NSW Resources Regulator

PLANNED INSPECTION PROGRAM

Consolidated report – Structural integrity of coal handling and preparation plants

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Contents

Executive summary

A compliance inspection program was undertaken this year, focusing on structural integrity at coal handling and preparation plants (CHPPs). Inspectors considered the integrity of structures including buildings, bins and gantries, as well as human interaction with plant and equipment.

Inspectors reviewed 46 coal handling facilities using broad ranking criteria that included the age of the plant, condition of the plant (in consideration of the outcome of past inspections) and previous issues/incidents. Twenty one facilities that constituted the highest-perceived risk to health and safety in terms of structural integrity were identified for planned inspections. Two additional facilities were added during the program.

For all of the sites selected, a review of the risk assessment process associated with CHPP structural failure, a review of the management systems for assessing and managing structural integrity, and an outline of the plant specification were carried out. Because not all plant had the same functionality, target areas were identified. Not all areas were present at each plant and consequently not all were assessed. The areas assessed included:

- wash plant buildings
- crushing and screening plant buildings
- coal and reject bins
- stockpile stackers and reclaimers
- reclaim tunnels
- elevated conveyor gantries and trestles
- thickener tanks
- dense medium sumps.

Washery and crushing/screening buildings have multiple levels with a high density of static and dynamic plant, as well as a complex network of walkways, platforms and/or stairs where there are risks of falling in the event of walkway/handrail failure. Bins, stockpile stackers/reclaimers and aerial conveyor gantries generally have single access at high elevations with the risk of falling if there is a failure. Reclaim tunnels have the risks of irrespirable atmosphere and engulfment. Thickener tanks and dense medium sumps are separated from the washery buildings as both have the added risk of drowning if walkways, platforms or handrails fail.

This report summarises the findings of the inspections undertaken between April and August 2017. The review focused on whether the facilities had developed and implemented an inspection and maintenance plan (including structural audits), that remediation works arising from inspection activities were being planned and executed, and that defect management systems were being used to capture structural defects. The review also included an inspection of the plant itself and any associated infrastructure.

The regulator issued 55 notices as a result of the planned inspection program - seven prohibition notices, 26 improvement notices and 22 notices of concern.

The inspections treated each facility in isolation and identified areas of good practice as well as areas of opportunity to improve. Good practices were noted 55 times in 13 categories including:

- functional design of plant item, mounting, operability, tool, etc.
- functional design of safety, guarding or isolation equipment
- well designed access to equipment to inspect or maintain
- well maintained and/or operated plant
- standard or procedure for job or isolation

- well designed and maintained reclaim tunnel.

The inspections also identified common opportunities for improvement:

- Guarding of plant:
    - Pulley guarding was absent or insufficient.
    - Drive belts were not adequately guarded.
    - Access hatches or guarding did not require a tool to open/remove.
    - Access was available to exposed sections of rotating shafts.
    - Protection against being hit by falling objects (underpans, barricades) was absent or compromised.
    - Temporary guarding or barricades compromised access for maintenance, inspection, or cleaning.
- Sites lacked a systematic approach to:
    - extracting action items from the structural audit report
    - prioritising the repairs
    - allocating the work
    - signing off each item as completed
    - verifying that the remedial control had effectively solved the issue identified in the audit.
- Plant and structures requiring review by suitably qualified engineers were:
    - damaged due to corrosion from spillage, or location of concrete that could exacerbate the potential for corrosion
    - modified on site without evidence of qualified engineering input
    - not identified as a confined space, or the confined space was readily accessible.
- Handrails:
    - Handrails on walkways were inadequate or badly corroded.
    - Handrails on sumps were inadequate or missing.
    - Barriers/handrails were not installed to prevent walking into, or falling onto, moving conveyors.
- Walkways and associated support beams:
    - were corroded
    - were loose or missing walkway retainers
    - had significant spillage along conveyors making walking difficult
    - had spillage or equipment stored on elevated walkways making kickrails and handrails ineffective and non-compliant.
- Reclaim tunnels had:
    - inadequate airflow in stockpile feeder voids
    - absent gas monitoring systems to ensure a respirable atmosphere.

Background

The NSW Resources Regulator uses planned inspections (PIs) as a proactive assessment tool to assess how effectively an operation controls critical risk. As with targeted assessments (TAs), planned inspection programs examine how effectively an operation controls risks associated with its principal hazard management plans (PHMPs) and principal control plans (PCPs).

