NSW GOVERNMENT

NSW Resources Regulator

SAFETY PERFORMANCE REPORT

REVIEW OF SERIOUS INJURY AND ILLNESS INCIDENT NOTIFICATIONS

2019 - 2020

NSW Resources Regulator

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Contents

Executive summary

In December 2020, the Resources Regulator advised the Mine Safety Advisory Council (MSAC) that an increase in serious injuries and illnesses reported by mine operators had been identified during data analysis for the Mine Safety Performance report for financial year 2019-20.

While a significant long-term downward trend in the serious injury frequency rate (SIFR) (per million hours worked) has been reported by industry since 2006, the review examined the identified increased serious injuries in the NSW mining industry – up from 78 in 2017-18 to 94 in 2018-19 and to 106 in 2019-20. Overall increased serious injury incident notifications were made by the underground coal, surface coal, underground metalliferous and extractives sectors.

The overall steady downward rate-based trend in lost time injuries (LTIFR) and total recordable injuries (TRIFR) observed since about 2013-14 suggests safety performance in NSW mining has shown general improvement.

Key findings

- Serious injuries analysis by bodily location for the three years from 2017-18 to 2019-20 found:
  - one-third of all notified injuries - and often double that of any other bodily location – were hand, fingers or wrist injuries
  - while a substantial proportion (45%) of injuries to hand, fingers or wrist occurred in the underground coal sector, notable increases in injuries to head or neck and upper limbs were also observed in this sector
  - serious injuries were mainly notified in the Hunter and the South-Eastern regions and in the Hunter, injuries to hand, fingers or wrist doubled from 2017-18 to 2018-19, with only a slight reduction seen in 2019-20
  - almost 80% of all serious injuries notified involved being hit by moving objects or falls, trips and slips of a person, with increases seen in injuries to the head or neck (with a mechanism of being hit by moving objects or hitting objects with a part of the body) and upper limbs (with a mechanism of being hit by moving objects or falls, trips and slips)
  - an increase was observed in serious injuries to hand, fingers or wrist in contractors while similar injuries to employees have decreased.

- A significant downward overall trend has been identified in SIFRs in NSW mining since 2006. At an operation type level, a significant downward trend was also seen in the surface coal sector. No other statistically significant rate-based trends were identified. While decreasing trends were observed for underground coal and surface metalliferous operations, none were considered to be statistically significant. The SIFR in the underground metalliferous sector was steady. An upward rate-based trend was evident for serious injuries in the extractives sector, however it was also not considered to be statistically significant.
- Trends indicate a general improvement in safety performance during the past ten years with decreasing rate-based trends for lost time and total recordable injuries across all sectors except for the metalliferous sector where an upward trend was observed for the lost time injury frequency rate (LTIFR). This trend was not considered to be statistically significant.
- The overall number of serious injuries reported to the Resources Regulator by the NSW mining sector has increased year-on-year during the past three years, with serious injury incident notifications having returned to levels previously set in 2016-17. Since 2017-18, serious injuries have increased by 36%, from 78 (2017-18) to 94 (2018-19) and to 106 in 2019-20. At an operational level, serious injury incident notifications increased in underground coal and underground metalliferous, with smaller increases seen in surface coal and extractives in the three years since 2017-18.
- Further breakdown analysis into the number of serious injuries by season and shift did not identify any notable patterns or trends across the three-year period. The analysis highlighted the increased prevalence of serious injury occurring mid-way and towards the end of a worker's shift.

Review conclusions

Multiple factors contribute to incident and injury notifications. These include (but are not limited to) inherent risk factors specific to sector, operation type and mine, and various other internal and external factors. In addition, because of the relatively small sample size, it was not possible to draw any reliable conclusions about the cause of any the changes identified during the past three years.

About the review

This report outlines the review findings including a detailed analysis of serious injuries across the NSW mining industry. Initially, an increase in serious injury incidents reported by mine operators was identified by the Resources Regulator during data analysis for the Mine Safety Performance report for financial year 2019-20.

The purpose of the review was to inform a briefing to the NSW Mine Safety Advisory Council on serious injuries and to identify whether there were any issues that may have required a targeted response.

The review sought to highlight any frequency and rate-based trends and to identify any factors that may have contributed to the increases observed in serious injury incident notifications during the past three years.

A causal analysis was undertaken on notified serious injuries during a three-year period (2017-18 to 2019-20). The analysis sought to understand the extent to which the severity and nature of serious injuries may have changed since 2017-18. This included a deep-dive analysis into mechanism, breakdown agency, employment type and region associated with serious injuries, with bodily location used as a severity filter. Employment type was also investigated.

Injury rates and trends

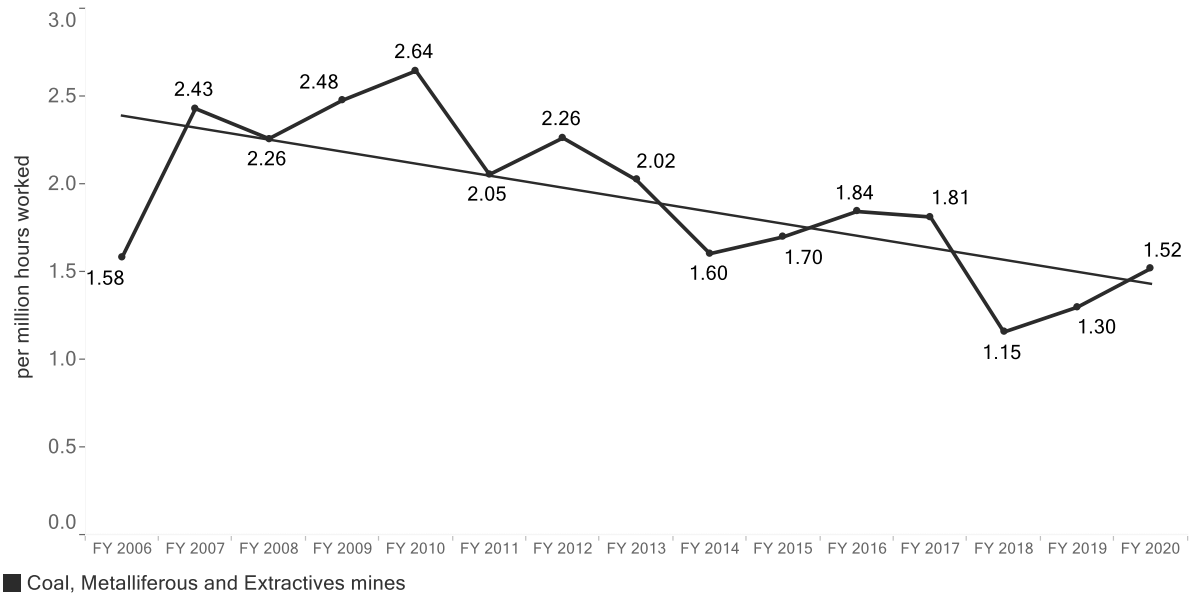
Serious injury frequency rates in NSW mining

A significant downward trend has been observed in the frequency rate of serious injuries in NSW mining.

Since 2006, a statistically significant[1] downward trend in SIFRs has been observed across the NSW mining industry overall, and in the surface coal sector specifically. While downward SIFR trends were identified for metalliferous and underground coal sectors during the 15-year period, none were statistically significant. In the extractives sector, an upward SIFR trend was observed but further analysis also found this trend was not statistically significant. See **Appendix 1** for sector-based frequency rate graphs and **Appendix 2** for details on the statistical models.

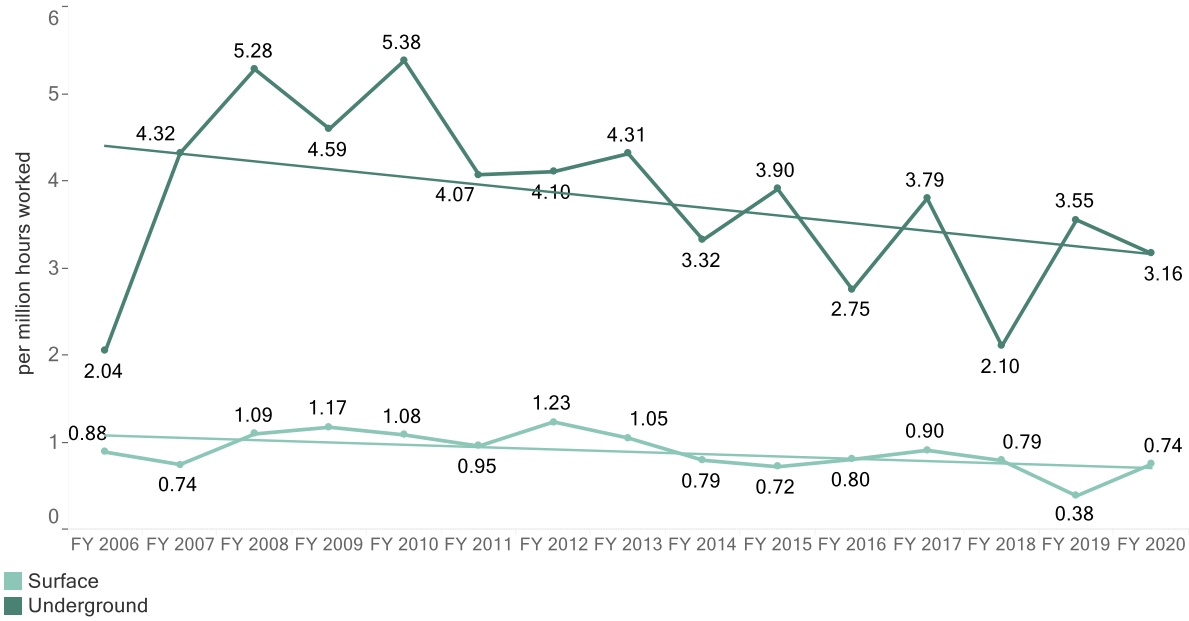
The serious injury data analysed for this report includes historical injuries deemed to be equivalent to current serious injuries. Historical injury outcome clauses have been mapped to in-patient hospital admission and/or loss of consciousness. More detail about how historical data was mapped is available in the explanatory notes in **Appendix 3**.

