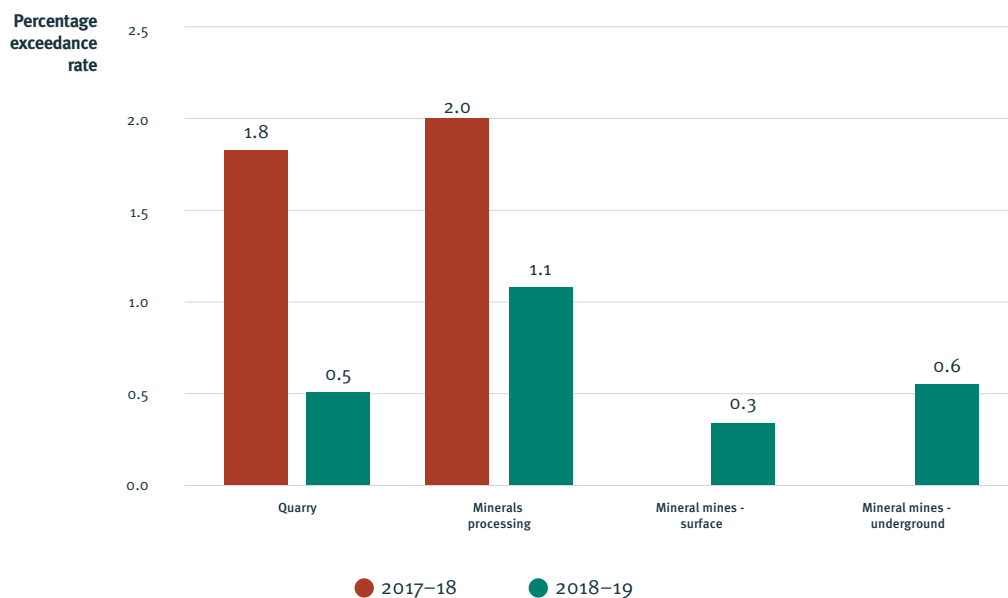
**FIGURE 17****EXCEEDANCE  
PERCENTAGE FOR  
RESPIRABLE DUST  
IN MINERAL MINES  
AND QUARRIES**

Figure 18 details the exceedances rationalised by the number of sites in each sector. In 2018-19, the minerals processing category reported the highest number of respirable crystalline silica exceedances for the number of operating sites, followed closely by underground sites. Surface sites and quarry sites reported the lowest proportion of exceedances. Minerals processing and underground sites represent around 46 per cent of the mineral mines and quarries workforce but only 6 per cent of operating sites.

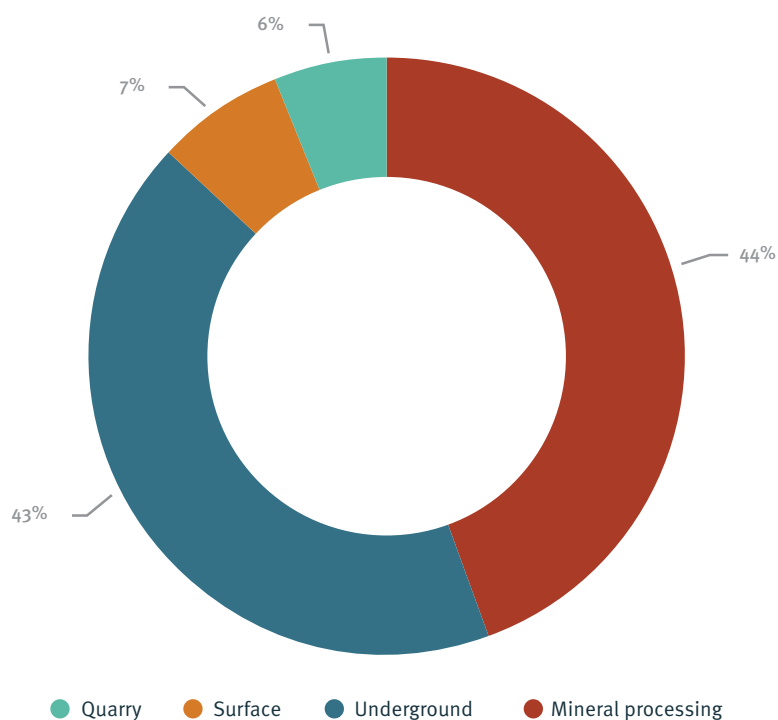
**FIGURE 18****PROPORTION  
OF RESPIRABLE  
CRYSTALLINE SILICA  
EXCEEDANCES  
BY INDUSTRY**

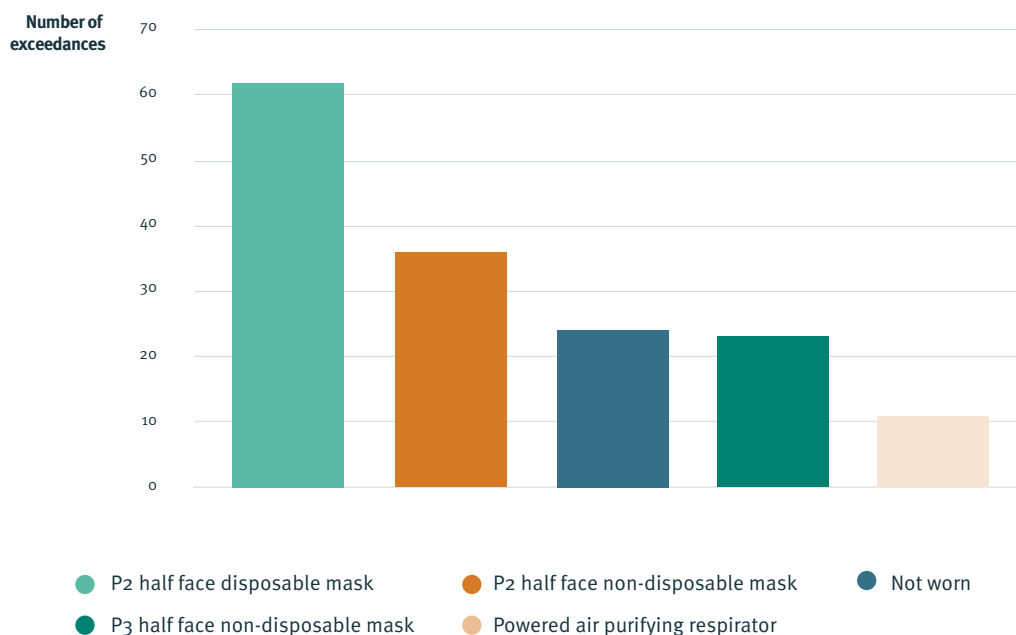
Figure 19 shows the top five types of respiratory protective equipment worn by mineral mine and quarry workers who experience exceedances.

The most common respiratory protective equipment worn is a *P2 half face disposable mask*. A *P2 half face disposable mask* is only protective up to 10 times the occupational exposure limit when it is fit tested and conforms to the requirements of *AS/NZS 1715:2009 Selection, use and maintenance of respiratory protective equipment*. However, exceedances at some minerals processing sites have been reported up to 27 times the occupational exposure limit, and up to 25 times the limit at some underground sites, up to 11 times the limit at some quarries, and up to 9 times the limit at some surface mines.

To ensure workers are sufficiently protected, sites must use appropriate respiratory protective equipment for the level of risk and must ensure equipment is maintained according to the manufacturer's instructions.

## FIGURE 19

### TOP 5 TYPES OF RESPIRATORY PROTECTIVE EQUIPMENT WORN BY MINERAL MINE AND QUARRY WORKERS WHO EXPERIENCE EXCEEDANCES



### Monitoring respirable crystalline silica in small mineral mines and quarries

On 1 July 2018, the inspectorate commenced a two-year program to conduct dust sampling in small to medium mineral mines and quarries and to assess compliance with *QGLo2*.

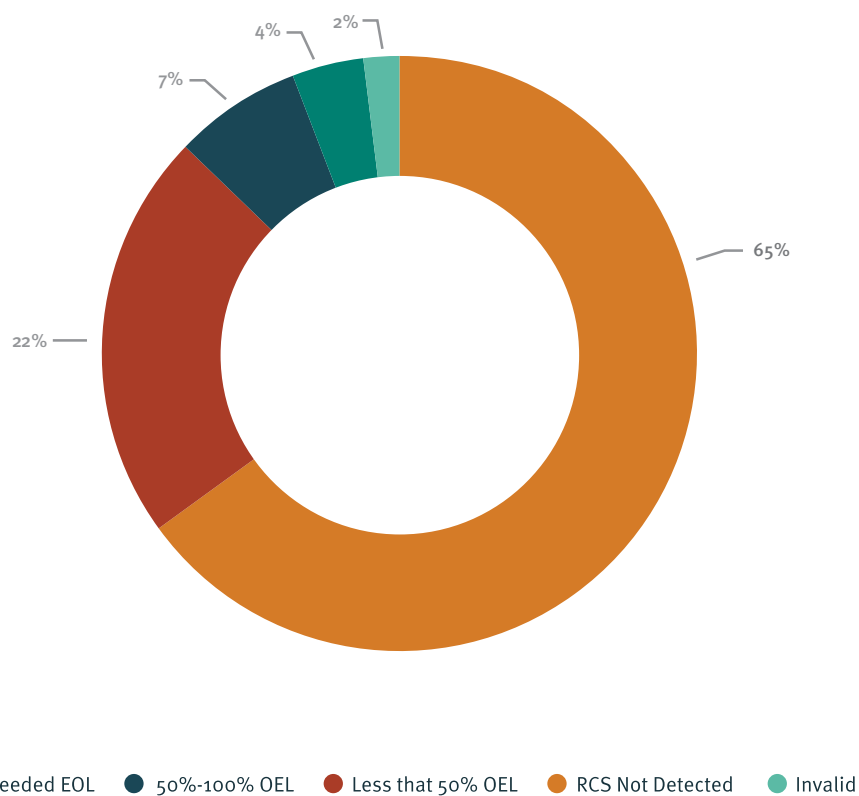
The program is being conducted in operations such as hard-rock quarries, sand mines, gemfield mines, and operations producing sandstone, bentonite, diatomaceous earth and lime. It includes the collection of dust samples by a mines inspector and a structured inspection program to monitor compliance with the guideline.

