Resources Regulator
Department of Regional NSW

Consolidated report

Electrical engineering control plan - exposure to an uncontrolled release of electrical energy – stage 2

Above surface coal sites & underground coal mines

March 2023 to December 2023

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Executive summary

A crucial part of the NSW Resources Regulator's Incident prevention strategy for mines and petroleum sites involves:

- targeted assessments and planned inspection programs - focusing on assessing an operation's control of critical risks through evaluating the effectiveness of control measures in the mine's safety management system
- priority programs - proactively assessing a topic that is an emerging risk across the industry, which is driven primarily from incident data as well as evolving industry trends. Although these topics may also be contained within the Regulator's planned inspection programs, the aim of compliance priority programs is to gather further information and knowledge about how the industry is managing and controlling a specific issue.

The Regulator has developed a bowtie hazard management framework and standardised assessment checklist for each program plan. Under each program plan, the effectiveness of the safety management system at each mine site is assessed against a standard set of control supports and critical controls.

Exposure to an uncontrolled release of electrical energy (Stage 2) at coal mines (above surface coal sites and underground coal mines) and the threats critical controls and control supports identified in the electrical engineering control plan (EECP) bow tie. Electrical hazards can occur within various mining environments and have the potential to cause serious and/or fatal injuries to workers if not controlled effectively.

This report will provide separate analysis and recommendations for above surface coal site assessments and underground coal mine assessments due to differing electrical legislation requirements.

An inspection assessment program was developed to assess how mines and surface sites are prepared to manage that risk.

In total there were 54 underground coal mine and above surface coal sites assessed including:

- 18 open cut coal mines
- 12 coal processing sites
- 7 above surface sites at underground coal mines
- 17 underground coal mines

In summary, there were 864 individual assessment findings and of those 105 assessment findings required enforcement action to be taken (combined above surface sites and underground mines).

The assessment program was conducted between March 2023 and December 2023.

In summary, there were 108 compliance notices issued in total comprising of:

- 75 compliance notices issued to 30 above surface coal sites
- 33 compliance notices issued to 15 underground coal mines

In summary, the types of compliance notices issued consisted of:

- 40 (above surface) and 21 (underground) WHS(MPS)A s23 notices of concern
- 32 (above surface) and 12 (underground) WHSA s191 improvement notices
- 3 (above surface) and 0 (underground) WHSA s195 prohibition notice.

Explanatory notes on the assessment system are also listed in Appendix A.

Assessment criteria for all assessments

Critical controls were identified by the Regulator and assessment criteria were assigned to each potential threat.

A tabulation of the threat, critical control and control support for the program plan electrical engineering control plan, exposure to an uncontrolled release of electrical energy - stage 2 is provided in Table 1.

Table 1. Threats and critical controls assessed for the planned inspection program electrical engineering control plan - stage 2 (above surface coal sites and underground coal mines)

Threat	Critical control	Control support
1. Direct contact with electricity 3. Arc blast	PC1.7	Switchgear design
1. Direct contact with electricity	PC1.8	Shelter from lightning
2. Indirect contact with electricity	PC2.4	Earthing

Definition of above surface coal sites assessments

For the purposes of this report the definition of above surface coal sites includes assessments of electrical equipment and installations assessed by the Regulator at open cut coal mines and surface electrical facilities at coal processing sites and the surface of underground coal mines.

Assessment findings for above surface coal sites

Overall, the assessment findings for above surface coal sites were:

- 37 above surface coal sites assessments comprised of:
- 18 open cut coal mines
- 12 above surface coal processing sites
- 7 above surface sites at underground coal mines
- 592 individual findings for the assessed criteria
- 75 findings with enforcement action recorded

The summary of above surface coal site assessments overall results by critical control and operation type is shown in Figure 1.