FIGURE 1: SERIOUS INJURY FREQUENCY RATE, COAL, METALLIFEROUS AND EXTRACTIVES[2] 2005-06 TO 2020-21



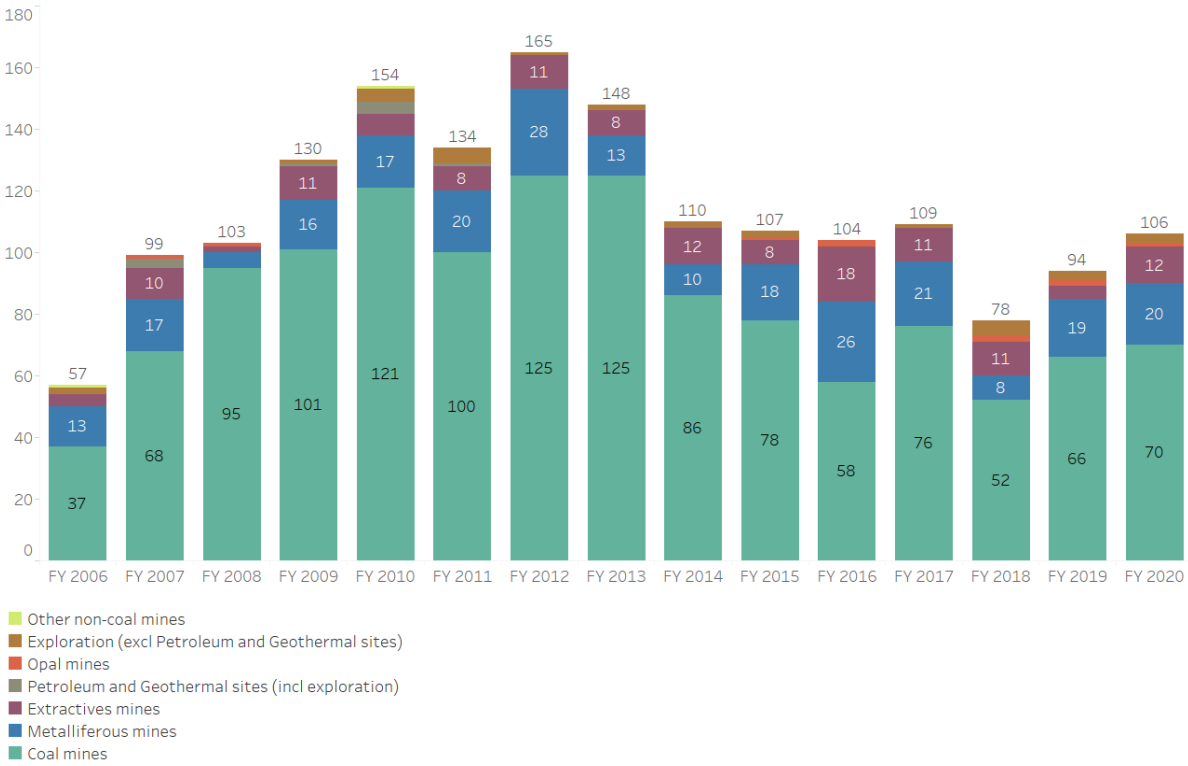
[1] P values of 0.05 or less were considered statistically significant
[2] Excludes exploration only

FIGURE 2: SERIOUS INJURY FREQUENCY RATE, COAL 2005-06 TO 2020-21



During the past three years, the number of serious injury incidents reported to the Resources Regulator by the NSW mining sector has increased year-on-year with notifications having returned to levels previously set in 2016-17. Since 2017-18, serious injury incident notifications have increased by 36%.

FIGURE 3: SERIOUS INJURY BY SECTOR 2005-06 TO 2020-21



Serious injury frequency rates by employment type

For each operation type serious injury frequency rates (per million hours worked) have been calculated by employment type – employees and other (contractors). Large fluctuations in SIFR were observed as often the underlying data represents a small number of serious injuries. The table below provides additional context.

In 2019-20, for each operation type except for surface coal, a greater SIFR was calculated for contractors than for employees.

TABLE 1: SERIOUS INJURIES AND HOURS WORKED BY OPERATION AND EMPLOYMENT TYPE 2017-18 TO 2019-20

				EMPLOYEES		CONTRACTORS	
Sector	Year	Total serious injuries	Total hours worked	Serious Injuries	Hours worked	Serious injuries	Hours worked
Coal	2017-18	52	43,061,700	36	22,319,181	16	20,742,519
	2018-19	66	49,100,948	39	25,348,502	27	23,752,446
	2019-20	70	47,837,430	38	26,473,221	32	21,364,209
Metalliferous	2017-18	8	12,611,997	8	7,267,380	0	5,344,617
	2018-19	19	13,663,607	12	7,032,2337	7	7,498,442
	2019-20	20	14,971,342	7	7,498,442	13	7,472,900
Extractives	2017-18	11	5,834,016	6	4,301,861	5	1,532,155
	2018-19	5	5,909,380	3	4,484,414	1	1,424,966
	2019-20	12	4,442,693	9	3,493,563	3	949,130
Total	2017-18	71	61,507,713	50	33,888,422	21	27,619,291
	2018-19	90	68,673,935	54	36,865,153	35	31,808,782
	2019-20	102	67,251,465	54	37,465,226	48	29,786,239