In 2018–19, the inspectorate collected more than 250 personal samples and 18 static-position samples from 66 sites. Sample results reflect those of larger mineral mining and quarrying operations and indicate that most workers in smaller operations are not exposed to dangerous levels of respirable crystalline silica.

As a result, 140 compliance actions have been issued, with the majority requiring the operation to evaluate and control their respirable crystalline silica risk and to engage an occupational hygienist to develop and undertake an exposure monitoring program.

## FIGURE 20

### SMALL MINE AND QUARRY RESPIRABLE CRYSTALLINE SILICA SAMPLE RESULTS





# HIGH POTENTIAL INCIDENTS

## The inspectorate considers HPIs to be an important lead indicator for measuring the effectiveness of safety and health systems.

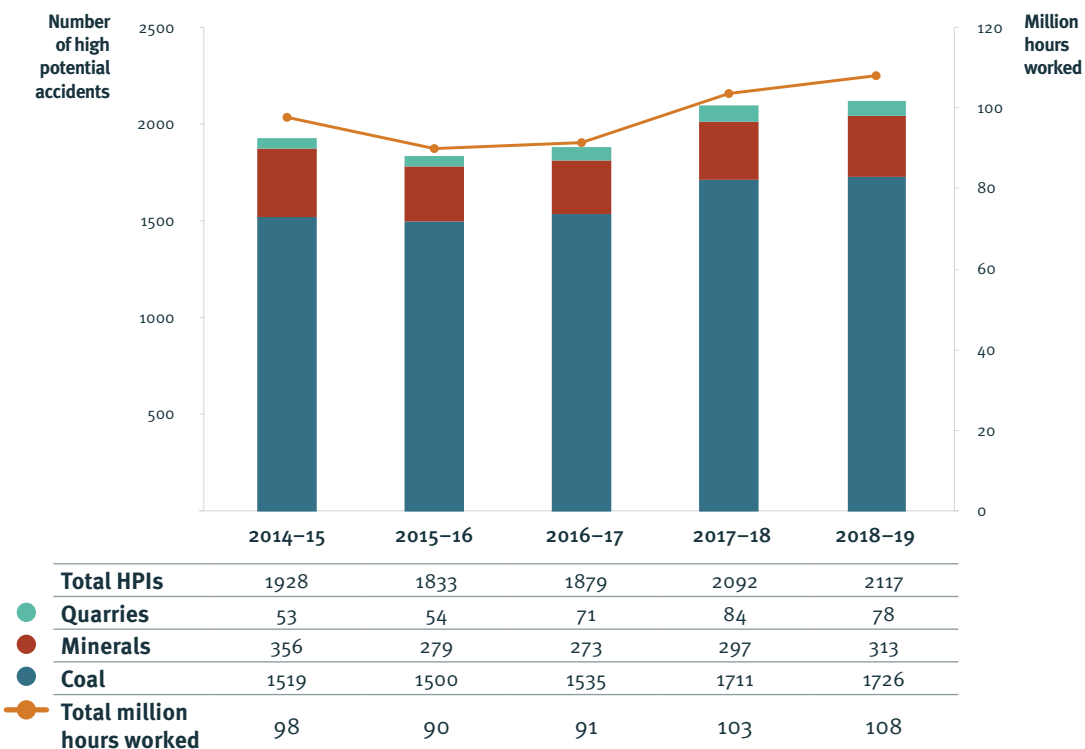
The overall high potential incident frequency rate for 2018–19 fell slightly to 19.6 incidents per million hours worked, from 20.2 incidents per million hours worked in 2017–18. The rate has remained relatively consistent over the past five years.

More than 85 per cent of high potential incidents over the last six years did not involve an injury to any worker. The reporting of high potential incidents to the inspectorate is an indicator of an industry with a mature reporting culture and strong regulatory oversight.

Analysing the root causes of HPIs plays an important role in improving performance. Figure 21 shows the number of HPIs relative to the total number of hours worked. The fatality review by Dr Sean Brady will include a detailed analysis into the HPIs and issues surrounding the events that resulted in the HPI.

### FIGURE 21

#### NUMBER OF HIGH POTENTIAL INCIDENTS RELATIVE TO NUMBER OF HOURS WORKED (ALL SECTORS), 2014–15 TO 2018–19



After the impact of improved reporting of gas management is considered,<sup>13</sup> the number of reported HPIs in coal mines has largely remained consistent over the past three years (1512 in 2016–17, 1612 in 2017–18, 1647 in 2018–19).

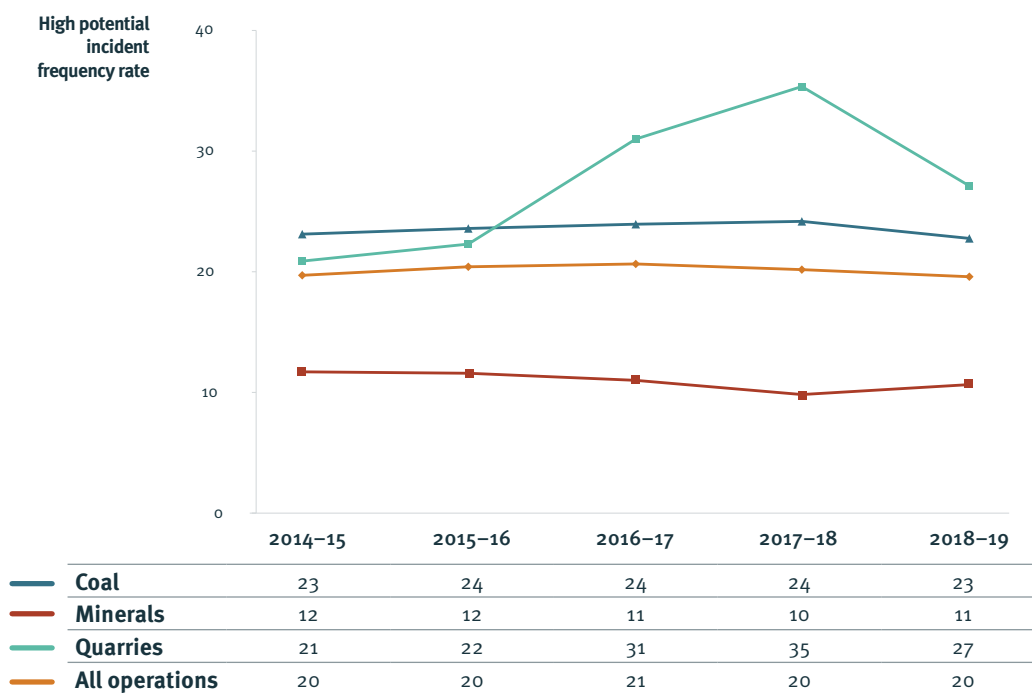
The most frequently reported HPIs across both coal mines and mineral mines and quarries were vehicle-related incidents, thermal (fire) events, explosives incidents, gravity (falling people or equipment) and electrical incidents. These categories and trends have remained consistent over the last three years.

The cause of HPIs can be varied, including organisational factors, the operating environment, individual and team causes, and absent or failed controls. Based on the information collected from industry, a substantial number of HPIs have been linked to a lack of awareness about the hazards and absent or failed controls. Industry is encouraged to implement higher level controls such as engineering, substitution and isolation to ensure the risk to workers is at an acceptable level.

<sup>13</sup> In 2017–18, the number of gas management-related HPIs reported increased by 76 to 99. In 2018–19, there were 79 gas management-related HPIs and 10 NRIs reported.