Figure 1. Summary for above surface coal sites assessment findings overall results by critical control and operation type

	Threat			Grand Total
	1. Direct contact with electricity 3. Arc blast	1. Direct contact with electricity	2. Indirect contact with electricity	
	PC1.7	PC1.8	PC2.4	
	Switchgear design	Shelter from lightning	Earthing	
Underground (surface location)	79%	89%	97%	88%
Open cut	84%	94%	89%	89%
Processing	78%	94%	94%	88%
Grand Total	81%	93%	92%	88%

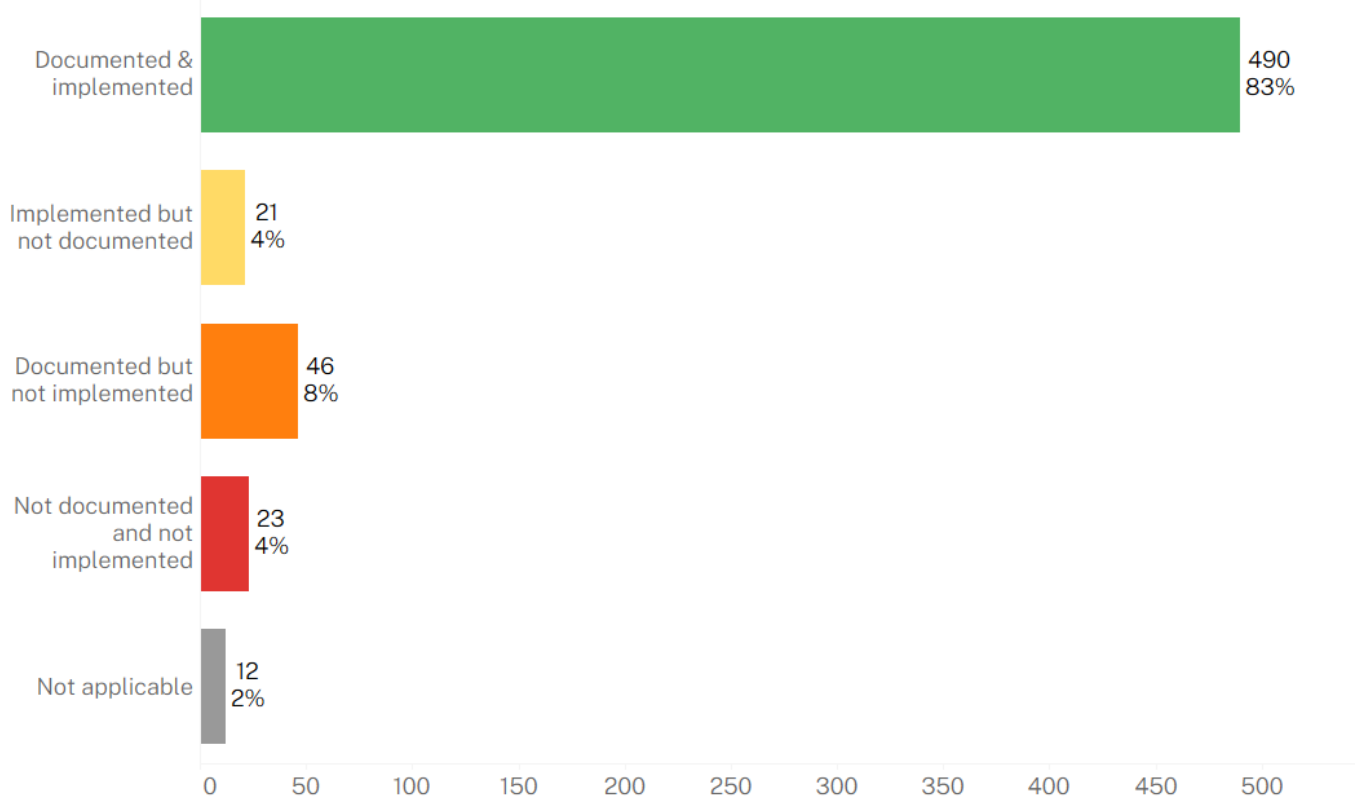
Green (=100%)
Yellow (>= 80% and <100%)
Orange (>= 65% and <80%)
Red (<65%)

In summary the total of all above surface coal sites assessment findings were 88%.