FIGURE 4: SURFACE COAL, SERIOUS INJURY FREQUENCY RATE BY EMPLOYMENT TYPE 2010-11 TO 2019-20

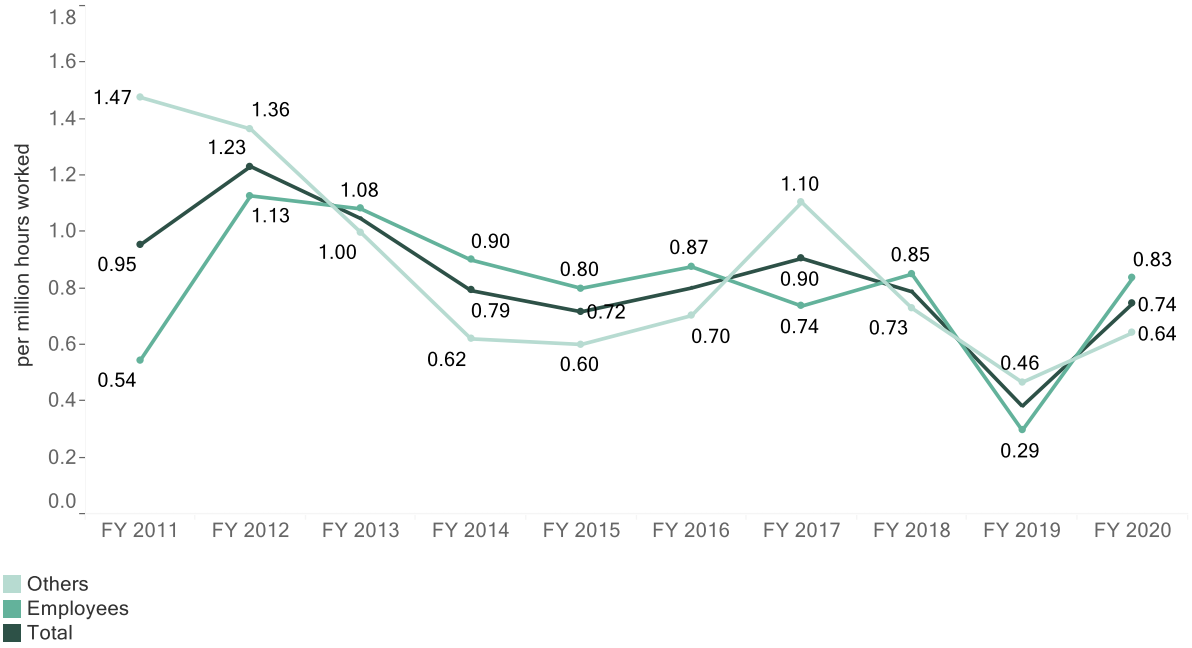


FIGURE 5: UNDERGROUND COAL, SERIOUS INJURY FREQUENCY RATE BY EMPLOYMENT TYPE 2010-11 TO 2019-20

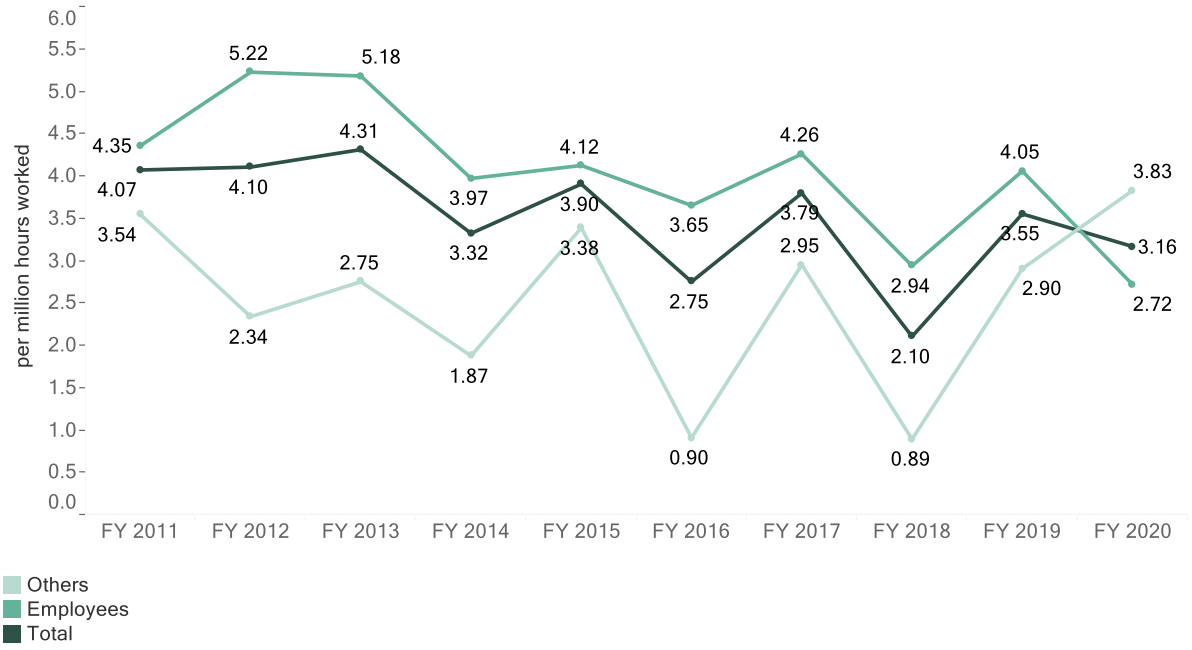


FIGURE 6: SURFACE METALLIFEROUS, SERIOUS INJURY FREQUENCY RATE BY EMPLOYMENT TYPE 2010-11 TO 2019-20

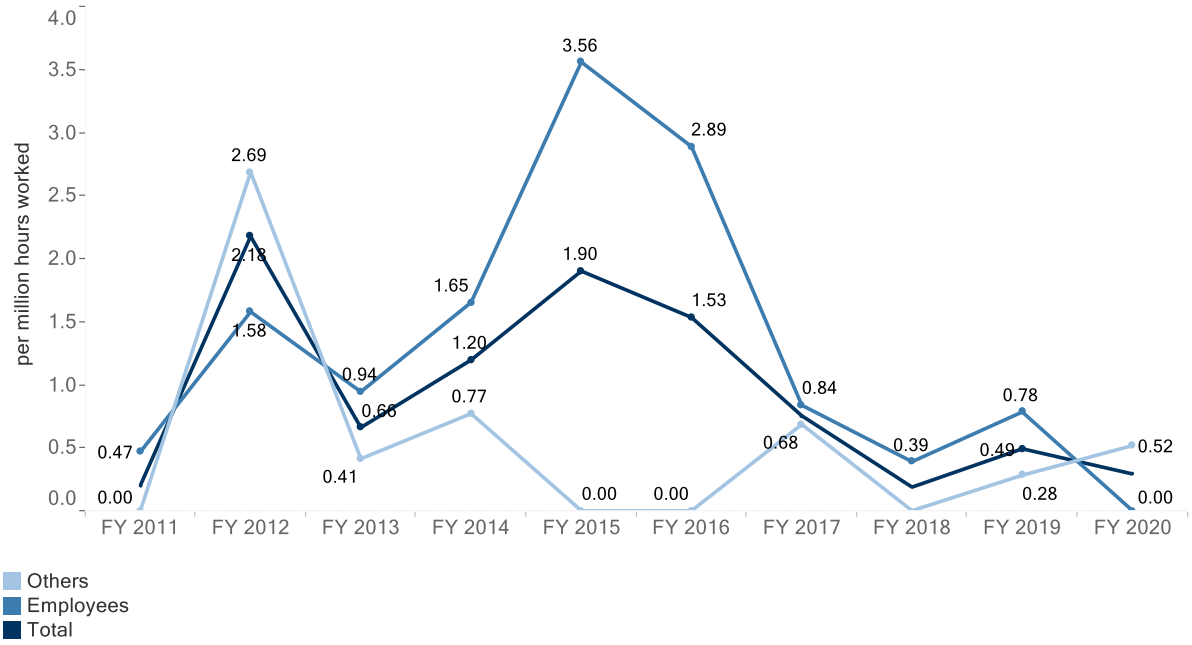


FIGURE 7: UNDERGROUND METALLIFEROUS, SERIOUS INJURY FREQUENCY RATE BY EMPLOYMENT TYPE 2010-11 TO 2019-20

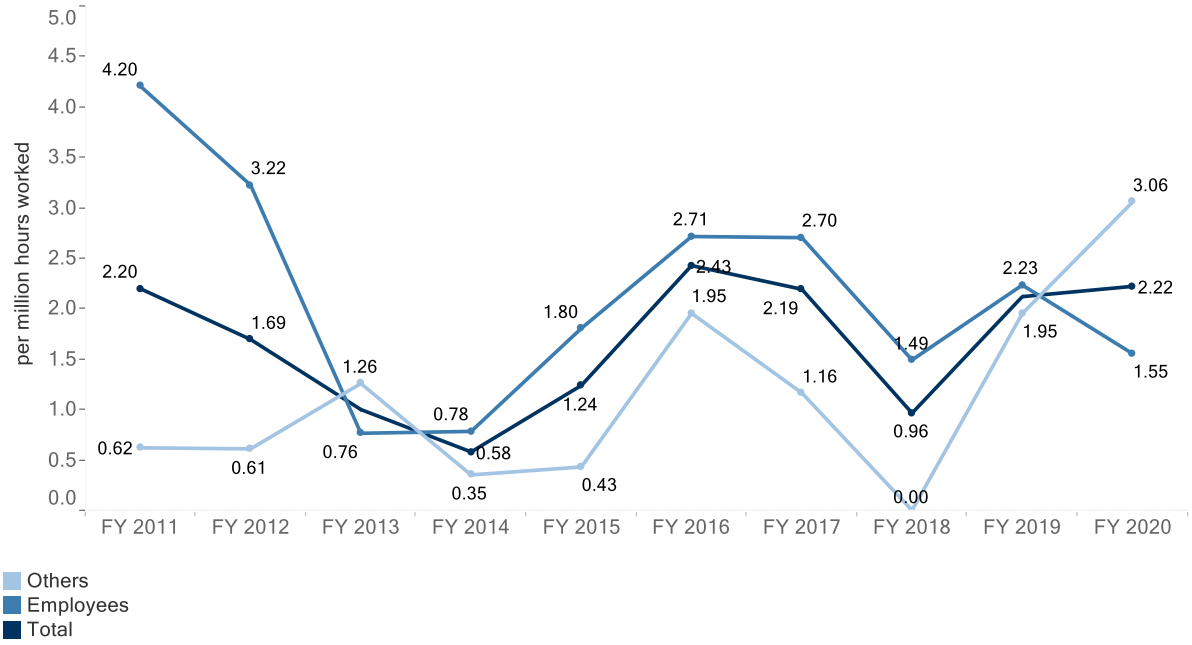


FIGURE 8: EXTRACTIVES, SERIOUS INJURY FREQUENCY RATE BY EMPLOYMENT TYPE 2010-11 TO 2019-20

Lost time and total recordable injuries

For the extractives sectors, an overall steady downward rate-based trend in LTIFRs was observed since about 2013-14. While LTIFR has been steady in the coal sector, a slight upward trend in LTIFR was observed in the metalliferous sector. Overall steady downward trends were observed in TRIFR for all sectors but since 2018-19, there was a slight uptick observed in TRIFR in extractives.

FIGURE 9: COAL, METALLIFEROUS AND EXTRACTIVES ROLLING FIVE-YEAR LTIFR 2010-11 TO 2019-20

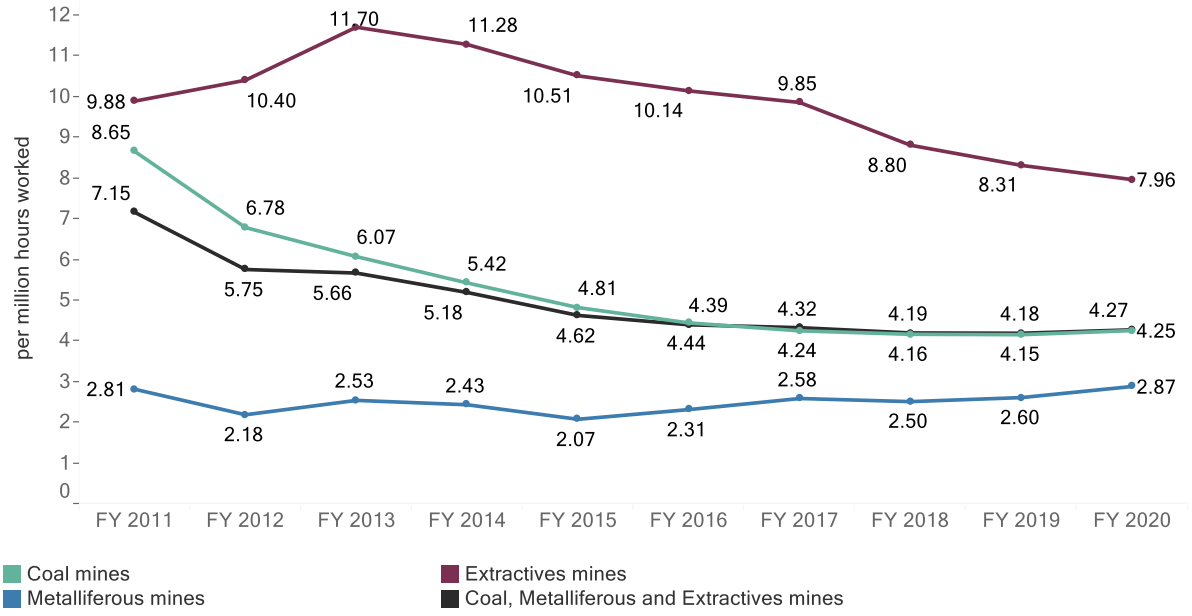
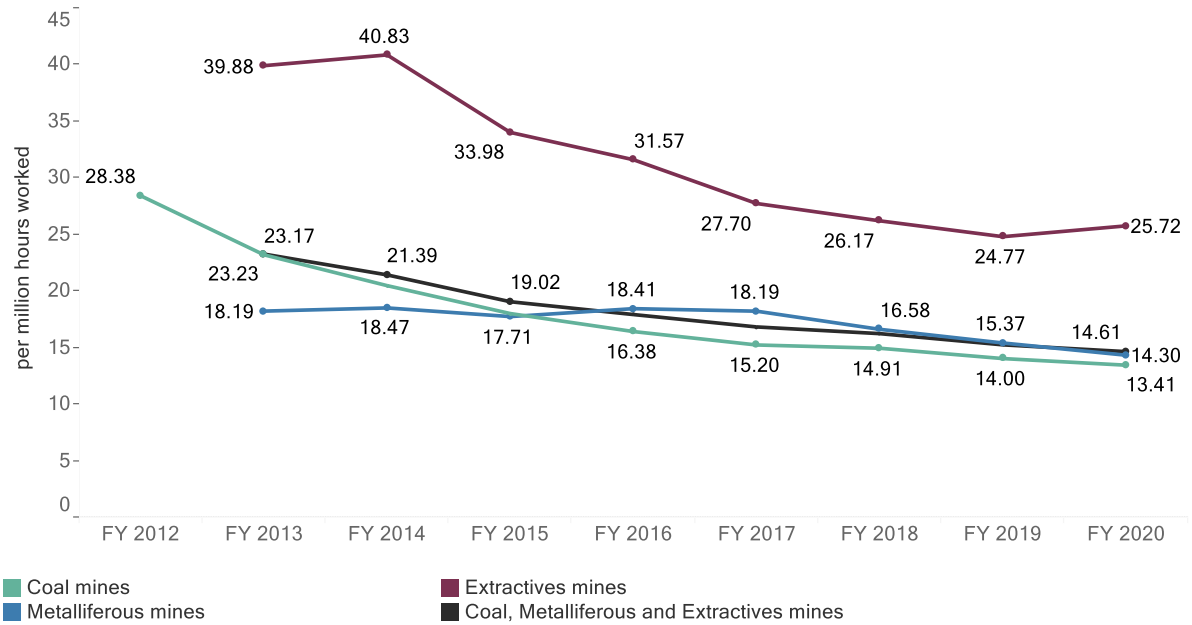


FIGURE 10: COAL, METALLIFEROUS AND EXTRACTIVES ROLLING FIVE-YEAR TRIFR 2010-11 TO 2019-20



In-depth review

Our in-depth analysis focused on serious injury incidents notified to the Resources Regulator during the three years from 2017-18 to 2019-20, even though a significant overall downward trend has been observed in the rate of serious injuries since 2006.