## FIGURE 22

### HIGH POTENTIAL INCIDENT FREQUENCY RATE (ALL SECTORS), 2014–15 TO 2018–19



# SERIOUS ACCIDENTS

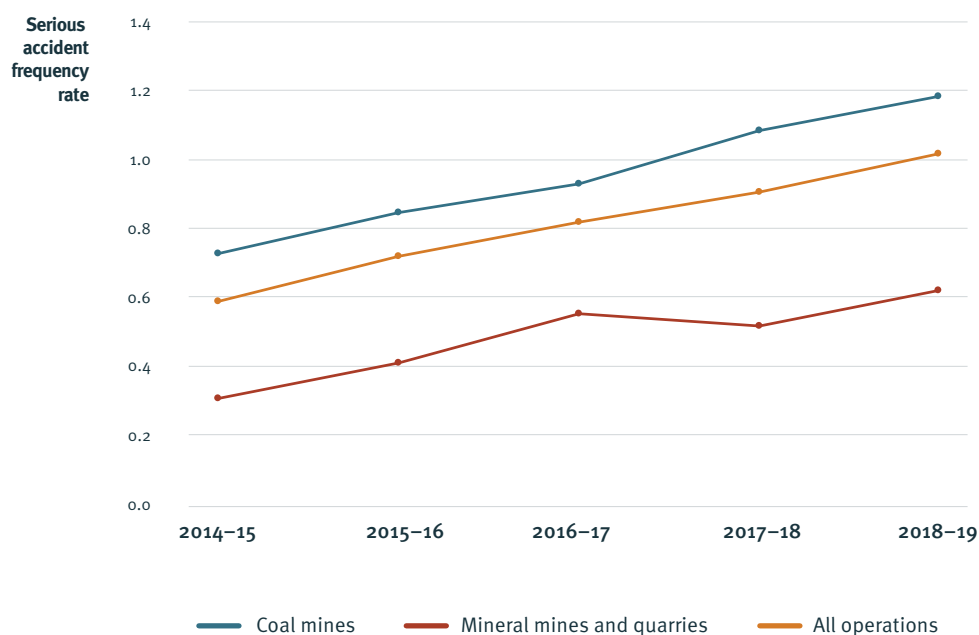
**A serious accident is defined as an accident that causes the death of a worker or requires a worker to be admitted to hospital as an inpatient.**

The serious accident frequency rate provides an insight into the effectiveness of critical controls on mine and quarry sites.

The frequency of serious accidents has been on a steady rise over the past five years, increasing from 0.59 serious accidents per million hours worked in 2014–15 to 1.02 in 2018–19. In total, there were 110 serious accidents in 2018–19 (90 in coal mines and 20 in mineral mines and quarries). Figure 23 shows the increasing trend for serious accidents across both coal mines and mineral mines and quarries.

## FIGURE 23

**SERIOUS ACCIDENT FREQUENCY RATE, 2014–15 TO 2018–19 (ALL SECTORS)**



In coal mines, the most frequent causes of serious accidents were being trapped/crushed, falls and vehicle interactions. In mineral mines and quarries, the most frequent causes of serious accidents were entanglement, falls and vehicle interactions/collisions.

In 2018–19, contractors were involved in 64 per cent of serious accidents in coal mines. This is in line with the previous year (67 per cent).

In 2018–19, contractors were involved in 35 per cent of serious accidents in mineral mines and quarries. This is lower than in 2017–18 (53 per cent).

Mine and quarry operators have an obligation to report serious accidents as soon as practicable after the event has occurred. A review of notification data for serious accidents from 2014–15 to 2018–19 shows that the mean time for all mines and quarries to report the accident to the inspectorate is 6.75 hours.

This is of concern to the inspectorate as it affects its ability to ensure an appropriate response, including notifying other mines with similar equipment or issues in a timely manner, investigating the incident if necessary, and communication and public interest issues. Delays in reporting may result in the scene not being effectively preserved prior to an investigation being commenced.

The inspectorate considers a notification time of less than three hours after the event has occurred to be appropriate. These concerns will be discussed with mines during the next year.

# CHAPTER 2

# OVERVIEW OF

# OCCUPATIONAL

# HEALTH OUTCOMES



# MINE DUST LUNG DISEASE

Reforms that have been delivered to address mine dust lung disease are focused on three key areas:

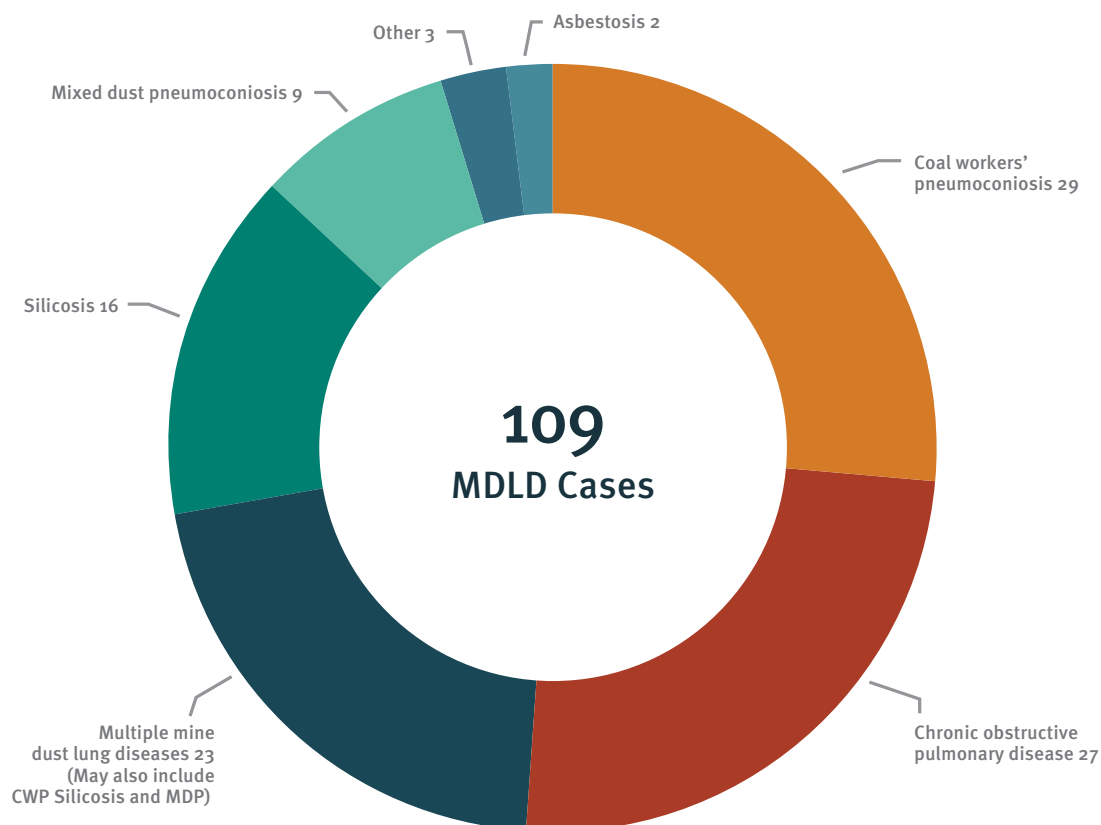
- ▶ prevention
- ▶ early detection
- ▶ provision of a safety net for affected workers.

Government, industry, unions and medical professionals are working together to deliver on these areas.

As at 30 June 2019, there were 109 reported cases of mine dust lung disease among current and former Queensland coal mine and mineral mine and quarry workers. This consolidated reporting captures all reported cases of mine dust lung disease from 1984. Of this total, 81 cases were among current and former Queensland coal mine workers whose experience was in coal mining only. This included 27 cases reported in 2018–19. There were 18 reported cases of mine dust lung disease which involved workers with experience in both coal mines and mineral mines and/or quarries, of which three cases were reported in 2018–19.

## FIGURE 24

**TOTAL INDIVIDUALS  
WITH MINE DUST LUNG  
DISEASE FOR ALL  
MINING SINCE 1984**



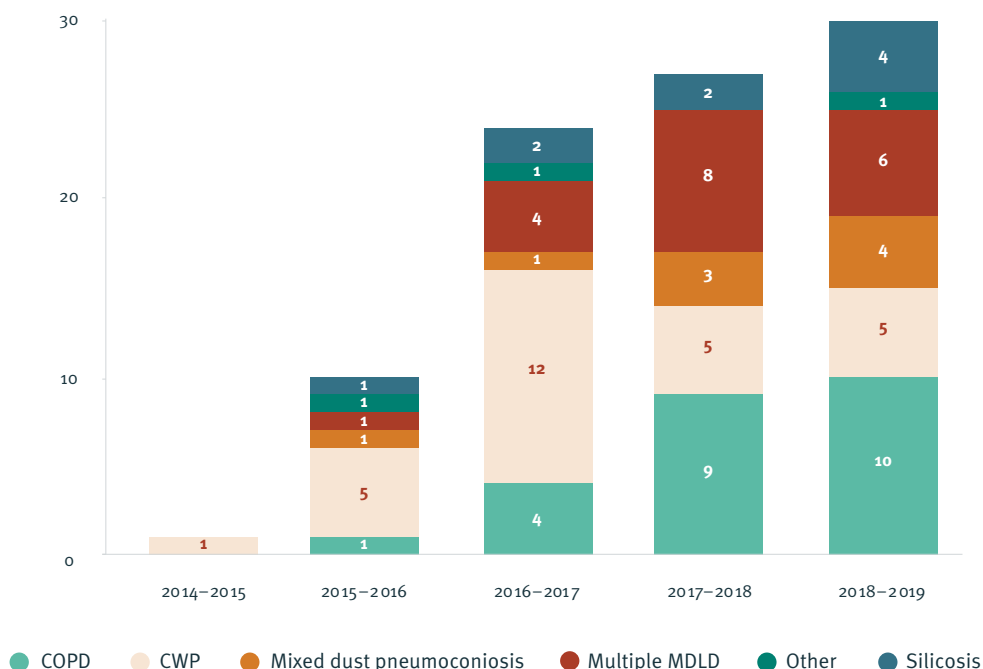
As a result of improvements made to the screening process and increased awareness of mine dust lung disease, we expect that the number of reported disease cases will increase.