Planned inspections look for evidence that:

- systems and procedures identified in a specific PHMP/PCP to manage risk are functional
- implementation of procedures described in the PHMP/PCP is ongoing
- it has been verified the risks are controlled
- the controls are being monitored to ensure they remain effective
- the workforce is competent and confident about the implementation of the identified risk controls relevant to their work area, equipment and level of responsibility.

The process

The process for undertaking a planned inspection generally involves the following stages:

1. a request for documentation and/or the site to prepopulate the inspection template provided
2. interviews, observations and inspections of relevant plant operations on site as per the inspection template. Any significant issue identified on site, regardless of its nature, will also be reviewed by the inspectors in attendance.
3. review of gathered information
4. on site debrief
5. discussion and feedback to the mine management team on the findings and actions that need to be taken by the operators in response.

The debrief provides immediate feedback on the outcomes including:

- the team's findings and recommendations
- any immediate enforcement action that will be taken
- advice of next steps – the process and an indication of the dates for the response of any notices issued.

Scoring

As part of the planned inspection, the items referenced in the inspection template will be assessed and scored to allow trend analysis, or identify key focus areas, to be determined across the sites. The scoring process is outlined in Table 1.

Table 1: Scoring system

Score	Code	System	Risk assessment and procedures	Field observations
5	Always	Control is always applied and appears to be fully implemented.	Hazard evaluated in high level risk assessment. Control nominated specifically led to development of documented system. System for implementation proven to be effective by documented review.	All areas of the plant or structure comply with requirements of the standards/systems.
4	Routine	Generally done and integrated into mine's standard way of doing work. Variances are rare.	Hazard recognised in high level risk assessment. Documented system developed. Control system implemented.	Plant or structure generally complies with standards/systems. A few minor variances that are easily corrected.
3	Mostly	It is becoming routine. However, variations occur as the control is not fully driven by the system. Workers are consistently applying procedures.	Hazard evaluated in control plan risk assessment. Documented system developed and implemented.	Items of non-conformance to standards or systems noted. Mainly technical non-compliances, and not specifically safety-related. Absence of controls not considered systemic, but a localised failure.
2	Sometimes	When required or instructed. Elements of a systematic approach observed, however, still inconsistent in application. Not all workers are doing the same thing.	Hazard evaluated in task risk assessment. System considered but reliant on individual to ensure ongoing control is retained.	Systemic issues relating to non compliance with standards or systems. Areas where absence of controls could potentially pose risk to health and safety.
1	Ad hoc	No structure and inconsistent approach. No alignment to the mine's documented system.	Hazard not risk assessed, but considered in job specific analysis such as job safety and environment analysis (JSEA), Take 5, etc. Workers aware of hazard, but no specific system to control it.	Risk identified, personnel use a procedural control, but no hard barriers in place. Significant issues identified that require immediate attention to prevent safety related issues.
0	No evidence	No evidence of a system.	Hazard not assessed.	No controls in place. No knowledge by workers of requirement for controls.
N/A	Not applicable	Not applicable.	Not applicable.	Not applicable.

Structural integrity of CHP and CHPP

A person conducting a business or undertaking must ensure, so far as is reasonably practicable, the health and safety of workers while the workers are at work in the business or undertaking. This obligation includes the provision and maintenance of safe plant and structures and the provision of safe systems of work.[1]

Guarding of plant is a specific control measure for managing the risk of workers coming into contact with moving parts or plant. Clause 208 of the Work Health and Safety Regulation 2017 applies if guarding is used as a control measure in relation to plant at a workplace.

The *Managing the risks of plant in the workplace code of practice* provides guidance on specific control measures including guarding of plant, isolation of energy sources and inspection of plant.

The *NSW Code of practice: Mechanical engineering control plan* provides practical guidance for the preparation, implementation and periodic review of a mechanical engineering control plan (MECP), as required under the WHS laws. The MECP provides the means by which the mine operator will manage any risks associated with mechanical aspects of plant and structures, and includes catastrophic failure (Section 4.4.5). These risks arise from hazards associated with 'mechanical energy' and include risks associated with plant such as machinery, equipment, appliances and structures. The risks may exist across mining operations and involve other hazards and controls. In the context of this code, 'mechanical energy' means all energy associated with plant and structures, other than electrical energy. This code provides information on other sources of information that may be helpful in developing the MECP or selecting control measures.