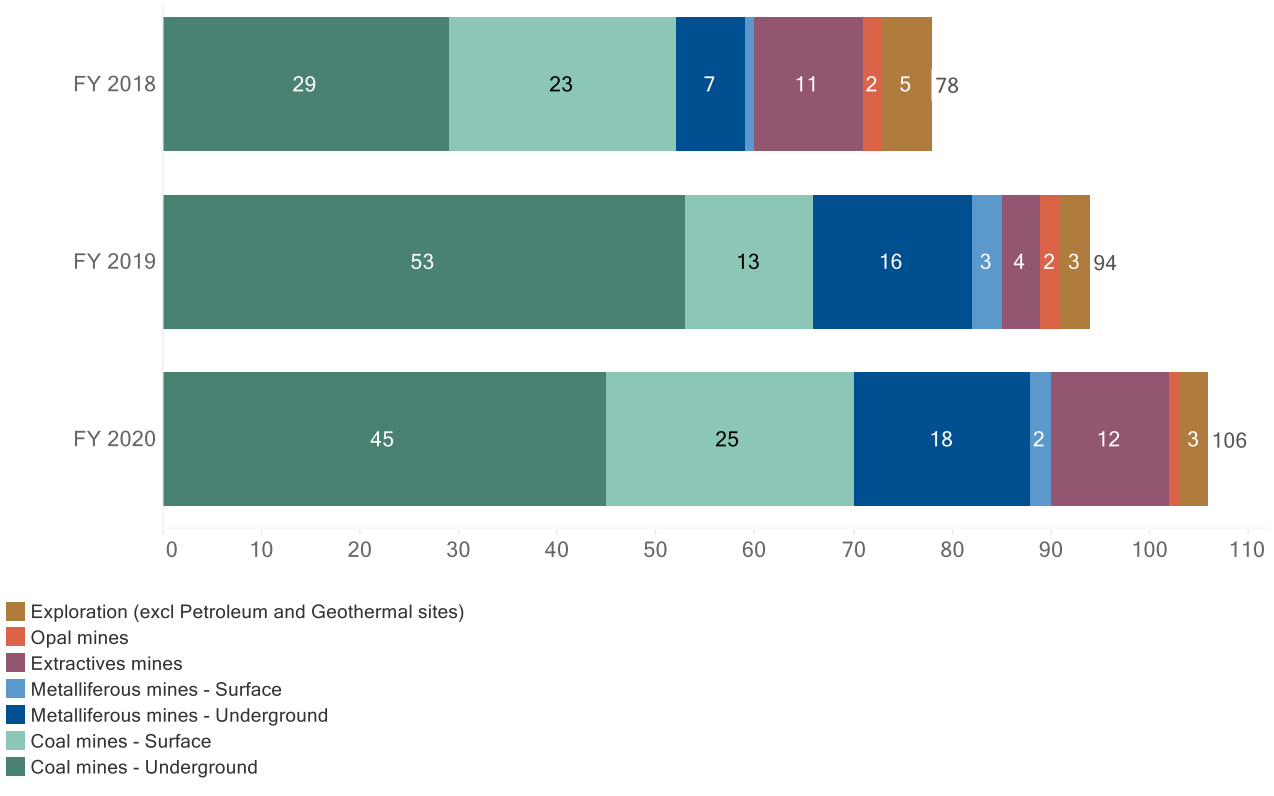
As part of this in-depth review, each serious injury was carefully re-assessed and verified against the definition in the legislation.

The analysis also examined the extent to which the severity and nature of serious injuries may have changed since 2017-18. Bodily location was used as a way to detect and predict precursors to larger failure and to help identify patterns of change associated with operation type, region, mechanism, breakdown agency and employment type.

Serious injury incident notifications by operation type

Increased notifications of serious injury incidents occurred in the underground coal and underground metalliferous sectors since 2017-18. Decreases in serious injury incident notifications in the surface coal and extractives sectors in 2018-19 returned in 2019-20 to levels previously observed in 2017-18.

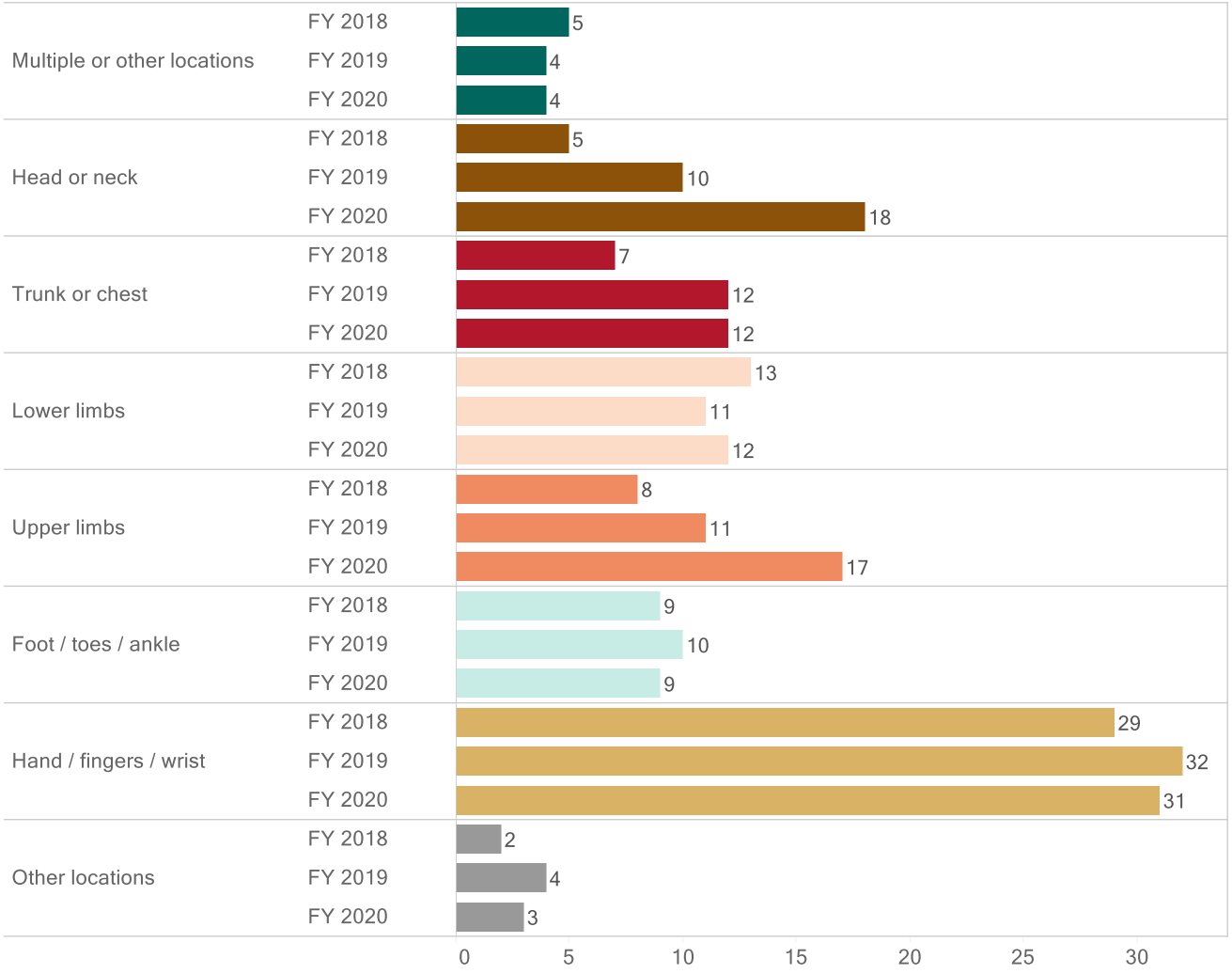
FIGURE 11: SERIOUS INJURIES BY OPERATION TYPE 2017-18 TO 2019-20



Serious injury incident notifications by bodily location

In any of the three years in the reporting period, serious injuries to hands, fingers and wrists were often double the serious injuries to any other bodily location. Notable increases were observed across the three years in serious injuries to head or neck (5 to 18), upper limbs (8 to 17) and trunk or chest (7 to 12) during the same period.

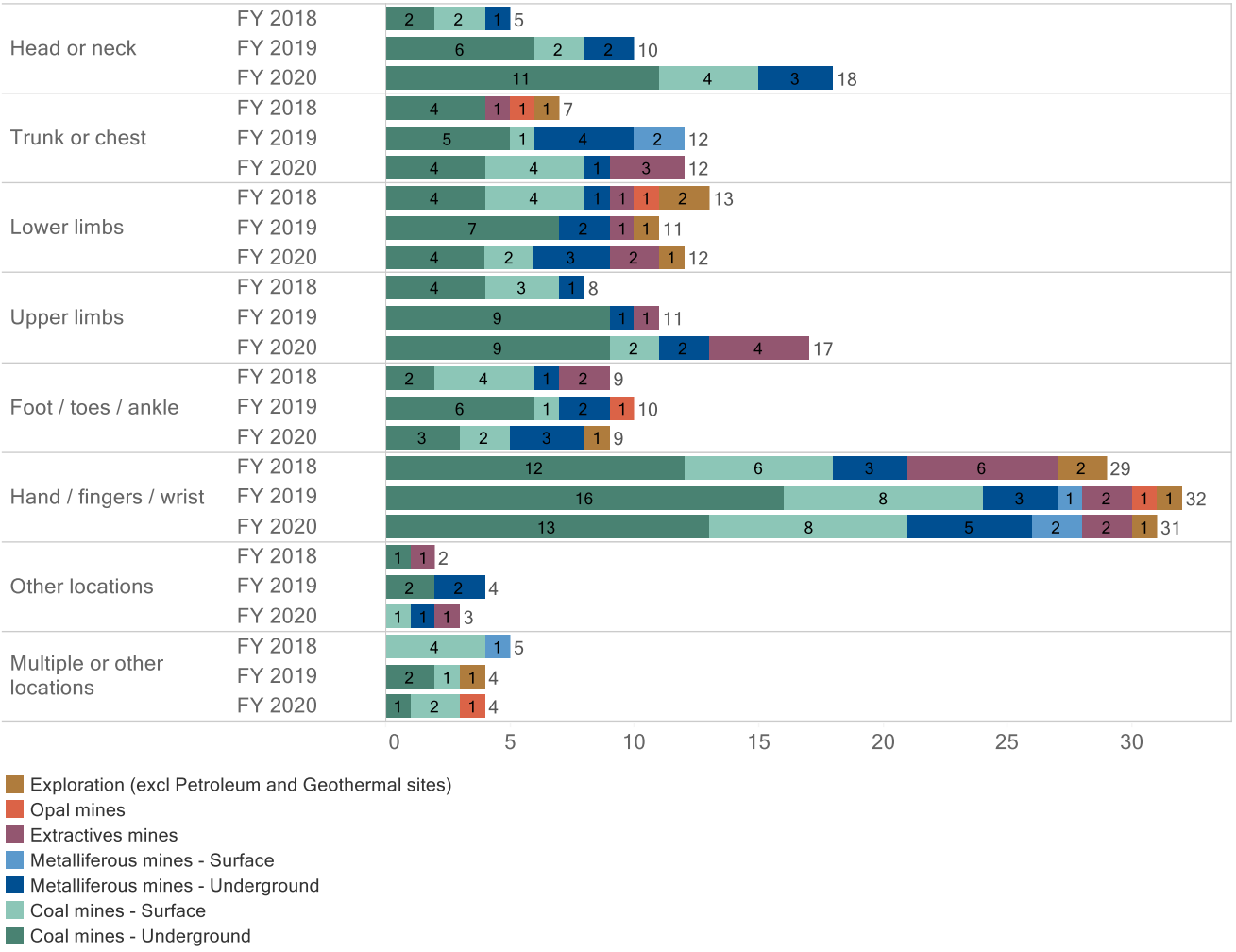
FIGURE 12: BODILY LOCATION OF SERIOUS INJURIES 2017-18 TO 2019-20



Operation type

Across the three-year period, a substantial proportion (45%) of serious injuries to hand, fingers or wrist occurred in the underground coal sector. Notable increases in injuries to head or neck (2 to 11) and upper limbs (4 to 9) were also observed in the underground coal sector. No substantial increases were seen in the other operation types.