The lowest ranked assessment findings were related to switch gear design assessed as 79% at above surface underground mine sites and 78% at surface processing sites.

The overall assessment findings ratings for above surface coal sites is shown in Figure 2.

Figure 2. Overall assessment findings ratings for above surface coal sites

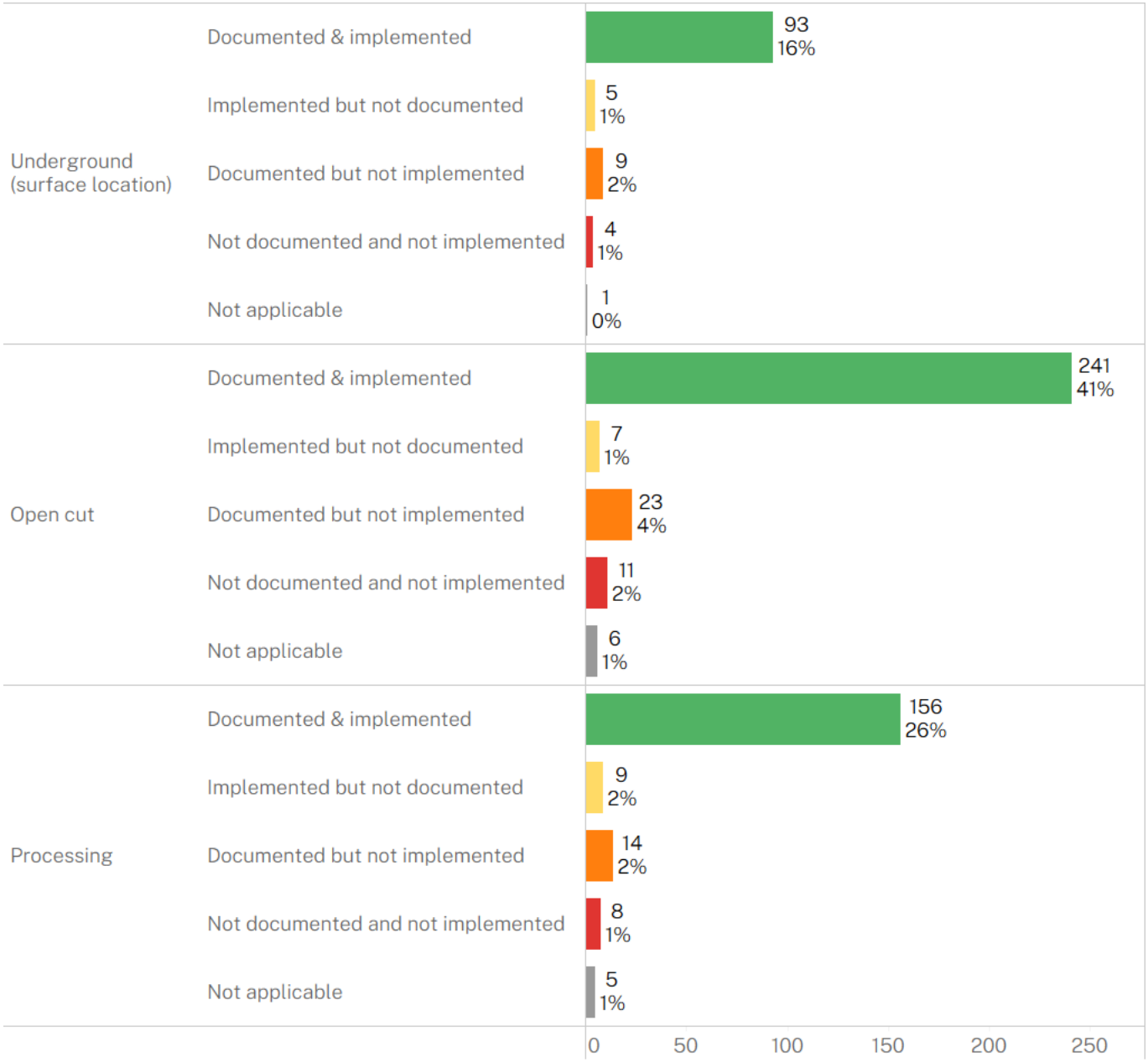


In summary the overall assessment findings ratings for above surface coal sites were:

- 83% rating for documented and implemented finding,
- 4% rating for implemented but not documented finding,
- 8% rating for documented but not implemented finding,
- 4% rating for not documented and not implemented finding,

The overall assessment findings ratings by operation type is shown in Figure 3:

Figure 3. Overall assessment findings ratings by operation type



In summary the overall assessment findings ratings by above surface coal operation type were:

- 16% rating for documented and implemented finding underground coal mine surface sites,
- 41% rating for documented and implemented finding open cut coal mines,
- 26% rating for documented and implemented finding surface coal processing sites.

Notices issued to above surface coal sites

There were **75** compliance notices in total issued to **30 above surface coal sites** during the assessment program.

The types and numbers of compliance notices issued by Inspectors during the assessment program to above surface coal sites is shown in Table 2:

Table 2: Notices issued for above surface coal sites

NOTICE TYPE	TOTAL ISSUED	NUMBER OF SITES
s.23 notice of concerns	40	24
s.191 improvement notice	32	15
s. 195 prohibition notice	3	2
Total	**75**	**30** **Note: some mine sites were issued** **multiple notices**

Review of surface coal site assessment findings

EECP risk assessment

Even though all surface coal sites had completed an electrical engineering control plan (EECP) risk assessment, most did not comply in their entirety to the legislation.

Specifically, the risk assessment did not assess the risks nominated in WHS(MPS) Regulation 2022 - Schedule 2 Principal Control Plans - Part 3 EECP item (2) to identify the control measures for those risks.

In many cases, a procedure was listed as the control measure in lieu of an actual control against the risk.

Risk assessments should clearly identify the risk, the consequence and the control measures that are in to be put in place to prevent or mitigate the unwanted event.

Electrical engineering control plans (EECP)

EECP at surface coal sites were not followed by the people undertaking the task and in many cases they were not readily available to all personnel on site.

A number of control plans were not set out in a manner that the control measures for the risks nominated in Schedule 2 are readily identified.

Rating of electrical equipment

A primary requirement to ensure that electrical equipment is adequately rated for the power system that it is connected to, is to know what the capacity of the power system is. The manner in which this is determined should be contained in the EECP.

The most effective method of determining the capacity of the power system is to perform a fault level study to determine the maximum prospective short circuit current.

Many surface coal sites only know their fault levels to the incoming termination of the MCC and no further. Surface coal sites need to know the maximum prospective short circuit current at all relevant parts of the network in order to comply with AS/NZ 3000.

If the fault level studies do not extend to all sections of the electrical distribution system it is impossible to tell if the equipment is capable of carrying and breaking a fault current should the need arise.

Electrical equipment plant files should contain up to date information with regards to the ratings of the equipment. This information needs to be available in the circumstances where the fault level changes to ensure that the equipment remains adequately rated.

Not all surface coal sites have formalised and implemented arc flash strategies and the topic is not well understood by workers.

Recommendations for above surface coal sites

Based on the findings outlined in this report and in relation to the numbers and types of compliance notices issued during the above surface coal site assessment program, the following recommendations should be reviewed by mine operators of above surface coal sites:

- Review EECP risk assessments to clearly identify the risk, the consequence and the control measures that are in to be put in place to prevent or mitigate the unwanted event.
- Review EECP to ensure workers who undertake electrical tasks are trained and are competent in the implementation of the EECP.
- Review electrical equipment plant files for information regarding the ratings of the equipment so that it can be determined that they are adequately rated suitable for the power systems they are connected to.

Definition of underground coal mines assessments

For the purposes of this report the definition of underground coal mine assessments is the Regulators assessment of electrical equipment and installations located in underground coal mines.