Inspection template

The inspection template was set out in standard format.

- Part 1 set out the guidelines for the inspection.
- Part 2 detailed the mine participants and their roles, including the site safety and health representative when available.
- Part 3 covered the document review for risk identification and assessment of CHPP structural failure, including whether the sites had developed and implemented an inspection and maintenance plan (including structural audits). This was significantly abridged from the PHMP planned inspections.
- Part 4 was broken down into sections to be assessed at the planned inspection. A review of the management systems for assessing and managing structural integrity, that remediation works arising from inspection activities were being planned and executed, that defect management systems were being used to capture structural defects, and an outline of the plant specification were carried out for all the sites. Because not all plant has the same functionality, ranging from crushing and screening (CHP) through to washing and coal handling (CHPP), a number of target areas were identified. Not all areas were present at each plant, and consequently not all were assessed.
- Part 5 is the post-inspection meeting to provide feedback on the visit, and any remedial work required.

In Part 4 the areas assessed included the plant itself and any associated infrastructure:

1. structural audit
2. plant specification
3. wash plant building(s)
4. crushing and screening plant building(s)

[1] *Work Health and Safety Act 2011*, section 19

5. coal and reject bins
6. stockpile stackers and reclaimers
7. reclaim tunnels
8. elevated conveyor gantries and trestles
9. thickener tanks
10. dense medium sumps.

The areas were determined to best cover functional areas from the majority of coal handling and preparation plant design. The primary risks identified were:

- Washery and crushing/screening buildings had multiple levels with a high density of static and dynamic plant, as well as a complex network of walkway/platforms/stairs to operate and maintain equipment. The building structures were susceptible to corrosion and vibration and there was a risk of falling as a result of walkway/handrail failure.
- Bins, stockpile stackers/reclaimers and aerial conveyor gantries were large, free-standing entities that generally had single access ways at high elevations. There was generally interaction with mobile plant that can lead to structural damage, with the risk of workers falling if there was a failure.
- Reclaim tunnels were generally below ground level and had the risk of irrespirable atmosphere and engulfment.
- Thickener tanks and dense/correct medium sumps were separated from the washery building as both had the added risk of engulfment/drowning if walkways/platforms/handrails failed.

Each area had a series of elements that focused on both major failure of the plant or structure, as well as failure of the walkway/platform/stairs/ladder access to operate and maintain the item. These elements were ranked as part of the assessment so that an area score and overall score could be determined.

Selection of facilities for inspection

Inspectors reviewed the 46 coal handling facilities, and used broad ranking criteria to select the 21 facilities for planned inspections. The broad selection criteria for the facilities included:

- age of plant
- condition of plant identified from previous inspections
- previous issues/incidents.

During the inspection program, two additional facilities were included that were local to, and owned by, the same operators where significant issues were identified.