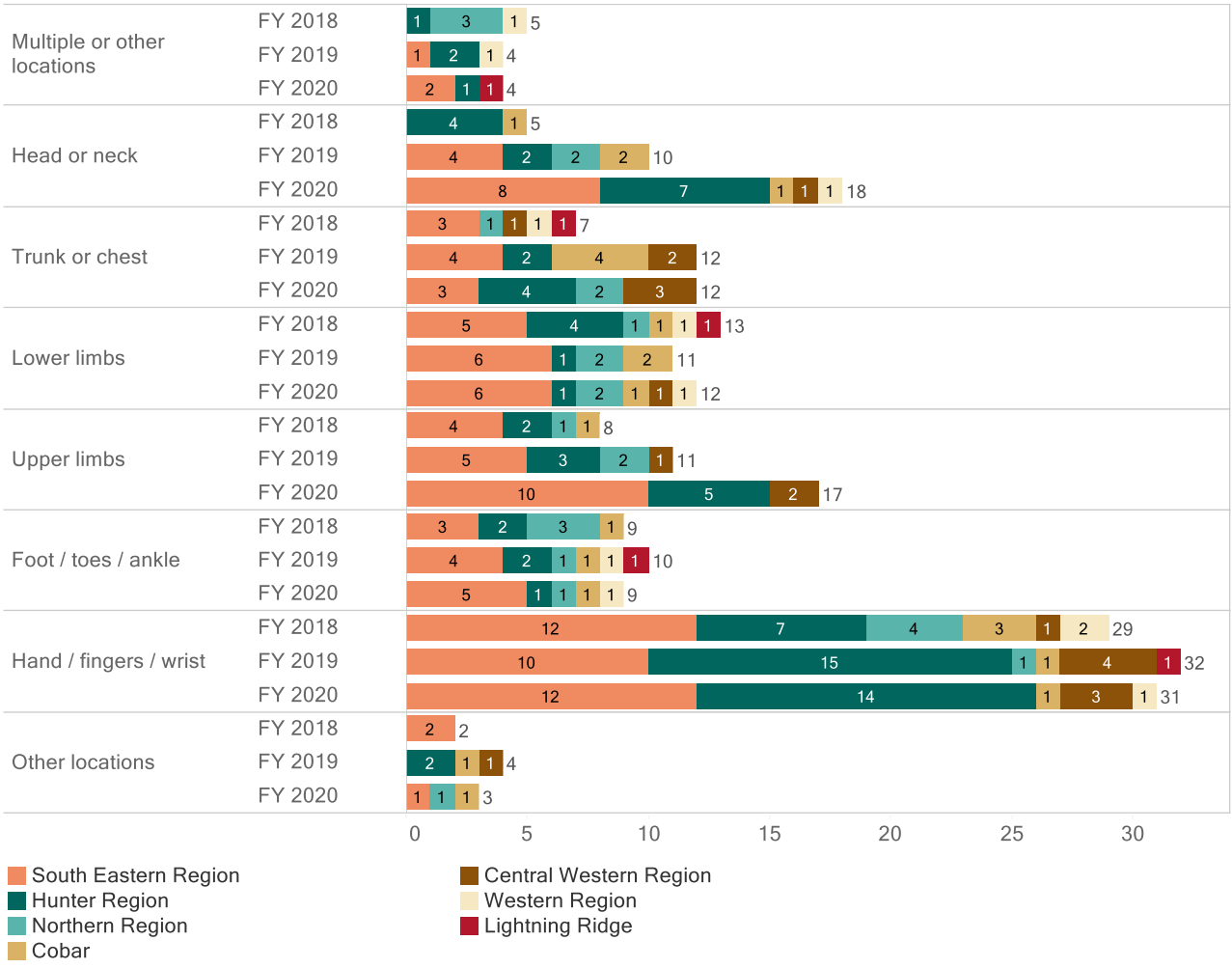
FIGURE 13: BODILY LOCATION OF SERIOUS INJURIES BY OPERATION TYPE 2017-18 TO 2019-20



Region

Serious injuries were largely notified in the Hunter and the South-Eastern regions. Serious injuries to hand, fingers or wrists increased in the Hunter region from 2017-18 to 2018-19 (7 to 15), with only a slight reduction to 14 in 2019-20. Increases in serious injuries to head or neck were observed in the South Eastern (0 to 8) and Hunter regions (4 to 7) across the three-year period. Increases in serious injuries to the upper limbs were also observed in the South-Eastern (4 to 10) and Hunter (2 to 5) regions.

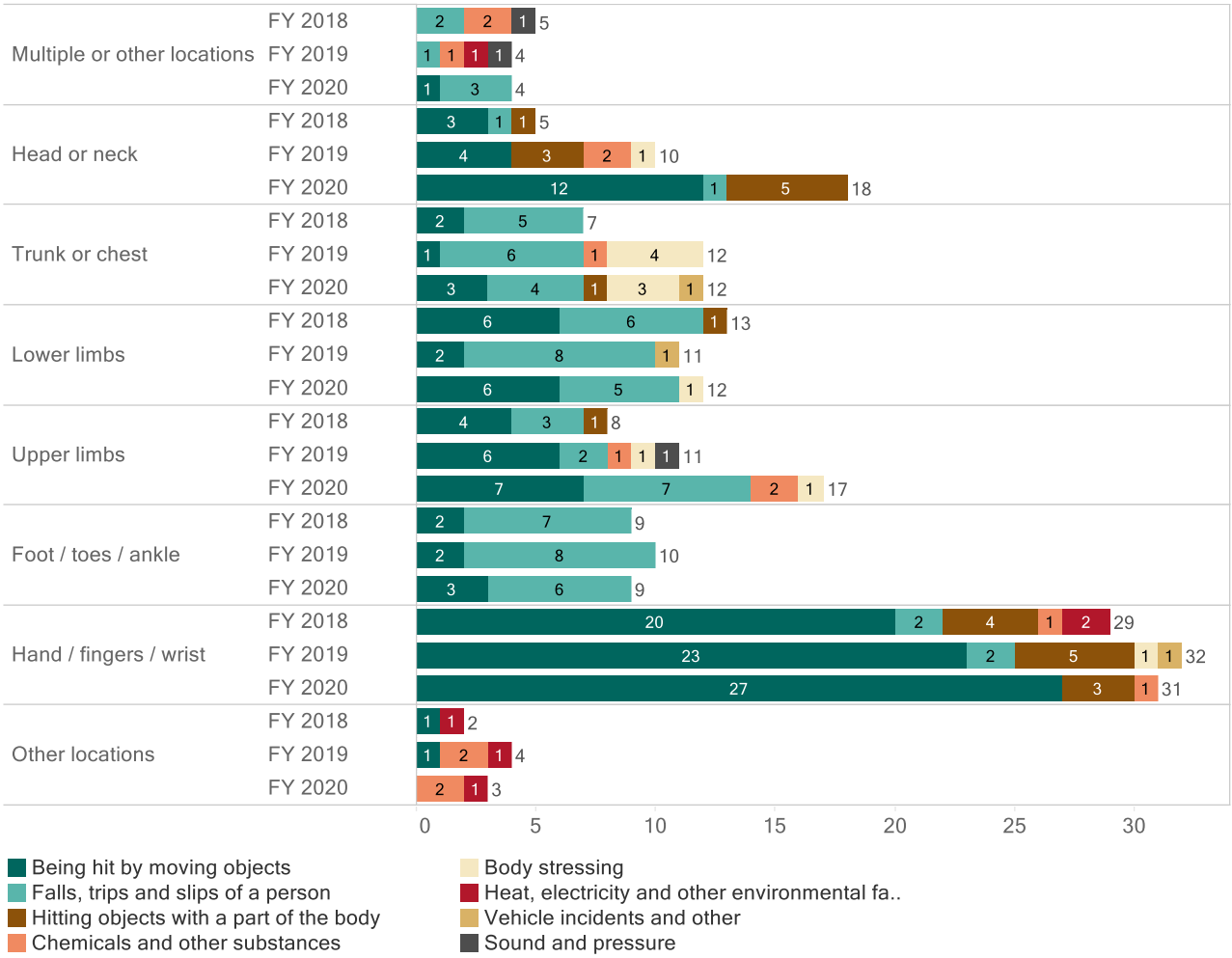
FIGURE 14: BODILY LOCATION OF SERIOUS INJURIES BY REGION 2017-18 TO 2019-20



Mechanism

Almost half of all serious injuries notified during the three-year period involved being hit by moving objects (136 out of 273) and a further 29% (79 out of 273) involved falls, trips and slips of a person. Notable increases seen in injuries to the head or neck related to the mechanism being hit by moving objects (3 to 12) or hitting objects with a part of the body (1 to 5). Being hit by moving objects (4 to 7) and falls, trips and slips of a person (3 to 7 were also identified as the mechanisms related to an overall increase in serious injuries to upper limbs from 8 to 17.

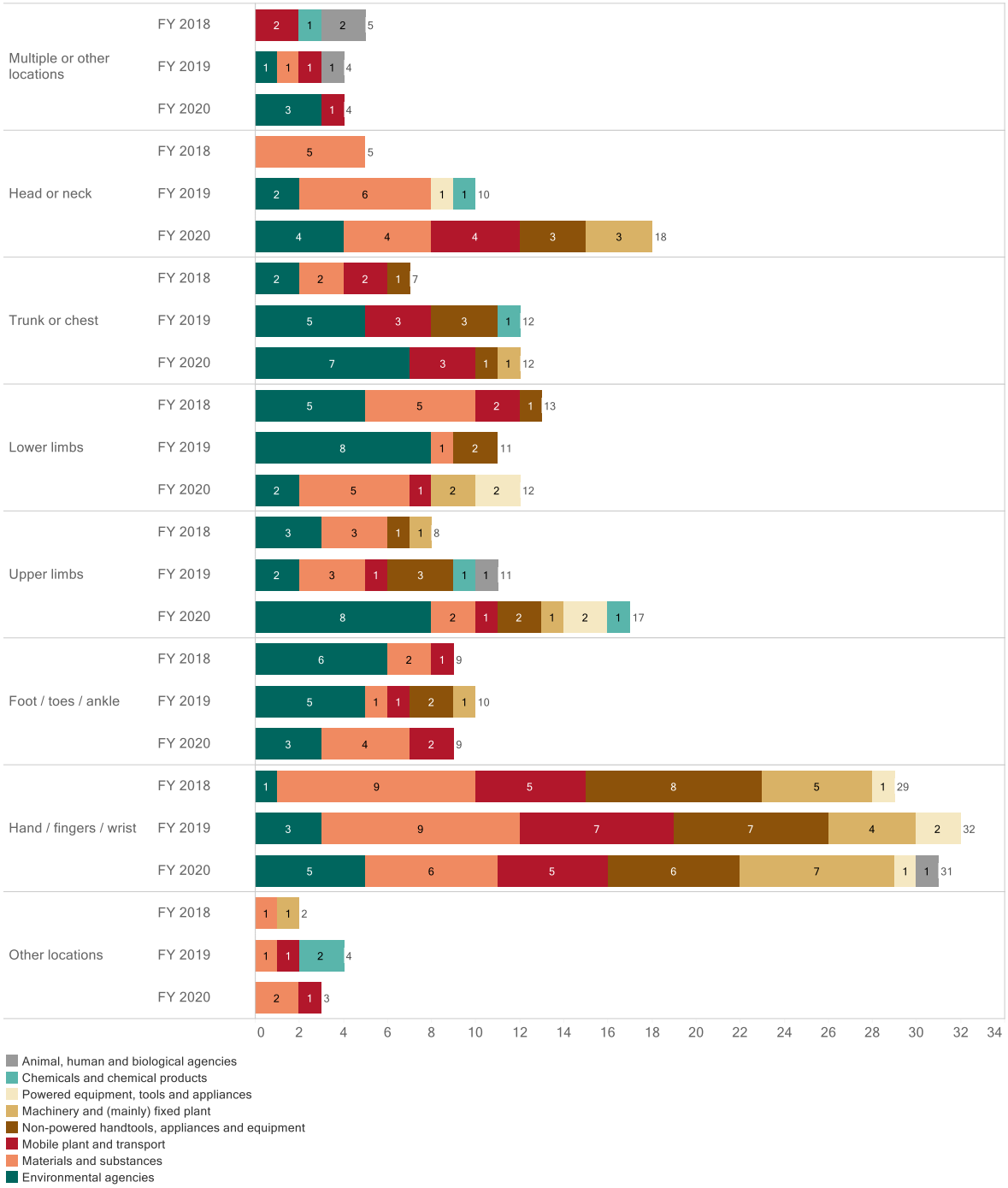
FIGURE 15: BODILY LOCATION OF SERIOUS INJURIES BY MECHANISM 2017-18 TO 2019-20



Breakdown agency

Environmental agencies were the most common causal breakdown agency (the thing that was principally involved in inflicting the injury or illness) representing 55% of total serious injuries notified in the three-year period. Within that category increases were seen in serious injuries to trunk or chest (2 to 7) and upper limbs (3 to 8). No other notable increases were observed.