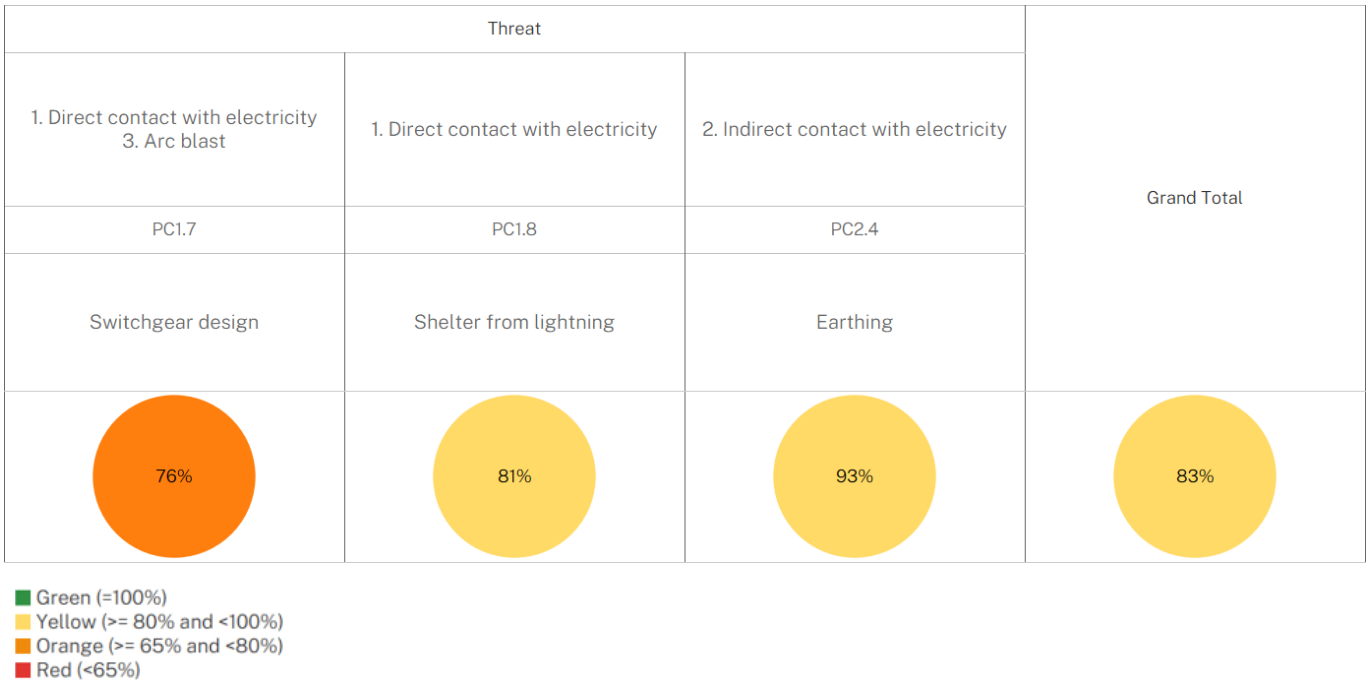
Assessment findings for underground coal mines

Overall, the assessment findings for underground coal mines were:

- 17 underground coal mines assessed in the program
- 272 individual findings for the assessed criteria
- 30 findings with enforcement action recorded

A summary of the overall results of underground coal mine assessment findings by critical control is shown in Figure 4:

Figure 4. Summary for underground coal mine assessment findings overall results by critical control