Other improvements to the dataset of disease cases include legislated requirements for mines to report known cases of prescribed diseases and the provision of data about accepted workers compensation claims from the Office of Industrial Relations. Further improvements to the dataset are expected as a result of the Queensland Government's Notifiable Dust Lung Disease Register and associated reporting requirements which commence in 2019–20.

Figure 25 shows the number of cases of mine dust lung disease reported each financial year for coal mine workers since 2015 when coal workers' pneumoconiosis was re-identified. The graph includes cases where workers have experience across coal mining and mineral mining and/or quarrying.

## FIGURE 25

### WORKERS WITH MINE DUST LUNG DISEASE – COAL HISTORY



The data shows a general continuation of the rates of mine dust lung disease seen in 2017–18, which may reflect a maturing scheme and greater overall awareness of the link between respirable dust and mine dust lung disease across all stakeholders. As disease reporting has become more sophisticated, cases of pneumoconiosis are now classified as coal workers' pneumoconiosis and silicosis, as well as mixed dust pneumoconiosis, where a worker has been exposed to multiple dust types. The single case of other mine dust lung disease this year represents a case where the specific mine dust lung disease diagnosis has not been finalised.

Of the reported cases for workers with coal mining experience in Queensland:

- ▶ 78 per cent aged > 50 years
- ▶ 52 per cent underground workers
- ▶ 33 per cent surface workers
- ▶ 24 per cent with interstate or international mining work history.

Queensland's mandatory health surveillance scheme for coal mine workers aims to detect any signs of mine dust lung disease early. Changes made to enhance the quality of examinations under the scheme as recommended by the Monash University review ensures the likelihood of detection is maximised.

In a voluntary scheme, it is more likely workers won't be checked and any disease will have progressed to a severe case before being detected.

Most of Queensland's reported cases have been identified during the early stages of disease and removing or reducing the worker's exposure to dust can prevent symptoms from progressing. Early stage mine dust lung disease has a good prognosis. Generally, it does not result in any symptoms and lung capacity remains within a normal range. However, health surveillance is key to identifying the disease in its earliest stages so that exposure can be reduced to prevent the disease from progressing.<sup>14</sup>

### Chest X-ray dual reading program

All chest X-rays are now examined against the International Labour Organisation's International Classification of Radiographs of Pneumoconioses (ILO Classification). The ILO Classification is the accepted international standard to describe and code potential abnormalities in chest X-rays that may indicate a mine dust lung disease. Through this screening process, the worker's X-ray is compared against a set of standard X-ray images. The concentration of small opacities in the affected zone of the lung is classified by increasing size on a 12-point scale which consists of four major categories (0, 1, 2 and 3) with three subcategories in each.

A classification of category 0 indicates a negative screening result. A result of 1 to 3 may indicate early stages of disease. Large abnormalities are classified as A, B or C and may indicate advanced stages of the disease, commonly referred to as progressive massive fibrosis. It is important to note that this is a screening process, and any positive screening result does not necessarily lead to a disease being diagnosed. Results must be further investigated using the clinical pathways guideline which provides the recommended process for follow-up investigation and referral to appropriate medical specialists and tests.

From 1 July 2016 to 30 June 2019, the department sent more than 49,000 chest X-rays to the United States for assessment by National Institute for Occupational Safety and Health approved B-readers. More than 37,000 chest X-rays have been reported and returned to the department. From 1 March to 30 June 2019, Lungscreen Australia's certified B-readers had also undertaken more than 6000 chest X-ray reports.

<sup>14</sup> Dr Robert Edwards, "Miners' Health Matters", Department of Natural Resources Mines and Energy, <https://www.dnrme.qld.gov.au/miners-health-matters/detection> [video], 2018

## FIGURE 26

### X-RAY READ RESULTS FROM JULY 2016 TO 30 JUNE 2019

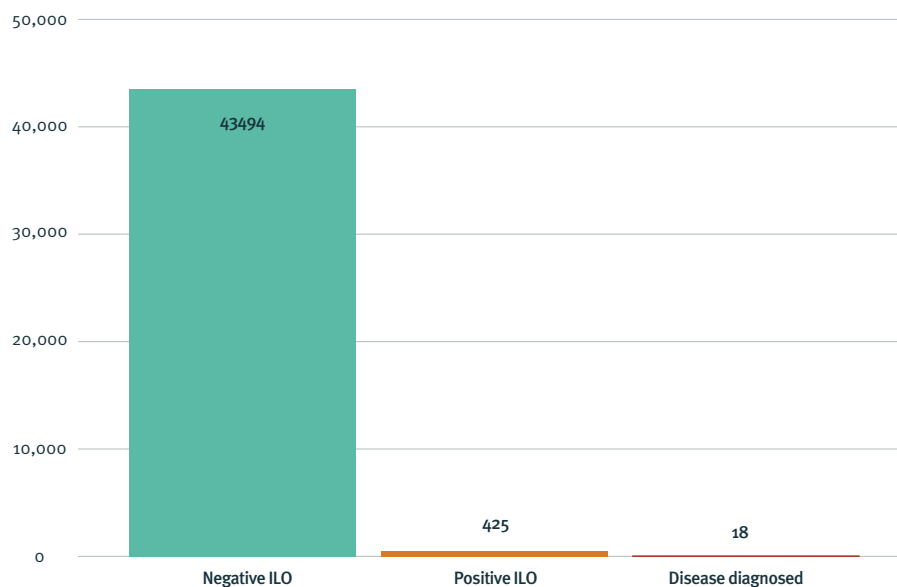




Table 2 shows the ILO Classification categories of chest X-rays reported by National Institute for Occupational Safety and Health-approved readers in the United States and by Lungscreen Australia as at 30 June 2019.

**TABLE 2****CHEST X-RAY  
SCREENING  
RESULTS**

ILO category	Number of X-rays reported
Negative (o)	43,494
1/0	223
1/1	148
1/2	33
≥2/1	13
A,B,C	8

Across both dual reading programs, 99 per cent of chest X-rays have returned a negative ILO Classification result. One per cent returned a positive result and, of these, 18 resulted in a mine dust lung disease diagnosis after investigation using the clinical pathways guideline.

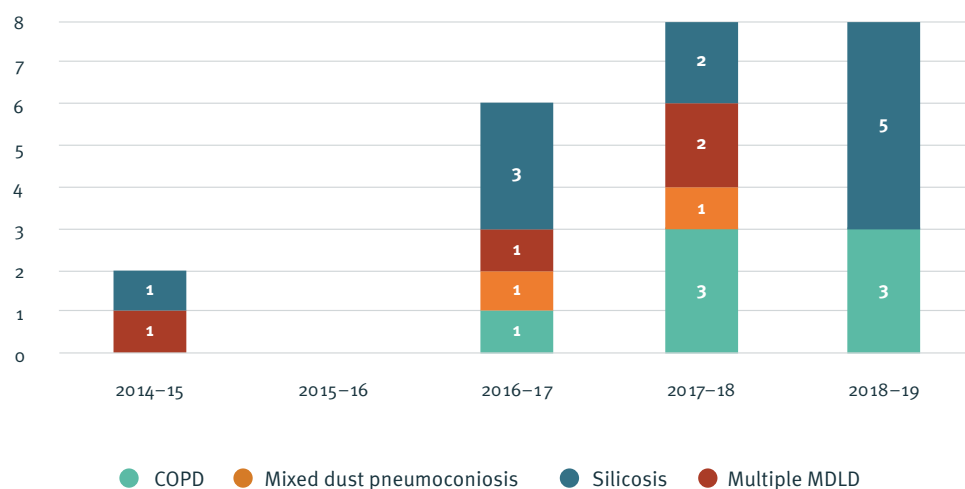
The use of X-ray readers from the United States has been an interim measure until Australian radiologists gained the internationally recognised B-reading qualification and sufficient experience in performing B-reads. With 13 qualified Australian B-readers now on the department's register of approved providers, the transition to an Australian X-ray reading service is complete.

**Mineral mines and quarries**

As at 30 June 2019, there have been 10 reported cases of mine dust lung disease among current and former Queensland mineral mine and quarry workers who have worked in mineral mining and/or quarrying only. Two of these cases were for workers with experience in quarries only. There have been 18 reported cases of mine dust lung disease which involved workers with experience in both coal mines and mineral miners and/or quarries.