FIGURE 16: BODILY LOCATION OF SERIOUS INJURIES BY BREAKDOWN AGENCY 2017-18 TO 2019-20



Employment type

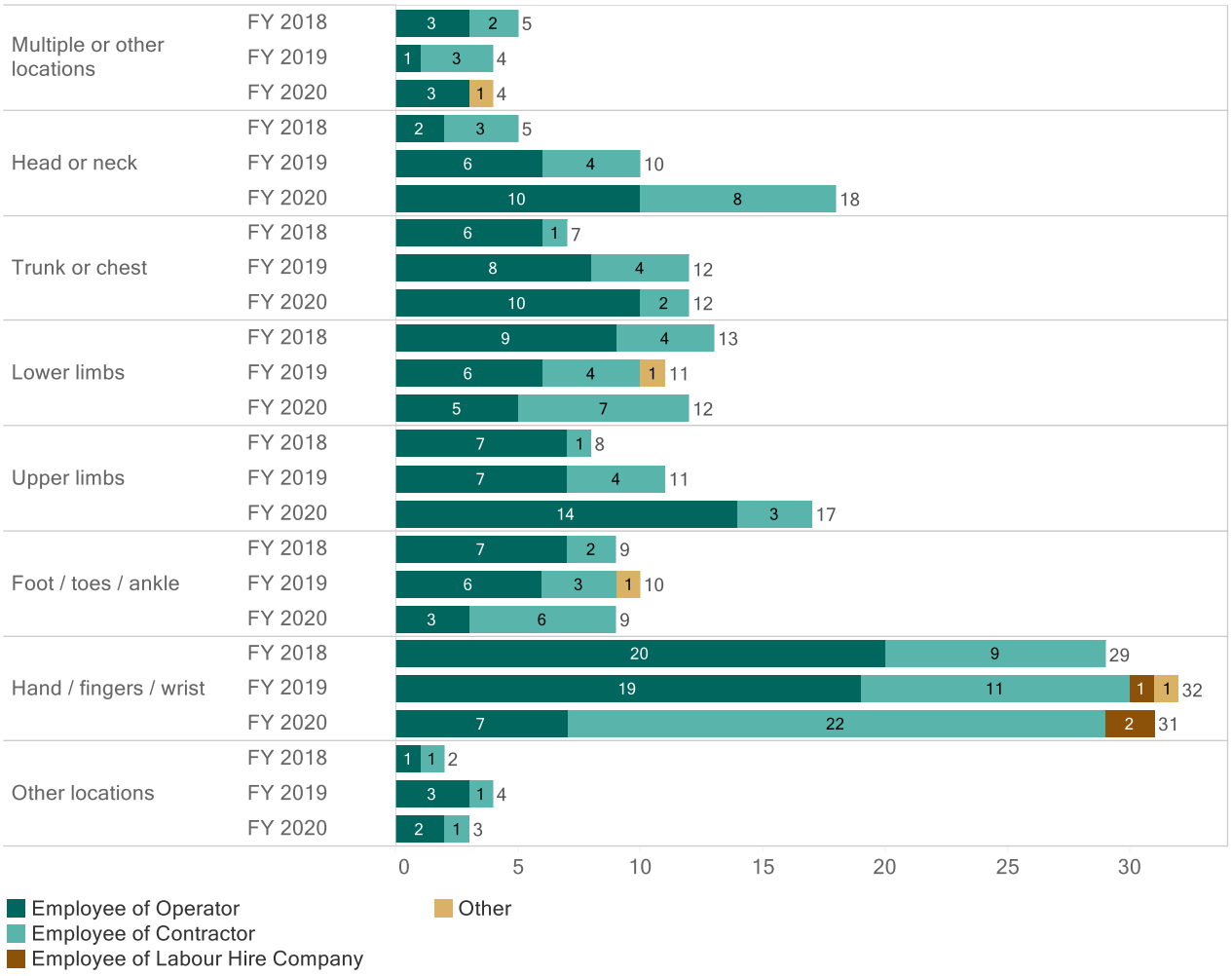
Overall, the reported number of serious injuries to contractors have more than doubled during the three-year period from 23 in 2017-18 to 49 in 2019-20, while serious injuries to employees have remained steady (55 in 2017-18 and 54 in 2019-20).

According to data collected from work health and safety reports submitted by mine operators, the number of hours worked by contractors has steadily increased year-on-year since 2015-16. In 2019-20 contractor hours now represent 44% of the total hours worked in NSW mining.

A notable increase was observed in serious injuries to hands, fingers and wrists in contractors (9 to 22), while similar injuries to employees have decreased (20 to 7).

Increases in serious injuries to head or neck were observed in both employees (2 to 10) and contractors (3 to 8), and upper limbs for employees only (7 to 14).

FIGURE 17: BODILY LOCATION OF SERIOUS INJURIES BY EMPLOYMENT TYPE 2017-18 TO 2019-20



Serious injury incident notifications by time-related factors

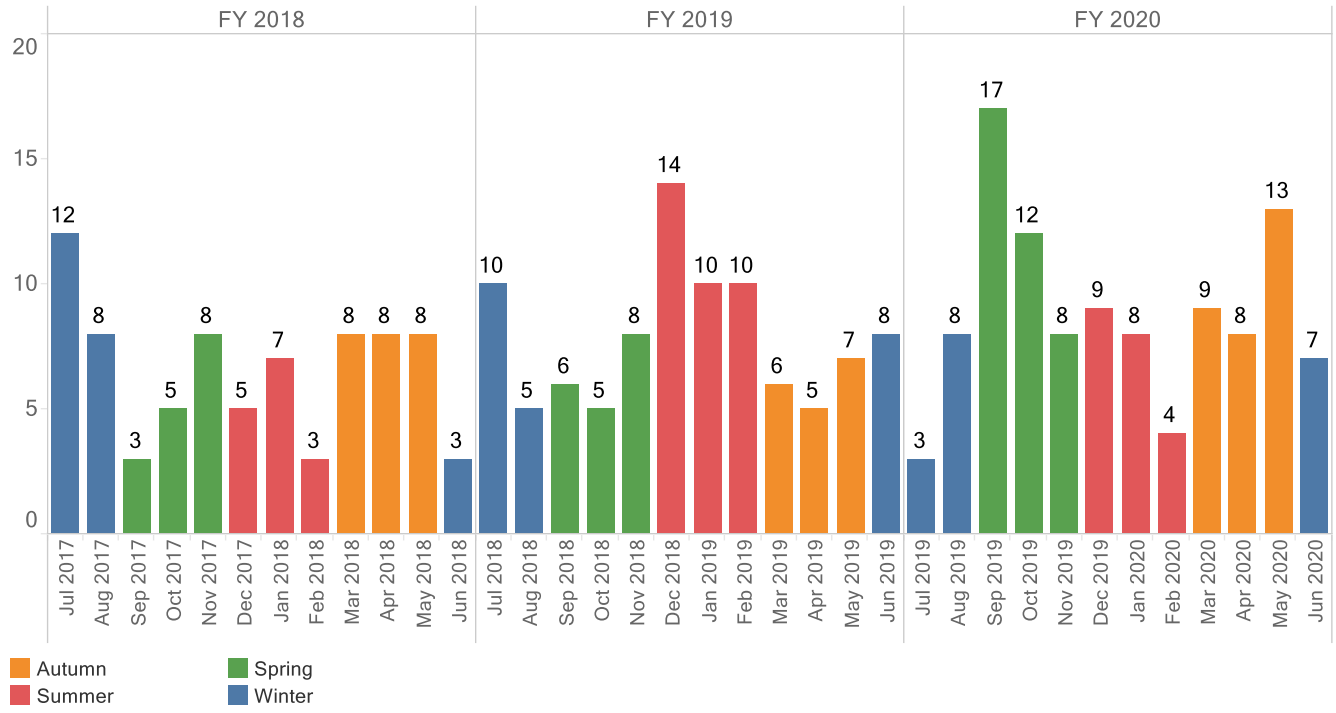
While further breakdown analysis into the number of serious injuries by season and shift did not identify any notable patterns or trends across the three-year period, it did highlight the increased prevalence of serious injury occurring mid-way through and towards the end of a worker's shift.

This analysis is not rate-based because hours worked data is reported annually and not by season, shift, weekday and hour.

Season

Analysis of serious injury by season did not reveal any consistent patterns or trends across the three years since 2017-18.