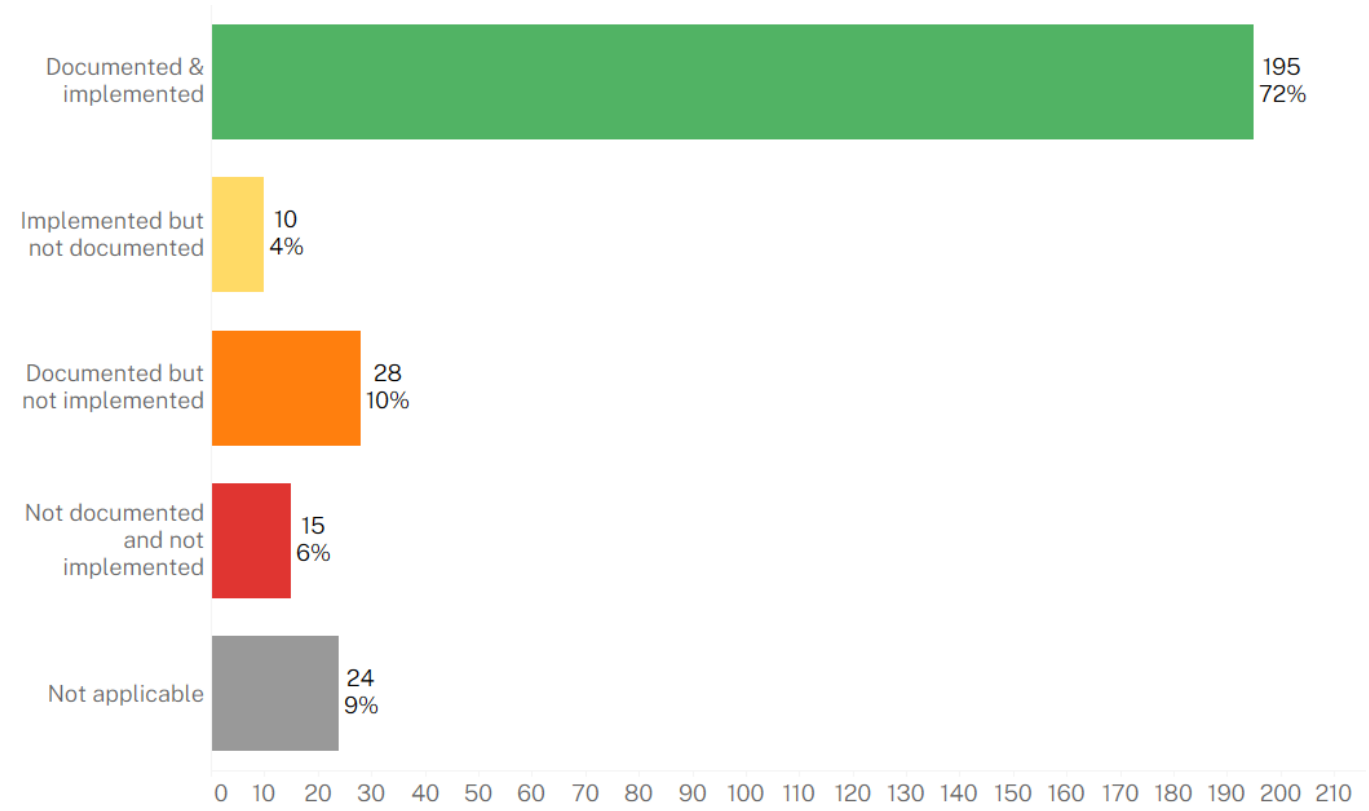


In summary the total of underground coal mines assessment findings were 83%.

The lowest ranked assessment findings were related to switch gear design assessed as 76% at underground coal mines.

A summary of overall assessment findings ratings for underground coal mines is shown in Figure 5:

Figure 5. Overall assessment findings ratings for underground coal mines



In summary the overall assessment findings ratings for underground coal mines were:

- 72% rating for documented and implemented finding,
- 4% rating for implemented but not documented finding,
- 10% rating for documented but not implemented finding,
- 6% rating for not documented and not implemented finding,

Notices issued to underground coal mines

There were **33** compliance notices in total issued to **15 underground coal mines** during the assessment program.