In 2018–19, five cases of mine dust lung disease were reported for workers with only a mineral mine or quarry work history.

Figure 27 shows the number of cases reported each financial year for mineral mine and quarry workers since 2015 when coal workers' pneumoconiosis was re-identified. The graph includes cases where workers have experience across coal mining and mineral mining and/or quarrying.

**FIGURE 27****WORKERS WITH MINE  
DUST LUNG DISEASE  
WITH MINERAL,  
QUARRY OR MINERAL/  
COAL WORK HISTORY**

# DIESEL PARTICULATE MATTER

**Diesel powered machinery is used extensively in modern underground mines and a wide range of diesel plant is used in both underground coal and mineral mines, including trucks, loaders and light vehicles.**

Diesel exhaust generated by these machines has been identified by the International Agency for Research on Cancer as a confirmed human carcinogen. Workers in underground mines may be more likely to be exposed than open cut workers due to the enclosed environment.

Queensland mining legislation currently has no prescribed regulatory limit for diesel exhaust. Queensland has adopted an occupational exposure limit of  $0.1 \text{ mg/m}^3$  (time weight average) as recommended by the Australian Institute of Occupational Hygienists, which is applied by all mines.

## Coal mines

The inspectorate now has a comprehensive record of more than 8500 personal diesel particulate matter exposure results from coal mines dating back to the early 2000s. This data is stored on the Department of Natural Resources, Mines and Energy respirable dust database which allows for detailed analysis of the risk to workers.

In the last three years, there has been demonstrable improvement in mean exposures in the highest risk SEG—longwall move—with mixed results recorded in other at-risk SEGs. However, most mines have generally recorded mean exposures well below the shift adjusted occupational exposure limit of  $0.9 \text{ mg/m}^3$ .

For the *longwall move* SEG, significant improvements were observed across all sites that reported, recording mean exposures below the shift adjusted occupational exposure limit.

For the *development production* SEG, 50 per cent of mines recorded an increase in their mean exposures in 2018 compared with the respective reported average in 2017, with two mines exceeding the shift adjusted occupational exposure limit, and one of those mines recording in excess of  $0.25 \text{ mg/m}^3$ .

The *underground maintenance* and *longwall production* SEGs generally recorded reduced mean exposures with all sites reporting average exposures well below the occupational exposure limit.

The *outbye construction and infrastructure* SEG recorded slightly raised mean exposures, but all mines recorded results well below the shift adjusted occupational exposure limit.

Monitoring rates vary considerably between sites and the monitoring frequency at some sites does not appear to be risk based. While monitoring alone does not reduce exposures, it does provide important information about exposure risk and effective controls. As exposure risk increases the focus needs to be on risk control, and the respective monitoring frequency should be sufficient to ensure effective control is maintained and validated.

## FIGURE 28

### MEAN EXPOSURES, DPM, LONGWALL MOVE SEG, 2015 - 2018



## FIGURE 29

### MEAN EXPOSURES, DPM, DEVELOPMENT PRODUCTION SEG, 2015 – 2018



### FIGURE 30

**MEAN EXPOSURES,  
DPM, UNDERGROUND  
MAINTENANCE SEG,  
2015 – 2018**

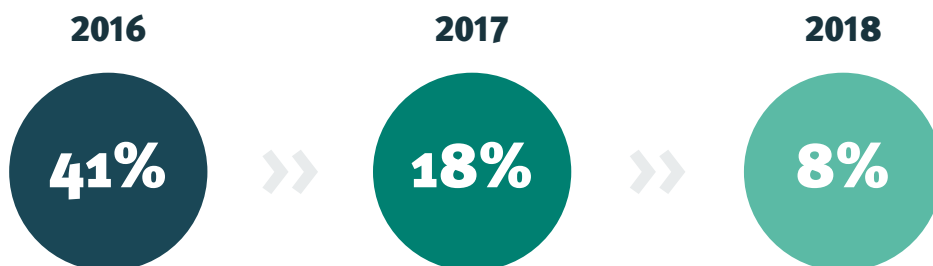


Over the last three years there has been a significant decrease in the single exceedance rate for diesel particulate matter for the *longwall move* SEG, while the single exceedance rate for the *development production* SEG has fluctuated, although the longer-term trend remains down.

Exposure data for 2019 will be requested from sites in early 2020 and will be analysed for exposure trending and assessment of the effectiveness of controls.

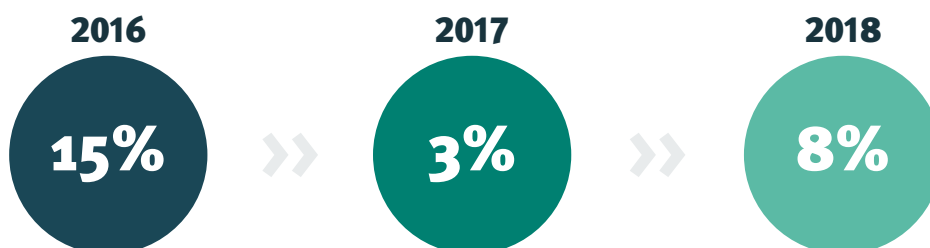
### FIGURE 31

**SINGLE EXCEEDANCE  
RATE – DIESEL  
PARTICULATE MATTER -  
LONGWALL MOVE SEG**



**FIGURE 32**

**SINGLE EXCEEDANCE  
RATE – DIESEL  
PARTICULATE MATTER  
– DEVELOPMENT  
PRODUCTION SEG**

**Mineral mines and quarries**

Exposure monitoring results for diesel particulate matter in underground mineral mines indicates that systems at each mine have been effective in managing exposure.

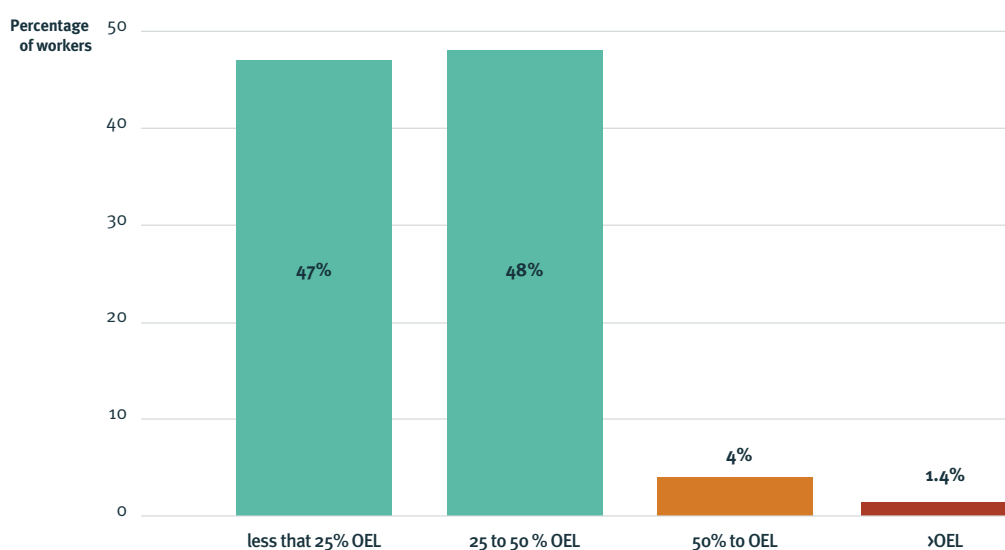
Analysis of diesel particulate matter samples taken in underground mineral mines from 2014–15 to 2018–19 show that more than 94 per cent of workers are engaged in SEGs where mean exposures are less than 50 per cent of the occupational exposure limit with only four per cent engaged in SEGs with mean exposures of between 50 to 100 per cent of the occupational exposure limit.

Approximately 1.4 per cent of workers are subject to exposures above the occupational exposure limit, in roles including:

- ▶ drilling including jumbo
- ▶ shotcreting operations
- ▶ service crew
- ▶ charge-up crew.

**FIGURE 33**

**DISTRIBUTION OF  
DIESEL PARTICULATE  
MATTER EXPOSURES  
FOR SEGs IN  
UNDERGROUND  
MINERAL MINES**



Generally, underground mineral mines have systems and processes in place that ensure the mean exposure of workers is below the occupational exposure limit. Of the 19 underground mineral mines in Queensland, three recorded a mean exposure above the occupational exposure limit in any of its most at-risk SEGs—two in their *shotcreting* SEG and one in its *charge crew* SEG.

# INORGANIC LEAD – AIRBORNE AND BLOOD LEAD

## **Workers in lead mining and mineral processing can be exposed to lead as an airborne particulate or settled material.**

Lead is toxic and when inhaled or ingested can cause a broad range of health problems to workers and their offspring if the levels become elevated.

In April 2018, Safe Work Australia completed an epidemiological review and established new levels at which workers must be removed from lead risk operations to ensure health is not compromised.

The mandatory removal levels which take effect in 2020 will be:

- ▶ 10 micrograms per decilitre (10 µg/dL) for females of reproductive capacity
- ▶ 30 µg/dL for males and all other females.