FIGURE 18: SERIOUS INJURY INCIDENTS BY SEASON 2017-18 TO 2019-20

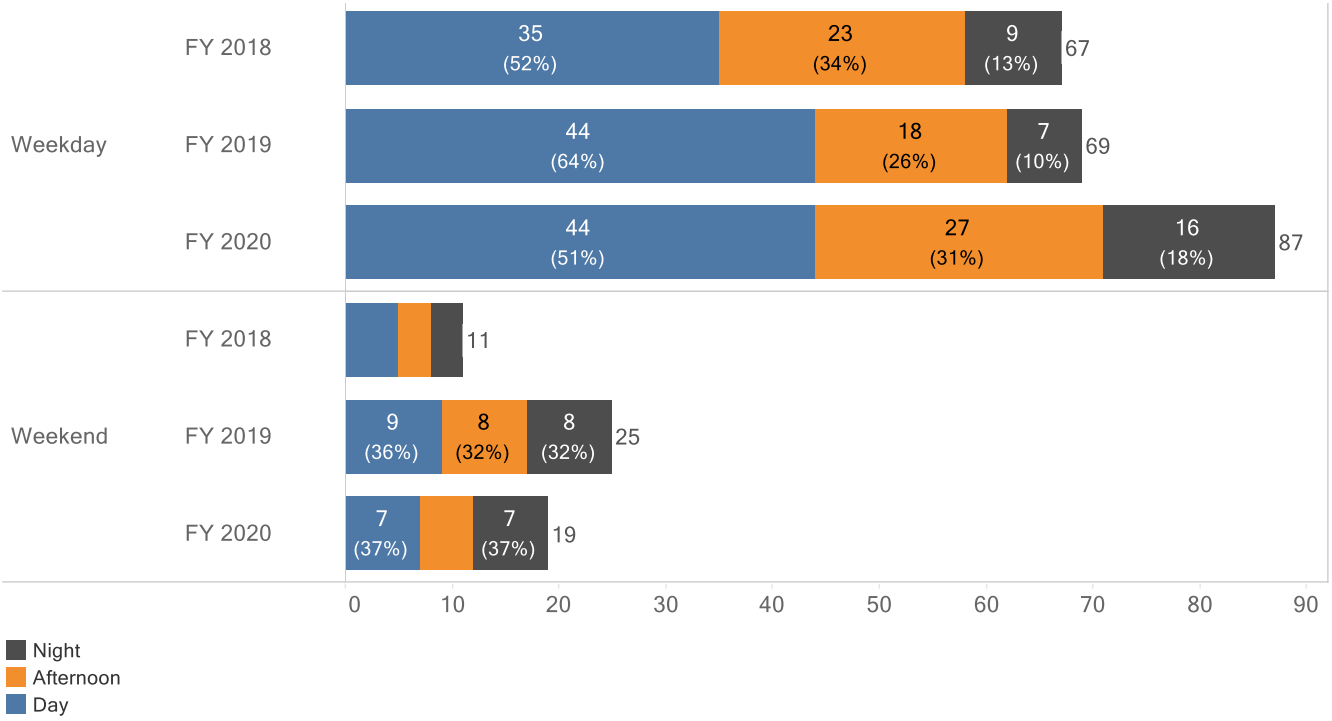


Shift

During the three-year period, on average the highest proportion of serious injuries occurred between 7am and 3pm (day) and 3pm to 11pm (afternoon) on weekdays, 53% and 31% respectively. This is likely due to the increased number of workers rostered on day shift, however hours worked data to confirm this was not available for this analysis.

There was no notable increase or decrease of serious injuries detected in relation to weekend shifts.

FIGURE 19: SERIOUS INJURY INCIDENTS BY SHIFT 2017-18 TO 2019-20

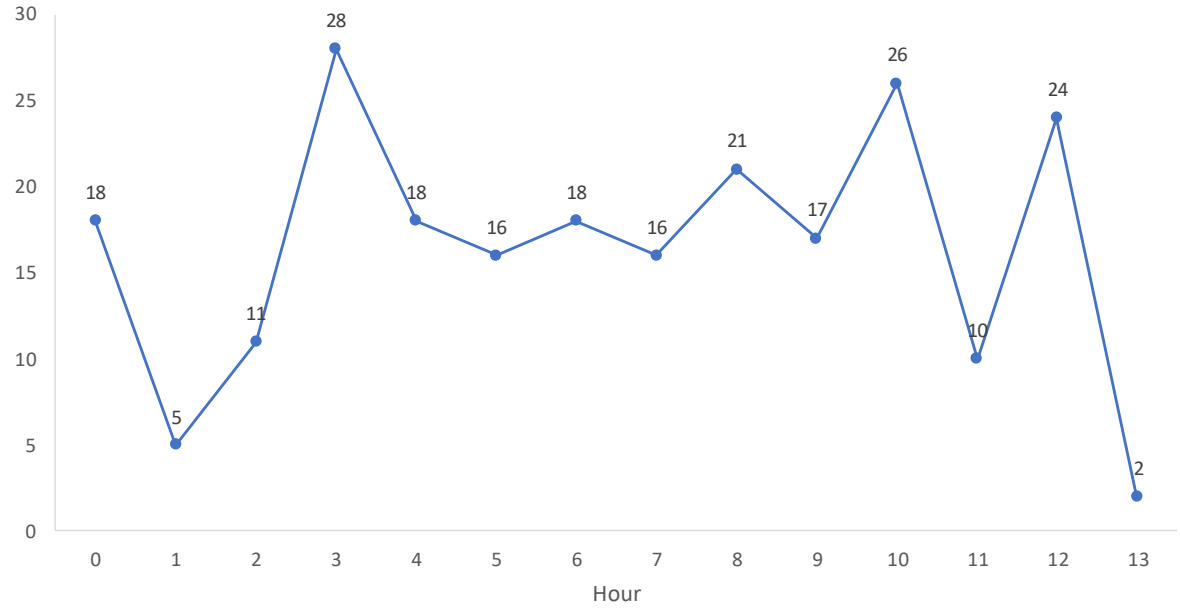


Hours worked prior to incident

During the three-year period, the number of hours worked prior to an incident where a worker was seriously injured are presented in the figure below. These findings highlight the increased prevalence of injury mid-way through and towards the end of a worker's shift[3,4].

Of note, due to an incomplete dataset, the figure below represents 230 of the 278 serious injuries reported during the three-year period.

FIGURE 20: HOURS WORKED PRIOR TO SERIOUS INJURY INCIDENT 2017-18 TO 2019-20



[3] Yang, L., Branscum, A., Smit, E., Dreher, D., Howard, K. and Kincl, L. 'Work-related injuries and illnesses and their association with hour of work: Analysis of the Oregon construction industry in the US using workers' compensation accepted disabling claims, 2001-2013'. *Journal of Occupational Health*, 2020; 62: e12118

[4] Friedman LS, Almberg KS, Cohen RA. 'Injuries associated with long working hours among employees in the US mining industry: risk factors and adverse outcomes'. *Occupational and Environmental Medicine* 2019;76:389-395.

Other contributing factors and considerations

Multiple factors contribute to incident, injury and illness notification levels and rates. While it is unlikely that a single factor has been the cause of any recent changes in notifications of serious injuries, the small sample size prevents us from drawing any reliable conclusions about the cause of any changes.

In addition to inherent risk factors specific to sector, operation type and mine there are various other external factors which may also contribute to notification levels.

Resources Regulator compliance, enforcement and engagement

- Compliance and enforcement activities including increased levels of regulatory engagement, proactive and reactive programmed assessments and volume and type of notices issued
- Increased focus on targeted intervention programs and compliance blitzes
- Publishing practices where assessment outcomes, details of prosecutions and prohibition notices are regularly communicated to industry via our website, regular reports and industry newsletters.

Resources Regulator's other activities and outputs

- Central Assessment Unit – established July 2016
- Online work health and safety reports – introduced January 2017
- Online incident notifications – introduced July 2017
- Compliance and enforcement approach policy – implemented July 2017
- Online portal for mine operators – introduced January 2019.

For more details see the Mine Safety Performance Report 2018-19 on our website.

External contributing factors

- Economic factors and commodity prices
- Mine-specific factors including changes in mine ownership, operator and management, reporting culture, financial distress, hazard management maturity and employment composition
- COVID-19 pandemic in the latter half of 2019-20.