The types and numbers of compliance notices issued by Inspectors during the assessment program to underground coal mines is shown in Table 3:

Table 3: Notices issued for the underground coal mine program

NOTICE TYPE	TOTAL ISSUED	NUMBER OF SITES
s.23 notice of concerns	21	15
s.191 improvement notice	12	6
s. 195 prohibition notice	0	0
Total	**33**	**15** **Note: some mine sites were issued** **multiple notices**

Review of underground coal mine assessment findings

EECP risk assessment

Even though all sites had completed an electrical engineering control plan (EECP) risk assessment, most did not comply in their entirety to the legislation.

Specifically, the risk assessment did not assess the risks nominated in WHS(MPS) Regulation 2022 - Schedule 2 Principal Control Plans - Part 3 EECP item (2) to identify the control measures.

In many cases, a procedure was listed as the control measure in lieu of an actual control against the risk.

Electrical engineering control plans (EECP)

EECP were not complied with by people undertaking the task and in many cases they were not readily available to all personnel on site. A number of EECP were not set out in a manner that the control measures for the risks nominated in the EECP were readily identified.

Rating of electrical equipment

A primary requirement is to ensure that electrical equipment is adequately rated for the power system that it is connected to, is to know what the capacity of the power system is.

The manner is which this is determined should be contained in the EECP. The most effective method of determining the capacity of the power system is to perform a fault level study to determine the maximum prospective short circuit current.

Fault levels need to be kept up to date due to the changing locations of the equipment underground. EECP should contain trigger points at which the determination of fault levels needs to be updated.

While most sites had conducted fault level studies, they did not extend to all sections of the electrical distribution system making it impossible to tell if the equipment were adequately rated for its fault duty.

Electrical equipment plant files should contain up to date information with regards to the ratings of the equipment. This information needs to be available in the circumstances where the fault level changes to ensure that the equipment remains adequately rated. Most plant files for custom built electrical equipment do not contain sufficient information to determine what the fault capacity of the equipment is or how that rating was determined. In many cases, identically designed equipment is fitted with varying equipment rating labels.

Not all sites have formalised and implemented arc flash strategies and the topic is not well understood by workers.

Recommendations for underground coal mines

Based on the findings outlined in this report and in relation to the numbers and types of compliance notices issued during the underground coal mine assessment program, the following recommendations should be reviewed by mine operators of underground coal mines:

- Review EECP risk assessments to clearly identify the risk, the consequence and the control measures that are in to be put in place to prevent or mitigate the unwanted event.
- Review EECP to ensure workers who undertake electrical tasks are trained and are competent in the implementation of the EECP.
- Review electrical equipment plant files for information regarding the ratings of the equipment so that it can be determined that they are adequately rated suitable for the power systems at the site. This should include a statement from the designer of the electrical equipment as to how the fault rating was determined.

Further information

For more information on safety assessment programs, the findings outlined in this report, or other mine safety information, please contact the NSW Resources Regulator:

CONTACT TYPE	CONTACT DETAILS
Email	cau@regional.nsw.gov.au
Incident reporting	To report an incident or injury call 1300 814 609 or log in to the Regulator Portal
Website	www.resourcesregulator.nsw.gov.au
Address	NSW Resources Regulator 516 High Street Maitland NSW 2320

Appendix A – Assessment criteria rating

Each assessed criteria is rated from 1 through 4 based on evidence supporting the expected control supports identified at the mine site:

Evidence supporting expected control supports

Expected control supports	Rating	Evidence supporting rating / comments
	4 3 2 1	

Assessment findings results are calculated based on the total points allocated to the assessed ratings as a percentage of the maximum possible points for each criteria group, and any findings rated as 'Not applicable' were excluded from the calculation.

Criteria assessed ratings and points

Assessed as	Rating	Points
Documented & implemented Compliant	4	4
Implemented but not documented Improvement needed	3	2
Documented but not implemented Significant improvement needed	2	1
Not documented and not implemented Non compliant	1	0
Not applicable (N/A)		

Findings results (points) with colours assigned as follows:

- Green (=100%)
- Yellow (>= 80% and <100%)
- Orange (>= 65% and <80%)
- Red (<65%)
- Not applicable