Based on current blood lead levels for both male and female workers, when the new standard applies, 0.4 per cent of males (up from zero under the previous standard at 50µg/dL) and 18.2 per cent of females (up from 1.8 per cent under the previous standard at 20µg/dL) would require removal from lead-risk work. This equates to 14 workers requiring removal from lead-risk work.

Mines need to consider how they will manage the reduction in mandatory blood lead removal levels.

# CHAPTER 3 OVERVIEW OF COMPLIANCE ACTIVITY





# OVERVIEW OF COMPLIANCE ACTIVITY

The objective of the inspectorate's compliance approach is to protect the safety and health of resource industry workers and the Queensland community at large, by ensuring that:

- ▶ the risk of injury or illness resulting from regulated activities is at an acceptable level
- ▶ obligation-holders receive the support, guidance, and information necessary to discharge their safety and health obligations
- ▶ industry, workers and the broader community have confidence in Queensland's resources safety and health framework.

Being an outcomes-focussed, risk-based regulator, the inspectorate applies its resources to the areas of greatest risk and to the activities that will achieve the best safety and health outcomes.

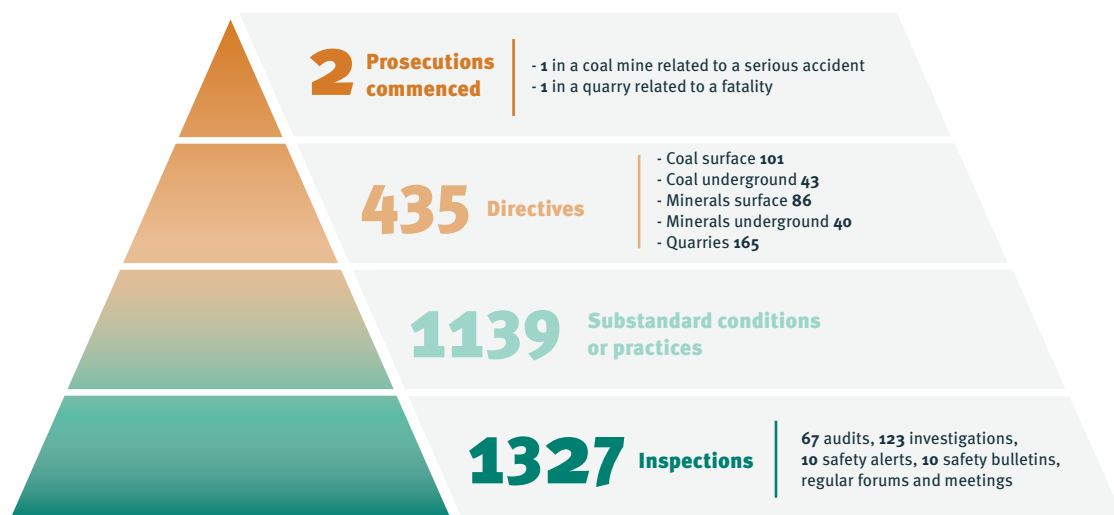
The various compliance and enforcement tools employed by the inspectorate have characteristics that are **educational** (engagement activities, safety alerts and bulletins, substandard conditions or practice advice, inspection and audit activities); **corrective** (directives, inspections, audits, substandard condition or practice advice); **deterrent** (prosecutions, directives, investigations, random inspections and audits); and in some cases, **punitive** (prosecutions).

In determining which of these actions is the most appropriate in any given case, the inspectorate will consider all relevant circumstances. The inspectorate seeks to support industry participants to uphold their obligations, recognising that most of the time, most people try to do the right thing. As such, in the majority of cases, an educational or corrective approach is taken. However, in a small minority of cases, obligation holders demonstrate behaviours that require a deterrent or punitive response. This is reflected in the compliance and enforcement activities undertaken in 2018–19.

In 2018–19, the inspectorate conducted 1327 mine inspections, 67 audits and 123 investigations. The inspectorate also issued 1139 SCPs, 435 directives, 10 safety alerts and 10 safety bulletins.

In recent times, the inspectorate has deliberately increased its use of mine site audits—particularly in coal mines which have increased 42 per cent compared to 2017–18. Audits provide a more in-depth analysis of an operation's safety and health performance and provide more valuable feedback to the mine regarding improvements that can be made.

It is important to note that while the inspectorate sets annual targets for inspections and audits, it must remain flexible to changes in industry performance. This may necessitate a change in the mix of regulatory activity during the year. For example, the inspectorate must prioritise the investigation of fatal incidents, serious accidents, complaints and significant events over routine inspections and other activities.

**FIGURE 34****COMPLIANCE  
ACTIVITIES  
IN 2018-19**

Prosecutions may be undertaken in response to instances of non-compliance where it is in the public interest to prosecute and there is sufficient evidence as to be capable of securing a conviction. For example, prosecution may be considered appropriate where the alleged offender shows significant resistance to, or disengagement with, its safety and health obligations.

In 2018–19, there were six prosecutions before the courts involving 13 defendants. Three of these prosecutions were finalised during this period, although two of these finalised prosecutions are now subject to appeals before the Industrial Court. As at the end of 2018–19, three prosecutions remained on foot, involving seven defendants. Two prosecutions were commenced during the period—one related to a serious accident at a coal mine and one related to a fatal incident at a quarry—involving three defendants.

# EDUCATION AND AWARENESS

## The inspectorate works collaboratively with industry and unions toward improving safety and health performance.

This tripartite relationship plays a vital role in creating an environment where issues can be raised and responded to, as they emerge, for the protection of worker safety and health.

During 2018–19, the inspectorate conducted meetings and forums with all stakeholders of the mining industry to highlight emerging issues, gain feedback and invite comments on incidents and issues. Meetings and forums were held with underground mine managers, open cut examiners, explosion risk zone controllers, open cut and underground electrical engineering managers, ventilation officers, opal and gemstone miners and mechanical engineering managers.

Resources Safety and Health staff also presented three papers at the Queensland Mining Safety and Health Conference 2018:

- ▶ Looking back to develop a pathway forward—using industry data
- ▶ A better health scheme for coal mine workers—working together and what we have learned
- ▶ Dust exposures in Queensland surface coal mines 2001–2017.

The inspectorate recognises the importance of sharing information with industry, workers and the public regarding investigations into mining safety and health incidents. Reports about investigations into safety and health incidents in Queensland’s coal mines and mineral mines and quarries are published where it is in the public interest to do so.

Publishing investigation reports can help raise awareness about risks that may affect the safety and health of workers, promote good safety and health practices, and deter practices and behaviours that endanger the safety and health of workers.

The inspectorate published two incident investigation reports in 2018–19:

- ▶ Report into a fatality at Goonyella Riverside Mine on 5 August 2017<sup>15</sup>
- ▶ Report into a winder brake failure at Osborne Mine on 1 March 2015.<sup>16</sup>

The inspectorate also provides industry with general advice and issued safety alerts and bulletins. In 2018–19, 10 safety alerts and 10 safety bulletins were issued to industry. A list of the safety alerts and bulletins is summarised in Appendices 2 and 3.

<sup>15</sup> [https://www.dnrme.qld.gov.au/data/assets/pdf\\_file/0007/1428703/goonyella-riverside-mine-investigation-report.pdf](https://www.dnrme.qld.gov.au/data/assets/pdf_file/0007/1428703/goonyella-riverside-mine-investigation-report.pdf)

<sup>16</sup> [https://www.dnrme.qld.gov.au/data/assets/pdf\\_file/0018/1415430/osborne-winder-brake-investigation-report.pdf](https://www.dnrme.qld.gov.au/data/assets/pdf_file/0018/1415430/osborne-winder-brake-investigation-report.pdf)

# COMPLAINTS ABOUT MINE SAFETY AND HEALTH

**Queensland mining safety and health legislation allows people to make confidential complaints about safety and health matters to the inspectorate.**

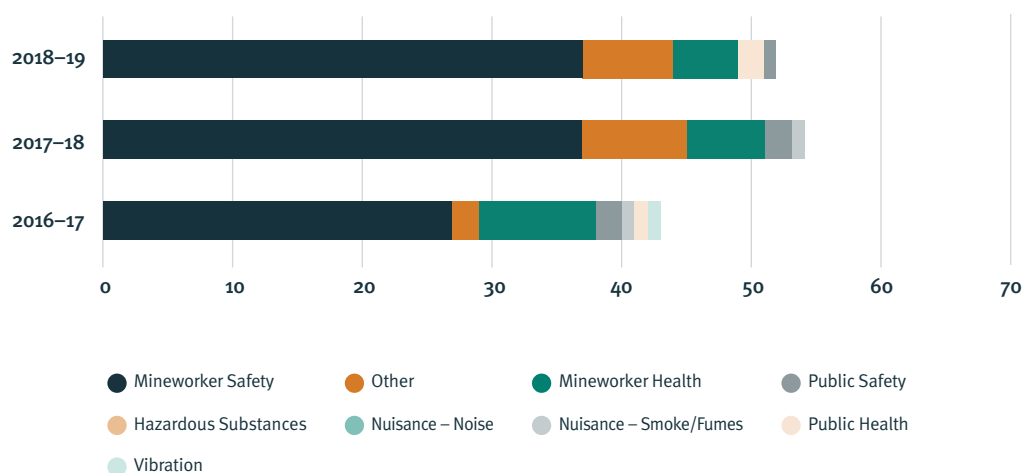
In 2018–19, a total of 104<sup>17</sup> complaints were made, which is a slight decrease from 107 in 2017–18. The inspectorate takes the investigation of complaints seriously and investigates all complaints and reports on the outcomes to the complainant. At all stages of the investigation, the identity of the complainant is kept confidential to ensure no reprisals take place against the complainant.