Appendix 1. Frequency rate trends

FIGURE 21: COAL, SERIOUS INJURY FREQUENCY RATE BY OPERATION TYPE 2005-06 TO 2019-2020

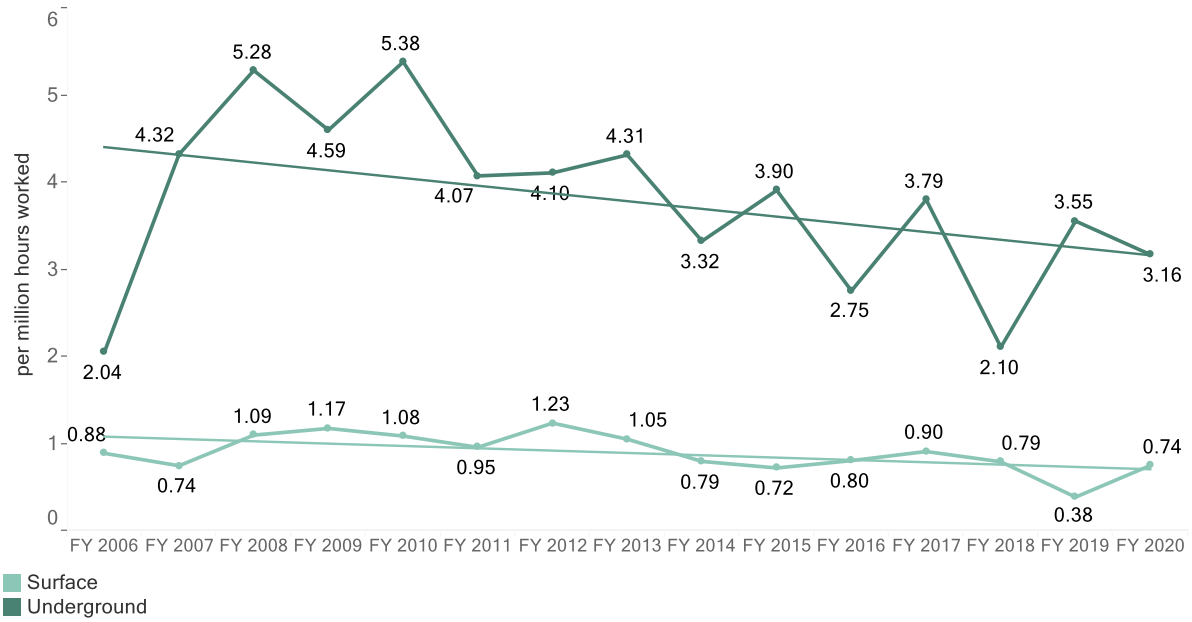


FIGURE 22: METALLIFEROUS, SERIOUS INJURY FREQUENCY RATE BY OPERATION TYPE 2005-06 TO 2019-2020

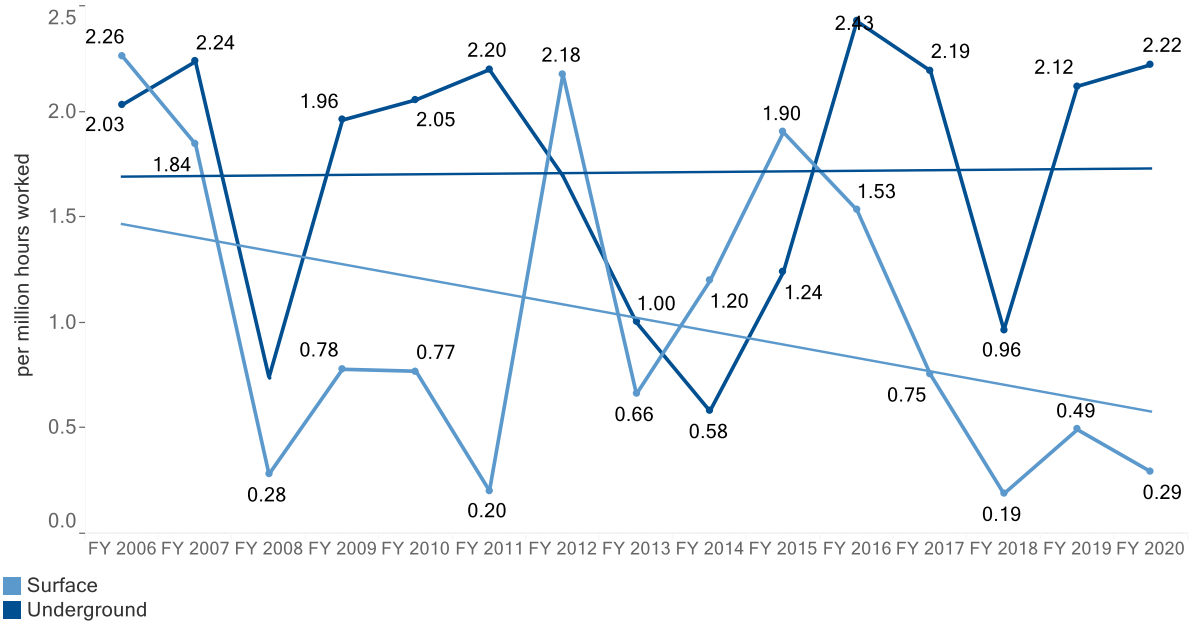
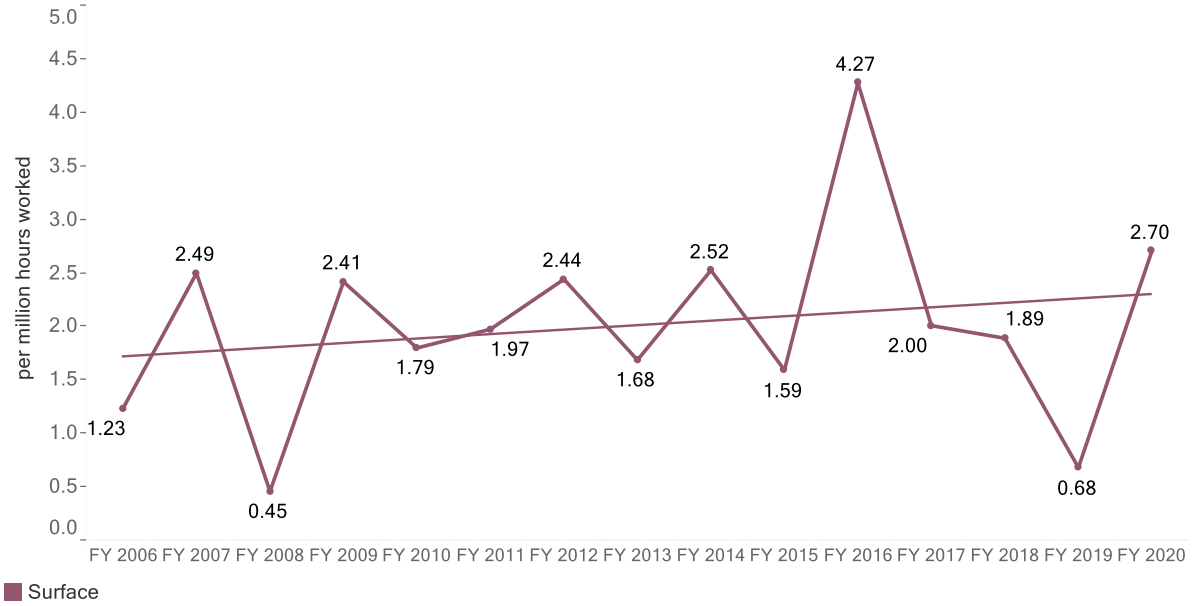


FIGURE 23: EXTRACTIVES, SERIOUS INJURY FREQUENCY RATE BY OPERATION TYPE 2005-06 TO 2019-2020



Appendix 2. Statistical models

To differentiate between random variation and meaningful patterns in the data, statistical significance tests were applied to SIFRs. Linear regression models for each operation type were applied to a 15-year period. This was made possible by mapping historically equivalent incidents (those that occurred before February 2015) to the current definition of serious injury for the purposes of establishing an adequate dataset for this analysis. P-values of 0.05 or less were considered significant. Model details, including R-squared values are shown below.

TABLE 2: SERIOUS INJURY FREQUENCY RATE STATISTICAL TEST RESULTS

OPERATION TYPE	R- SQUARED	DF	STANDARD ERROR	P-VALUE	MODEL MAYBE SIGNIFICANT AT P ≤ 0.05
All industry	0.47434	13	0.33456	0.0045197	Yes ↓
Underground coal	0.159995	13	0.942942	0.139602	No
Surface coal	0.302554	13	0.18844	0.0336363	Yes ↓
Underground metalliferous	0.0003904	13	0.64883	0.944278	No
Surface metalliferous	0.146913	13	0.7097	0.158467	No
Surface extractives	0.0419902	13	0.924139	0.463795	No

Appendix 3. Explanatory notes

Definition of serious injury – current legislation

Mine operators are required to notify the Resources Regulator of any serious injuries and illnesses under the *Work Health and Safety (Mines and Petroleum Sites) Act 2013* (WHS (MPS) Act).

Serious injuries and illnesses are defined in section 178 of the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 (the Regulation), and include injuries and illnesses requiring immediate treatment for; amputation of any part of the body, serious head injury, serious eye injury, serious burn, separation of skin from underlying tissue, spinal injury, the loss of a bodily function, serious laceration a fracture to bone excluding hand or foot are included within the definition as well as any injury or illness, irrespective of its nature, that results in immediate treatment as an in-patient in hospital.

With the commencement of the Regulation on 1 February 2015, the definition of a serious injury was expanded to include additional injury and illness types, as well as any injury or illness irrespective of its nature, that results in immediate treatment as an in-patient in a hospital.

In general, a serious injury under this definition is not directly comparable to definitions in other mining jurisdictions or SafeWork Australia.

Definition of serious injury – previous legislation

Prior to commencement of the WHS (MPS) Act, an injury was classified as serious if it was reported under clauses 55(a)(i)-(vi) or 55(c)(v) of the Coal Mine Health and Safety Regulation 2006 (CMHSR) or clauses 145(a)(i)-(vi) or 145(c)(iv) of the Mine Health and Safety Regulation 2007 (MHSR) – these did not include injuries resulting in hospital inpatient admission or loss of consciousness.

If any injury – serious or non-serious – resulted in hospital inpatient admission and loss of consciousness, the applicable clauses, CMHSR 55(a)(vii) and 55(b) and MHSR 145(a)(vii) and 145(b), were recorded as injury outcomes.

Definition of breakdown agency

According to the Australian Safety Compensation Council 'Type of occurrence classification system', the breakdown agency is intended to identify the object, substance or circumstance (the thing) that was principally involved at the point at which things started to go wrong and which ultimately led to the injury. The agency of injury refers to the thing directly involved in inflicting the injury or disease.

Of note, the hazard mechanism is the overall action, exposure or event that best describes the circumstances that resulted in the serious injury or disease.

Re-classification of historical serious injuries

Regression line statistical analysis requires sufficient data points to increase the model's validity, commonly agreed as a minimum of 15 data points. In order to obtain sufficient data points for this analysis, injuries were reclassified as notified under CMHSR and the MHSR between 2005-06 to 2014-15.

The re-classification provided equivalence in serious injuries across serious injury definitions in the previous legislation and the current legislation. The serious injuries in the report consist of:

1. Injuries classified with an injury classification of Injury, Serious, Work-related or Illness, Serious, Work-related
2. Any non-serious injuries with outcomes that resulted in-hospital inpatient admission and/or loss of consciousness.

Note: it is recognised that while the injuries classified under the previous legislation were recorded with hospital inpatient admission clauses, some of these may have only resulted in hospital treatment (eg for sutures), rather than inpatient admission.

FIGURE 24: SERIOUS INJURIES WITH RE-CLASSIFIED HISTORICAL SERIOUS INJURIES 2005-06 TO 2019-20

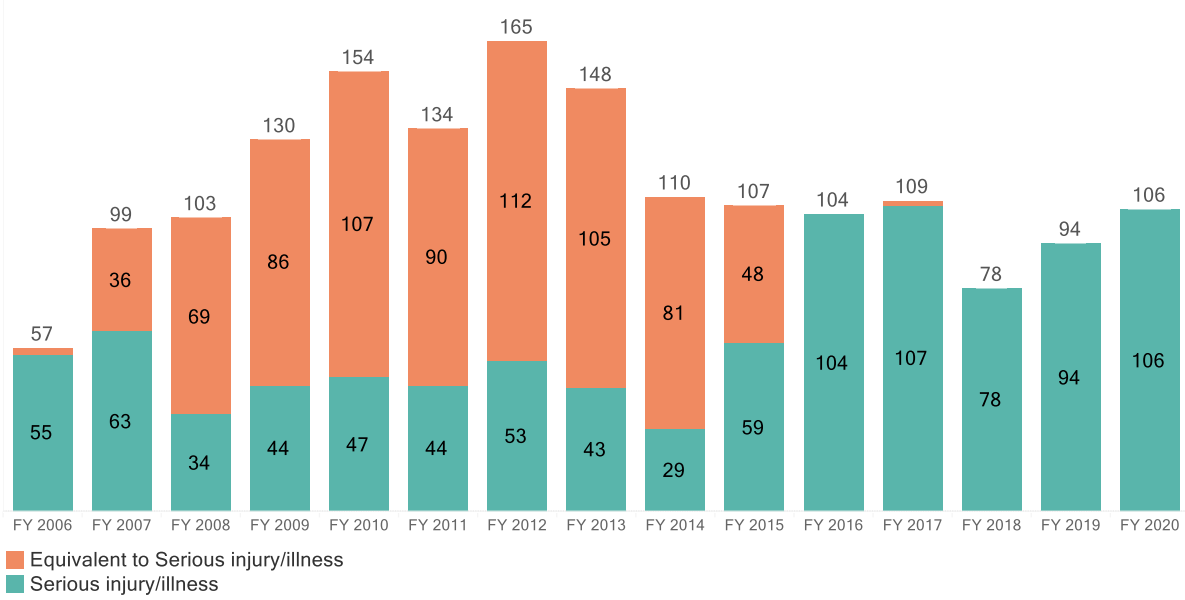


TABLE 3: SERIOUS INJURIES WITH RE-CLASSIFIED HISTORICAL SERIOUS INJURIES 2005-06 TO 2019-20

		FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Coal mines	Equivalent to Serious injury/illness	2	36	69	73	88	68	90	90	67	37		1			
	Serious injury/illness	35	32	26	28	33	32	35	35	19	41	58	75	52	66	70
	Total	37	68	95	101	121	100	125	125	86	78	58	76	52	66	70
Metalliferous mines	Equivalent to Serious injury/illness				6	12	12	16	10	6	9					
	Serious injury/illness	13	17	5	10	5	8	12	3	4	9	26	21	8	19	20
	Total	13	17	5	16	17	20	28	13	10	18	26	21	8	19	20
Extractives mines	Equivalent to Serious injury/illness				6	4	5	6	4	7	1					
	Serious injury/illness	4	10	2	5	3	3	5	4	5	7	18	11	11	4	12
	Total	4	10	2	11	7	8	11	8	12	8	18	11	11	4	12
Petroleum and Geothermal sites (incl exploration)	Serious injury/illness		3		1	4	1									
	Total		3		1	4	1									
Opal mines	Serious injury/illness		1	1							1	2		2	2	1
	Total		1	1							1	2		2	2	1
Other non-coal mines	Equivalent to Serious injury/illness					1										
	Serious injury/illness	1														
	Total	1				1										
Exploration (excl Petroleum and Geothermal sites)	Equivalent to Serious injury/illness				1	2	5		1	1	1		1			
	Serious injury/illness	2				2		1	1	1	1			5	3	3
	Total	2			1	4	5	1	2	2	2		1	5	3	3
Grand Total		57	99	103	130	154	134	165	148	110	107	104	109	78	94	106