Fifty-two complaints were made about coal mines in 2018–19. Mineworker safety continues to be the main concern with the percentage of complaints increasing from 68 per cent in 2017–18 to 72 per cent in 2018–19. The majority of complaints were made by mine workers (84 per cent) with 14 per cent of complaint made by the public.

<sup>17</sup> Two complaints did not involve a mine or quarry

## FIGURE 35

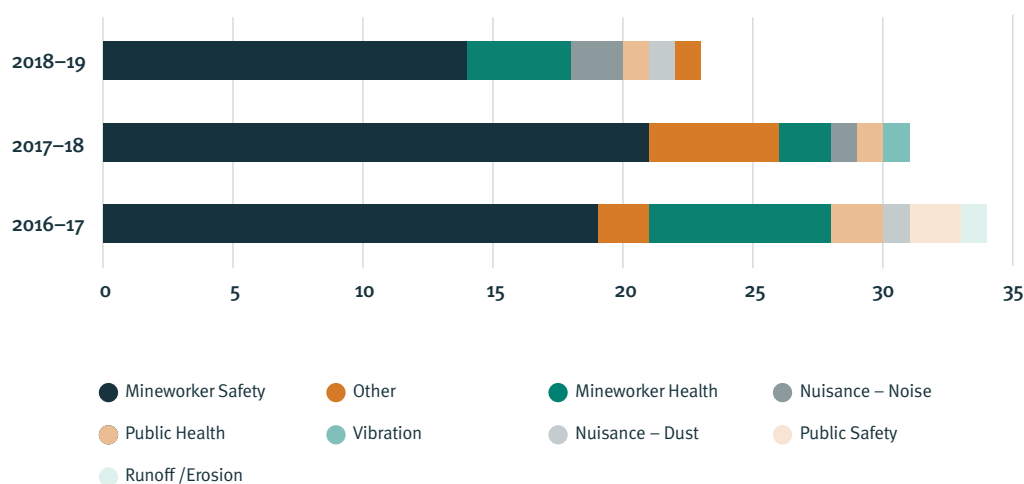
**NUMBER OF  
COMPLAINTS  
BY TYPE, COAL,  
2016–17 TO 2018–19**



Twenty-three complaints were made about mineral mines in 2018-19. Mineworker safety continues to be the main concern despite the percentage of complaints decreasing to 56 per cent in 2018-19 from 67 per cent in 2017-18. A total of 52 per cent of complaints were made by mine workers and 48 per cent by the public.

## FIGURE 36

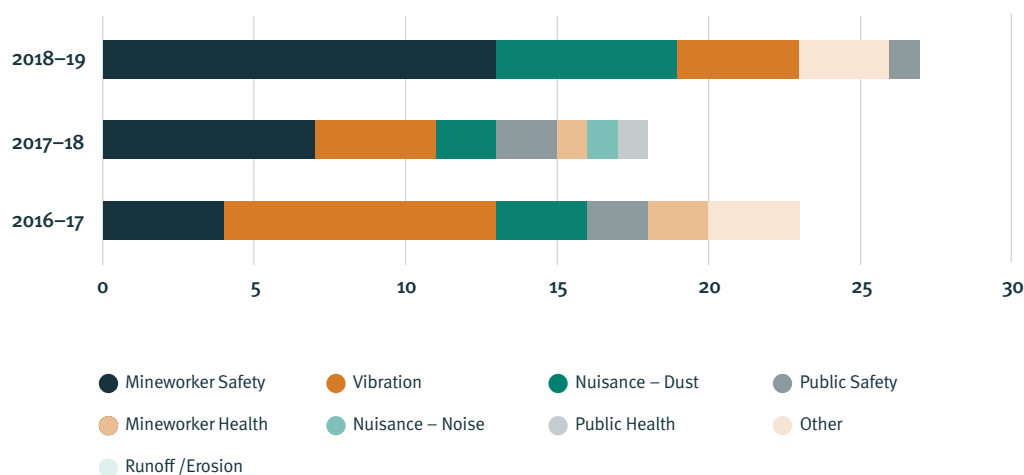
### NUMBER OF COMPLAINTS BY TYPE, MINERALS, 2016-17 TO 2018-19



In 2018-19, 27 complaints were made about quarries. Mineworker safety accounts for 46 per cent of complaints followed by 21 per cent being associated with dust. A total of 61 per cent of complaints were made by the public and 39 per cent by mineworkers.

## FIGURE 37

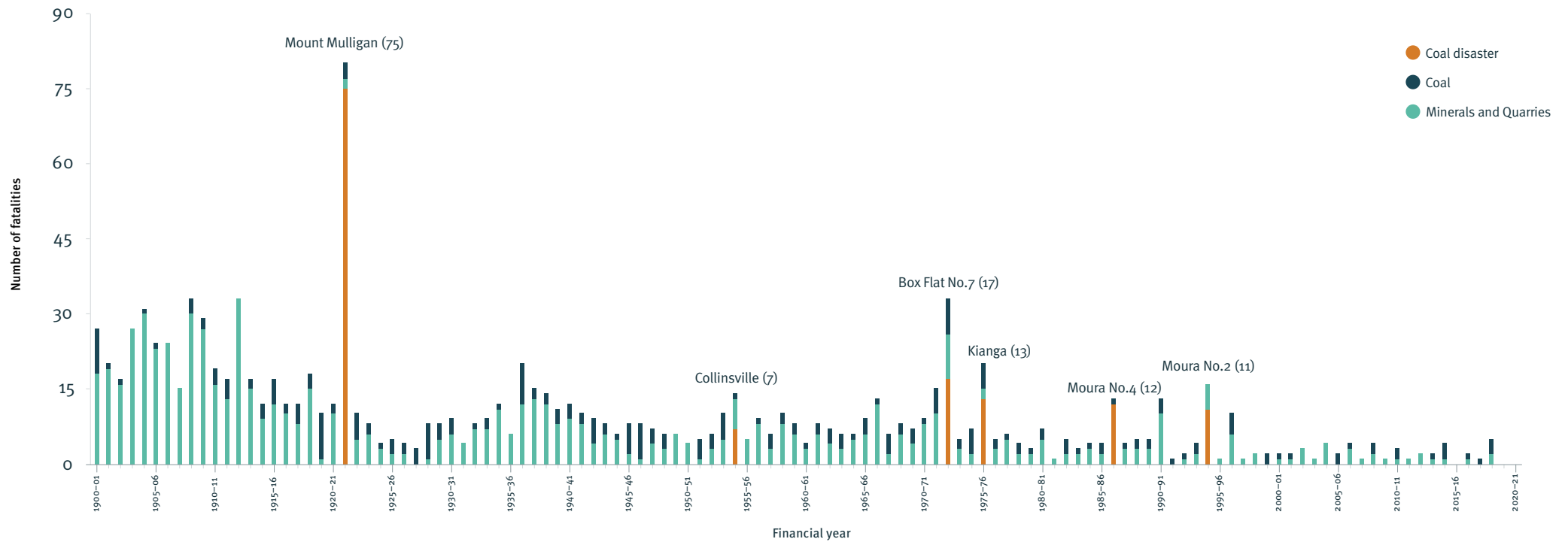
### NUMBER OF COMPLAINTS BY TYPE, QUARRIES, 2016-17 TO 2018-19



# APPENDICES



# FATALITIES IN QUEENSLAND MINES (ALL SECTORS) 1900 TO 2019



## COMPARISON OF KEY REGULATION INDICATORS 2017-18 AND 2018-19 BY SECTOR

Year	Number of unannounced inspections		Number of announced inspections		Number of audits		Number of investigations		Number of SCPs		Number of directives		Number of complaints	
	17-18	18-19	17-18	18-19	17-18	18-19	17-18	18-19	17-18	18-19	17-18	18-19	17-18	18-19
<b>Coal surface</b>	26	58	270	208	18	42	32	60	184	223	116	101	40	41
<b>Coal underground</b>	8	13	86	86	24	18	13	14	57	80	31	43	14	11
<b>All coal</b>	<b>34</b>	<b>71</b>	<b>356</b>	<b>294</b>	<b>42</b>	<b>60</b>	<b>45</b>	<b>74</b>	<b>241</b>	<b>303</b>	<b>147</b>	<b>144</b>	<b>54</b>	<b>52</b>
<b>Mineral surface</b>	83	68	307	268	4	3	24	20	211	300	125	86	21	18
<b>Mineral underground</b>	7	14	133	156	10	4	12	13	123	169	49	40	10	5
<b>All minerals</b>	<b>90</b>	<b>82</b>	<b>440</b>	<b>424</b>	<b>14</b>	<b>7</b>	<b>36</b>	<b>33</b>	<b>334</b>	<b>469</b>	<b>174</b>	<b>126</b>	<b>31</b>	<b>23</b>
<b>Quarries</b>	<b>60</b>	<b>89</b>	<b>396</b>	<b>367</b>	<b>9</b>	<b>0</b>	<b>5</b>	<b>16</b>	<b>289</b>	<b>367</b>	<b>129</b>	<b>165</b>	<b>18</b>	<b>27</b>
<b>All mineral mines and quarries</b>	<b>150</b>	<b>171</b>	<b>836</b>	<b>791</b>	<b>23</b>	<b>7</b>	<b>41</b>	<b>49</b>	<b>623</b>	<b>836</b>	<b>303</b>	<b>291</b>	<b>49</b>	<b>50</b>
<b>All sectors</b>	<b>184</b>	<b>242</b>	<b>1192</b>	<b>1085</b>	<b>65</b>	<b>67</b>	<b>86</b>	<b>123</b>	<b>864</b>	<b>1139</b>	<b>450</b>	<b>435</b>	<b>107#</b>	<b>104*</b>

\* Total includes 2 complaints with no mine identified.

# Total includes 4 complaints with no mine identified

Exploration included in coal surface and mineral surface



# SAFETY ALERTS ISSUED IN 2018–19

SAFETY ALERT NO.	TITLE	DESCRIPTION
Mines safety alert 354	Persons and mobile plant falling over edges	In June 2018 on a surface coal mine, a D11 Dozer travelled over the crest of a highwall while ripping after dark, falling approximately 16 metres onto a lower bench. The dozer also rolled 360 degrees before coming to rest, and the dozer operator was seriously injured.
Mines safety alert 355	Grader falls off low loader	A grader that was being driven onto a low loader was misaligned, causing the left hand side rear wheel tandem to slip off the ramp. During the attempt to correct the misalignment, the grader toppled sideways off the low loader.
Mines safety alert 356	Vehicle roll-overs	Increase in reported unplanned movement/loss of control incidents involving rubber tyred vehicles. Of particular concern is the increase number of vehicles contacting centre dividers and safety berms then rolling.
Mines safety alert 357	South African copper mine conveyer fire	On Sunday 15 July 2018, six mine workers in a South African underground copper mine died in a refuge chamber as a result of a fire on a conveyer.
Mines safety alert 358	Fatality involving an articulated dump truck	An articulated dump truck operator who was working at a quarry, was moving fully loaded down the access ramp, when it appears he lost control of the vehicle and overturned, partially pinning him under the cab. He later succumbed to his injuries.
Mines safety alert 359	Worker survives irrespirable atmosphere	A pump fitter entered the unventilated heading in a light vehicle and experienced difficulties due to an oxygen deficient, excess carbon dioxide atmosphere.
Mines safety alert 360	Fatality involving a quarry plant operator	On Thursday 15 November 2018, a worker was fatally injured at a quarry when he became entangled in the rotating tail drum of a conveyor belt. A co-worker activated the emergency stop device fitted to the conveyor.
Mines safety alert 361	Serious accident involving an articulated water cart	An articulated water cart ran away backwards down the face of a tailings dam wall, overturning at the bottom and pinning the operator in the cab.
Mines safety alert 362	Fatal incident as bulldozer overturns into pit	On Monday 31 December 2018, at approximately 10:30pm, an experienced 49 year old coal mine worker was fatally injured while he was operating a bulldozer at an open-cut coal mine near Dysart in Central Queensland.
Mines safety alert 363	Welded flange failure on SMBS pump	A worker was standing next to a mono pump that pumped 30% sodium meta-bisulphite (SMBS) when a welded flange on the discharge failed.

# SAFETY BULLETINS ISSUED IN 2018–19

SAFETY BULLETIN NO.	TITLE	DESCRIPTION
<a href="#">Mines safety bulletin 173</a>	Miner struck by rockfall at development face	During charging on an underground development heading, about 11 tonnes of rock fell from the face, trapping an operator in a charge basket. Recommendations from this include using routine face support.
<a href="#">Mines safety bulletin 174</a>	Incident at North Goonyella Coal Mine	On 1 September 2018, Peabody Energy, operator of North Goonyella coal mine made a safety-based decision to remove all personnel from the underground mine. This was in response to elevated gas readings at the location of the longwall block that it had been recently mining.
<a href="#">Mines safety bulletin 175</a>	Storm season 2018	This safety bulletin outlines measures to be taken by mine sites to mitigate or prevent injury and damage from severe storm events.
<a href="#">Mines safety bulletin 176</a>	Lightning strikes on rubber-tyred vehicles	During lightning storms, heavy, rubber tyred vehicles should not be recommended as a place of safety.
<a href="#">Mines safety bulletin 177</a>	Anchoring of temporary building structures	Reported mine site incidents show that anchoring of temporary and other building structures has been insufficient to withstand strong winds.
<a href="#">Mines safety bulletin 178</a>	Potable water on mine sites	Potable water is defined in the Australian Drinking Water Guidelines (ADWG). All coal mines, including exploration and construction sites, should maintain a scheduled routine drinking water testing program.
<a href="#">Mines safety bulletin 179</a>	Overload protection in lifting gear	A maintenance fitter suffered multiple injuries when a hoist he was using fell on him when the upper hook detached from the rest of the assembly.
<a href="#">Mines safety bulletin 180</a>	Mine ERZ controller sustains injuries trapped by an airlock door	A mine ERZ controller sustained permanent disabling injuries after his leg was trapped in an airlock door for over five hours. This potentially life threatening injury also had a high risk of amputation.
<a href="#">Mines safety bulletin 181</a>	Using non-slewing mobile cranes	Non-slewing mobile cranes continue to be involved in incidents in the Queensland mining quarrying industry. They are regularly used around sites and have particular hazards associated with them such as travelling with a load; lifting loads whilst articulated in combination with being on a side slope; and used in congested areas.
<a href="#">Mines safety bulletin 182</a>	Engineering and maintenance of mobile plant braking systems	The purpose of this safety bulletin is to provide information on investigations by the Mines Inspectorate where deficiencies in engineering and maintenance of mobile plant braking systems have contributed to incidents.

# ABBREVIATIONS AND DEFINITIONS

## Coal Workers' Pneumoconiosis

Coal workers' pneumoconiosis is a disease of the lung parenchyma caused by deposition of dust particles, and the reaction of lung tissue to the dust.

## Days on alternative duties

The number of days a worker is unable to perform his/her regular job and has been assigned other temporary or modified duties. Alternative duties include a changed work environment, roster or shift pattern.

## Days lost

All rostered shifts that a worker is unable to work because of injury, not including the day of the injury. This also includes days lost because of recurrences of injuries from previous periods and days on alternative duties after returning to work. A fatal injury is treated as 220 days lost (as per Australian Standard AS1885.1-1990, Clause 6.17).

## Disabling injury

A work-related injury or disease resulting in a worker being unable to fully perform his/her regular job. Either light or alternative duties are performed.

## DPM

Diesel particulate matter

## High potential incident (HPI)

An event, or series of events, that causes or has the potential to cause a significant adverse effect on the safety or health of a person.

## ILO Classification

International Classification of Radiographs of Pneumoconiosis

## Lost time injury

An incident resulting in a fatality, permanent disability or time lost from work of one shift or more. The shift on which the incident occurred is not counted as a shift lost.

## Lost time injury frequency rate

The number of lost time injuries/diseases per million hours worked.

## Lost time and disabling injury frequency rate

The number of lost time injuries and disabling injuries per million hours worked.

## Mine dust lung disease

Mine dust lung disease is caused by mine dust exposure, and comprises a group of occupational lung diseases that result from the cumulative inhalation of respirable mine dust over several years. These diseases can include, but are not limited to, coal workers' pneumoconiosis, mixed dust pneumoconiosis, silicosis, emphysema, chronic bronchitis, and diffuse dust-related fibrosis.

**Permanent incapacity**

A permanent incapacity is any work-related injury or disease that leads to one or more of the following outcomes:

- ▶ the complete loss, or permanent loss of use, of any member or part of the body
- ▶ any permanent impairment of any member or part of the body, regardless of any pre-existing incapacity of that member or part
- ▶ any permanent impairment of physical/mental functioning, regardless of any pre-existing impaired physical or mental functioning
- ▶ a permanent transfer to a different job
- ▶ termination of employment

**SCP**

Substandard conditions or practice

**Serious accident**

An accident at a mine that causes –

- a) the death of a person; or
- b) a person to be admitted to a hospital as an in-patient for treatment for the injury.

**Similar exposure group (SEG)**

Groups of workers who have the same general exposure to risk e.g. they perform similar tasks or use the same types of materials or processes.

**Site senior executive (SSE)**

The most senior officer employed or otherwise engaged by the mine or quarry operator who is located at or near the mine or quarry and has responsibility for the mine or quarry.