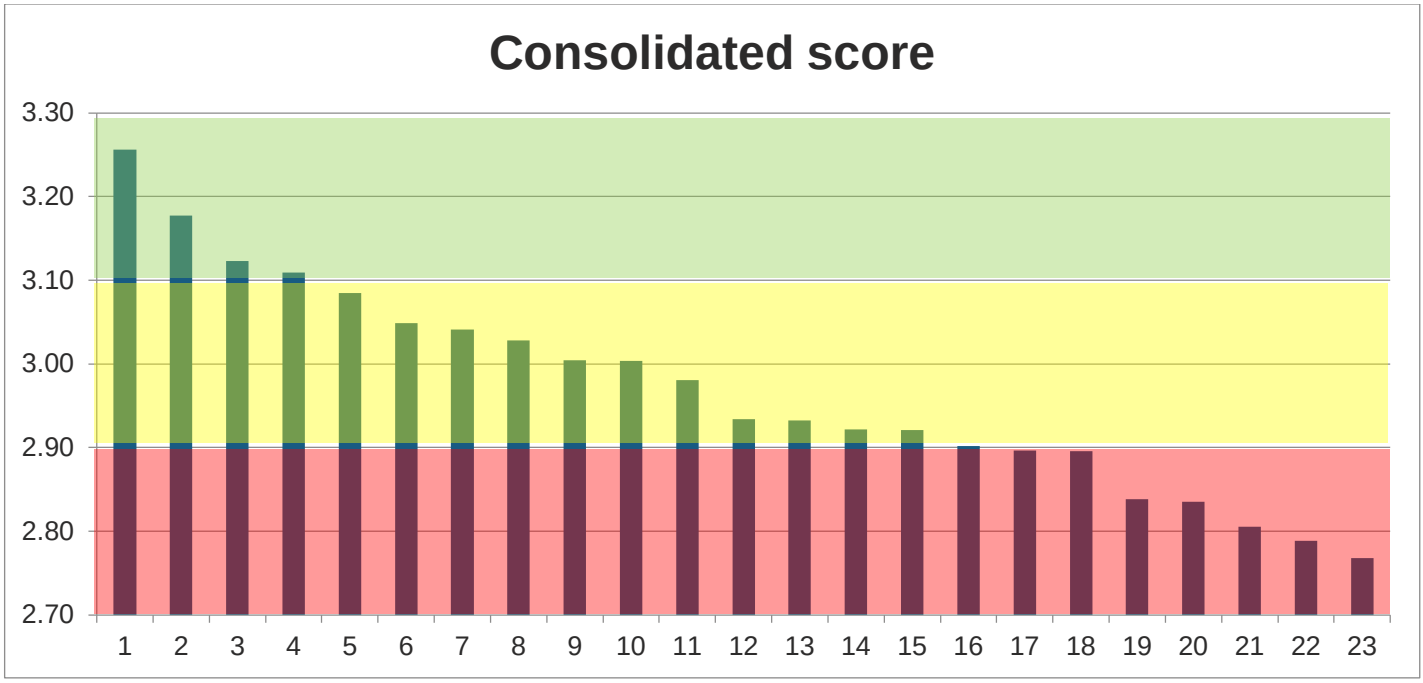
Inspection review

Inspections were undertaken between April and August, 2017. Data from the completed CHPP inspection reports was tabulated and analysed. Plant specification was not an assessable criteria, consequently the consolidated score is the average of the remaining 10 areas, including Part 3 risk management.

Each area had a number of ranked elements, and the score for the area was an average of the ranks for each element. The consolidated score is the average of all the assessed areas. Based on the assessment outcomes the scores are shown in Graph 1 below, and can be considered as follows:

- greater than 3.1 is considered satisfactory (highlighted green)
- between 2.9 and 3.1 was considered marginal, and site review of systems is recommended (highlighted yellow)
- less than 2.9 is considered unsatisfactory and site systems require review (highlighted red)

Graph 1: Facility score and ranking.



Four sites were considered satisfactory overall, although there were still some issues for the sites to address. Twelve sites were considered marginal and constituted the majority of notices, 29 in total, including five prohibition notices. The remaining seven sites were considered unsatisfactory, and had a total of 17 notices issued including two prohibition notices.

The ranked scores for each area at each facility were tabulated. Review of the data enabled inspectors to:

- review areas to see which sites best managed particular areas so facilities that did not perform as well could have a good baseline to work from. An example was reclaim tunnel ventilation management where inspectors facilitated communication between two sites to assist the poorer performing site to improve standards
- review each site to assess if particular areas required improvement
- determine if there were any areas that were generally handled well across sites
- determine if there were any areas that were generally handled poorly across the sites.

Table 2: Facility area scores and ranking.

Facility		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Consolidated score		3.26	3.18	3.12	3.11	3.08	3.05	3.04	3.03	3.00	3.00	2.98	2.93	2.93	2.92	2.92	2.90	2.90	2.90	2.84	2.84	2.81	2.79	2.77
Part 3		3.71	3.71	3.57	3.57	3.71	3.43	3.86	3.43	3.57	3.29	3.71	3.43	3.57	3.71	3.43	3.29	3.71	3.86	3.43	3.86	3.57	3.00	3.71
Part 4		3.21	3.10	3.03	3.04	2.99	2.99	2.95	2.97	2.93	2.97	2.88	2.88	2.84	2.82	2.82	2.85	2.78	2.78	2.76	2.49	2.71	2.76	2.53
1	Structural audit	3.24	3.06	2.76	2.82	3.29	3.18	3.47	2.88	3.12	3.06	3.06	2.59	2.88	2.82	2.59	3.06	2.94	2.47	2.59	2.75	2.88	2.71	2.65
3	Wash plant building	3.09	3.09	3.00	3.09	3.36	3.00	2.55	3.18	3.00	3.00	3.18	2.91	3.00	2.91		3.55	2.73	2.91	2.45		2.45	2.73	
	crushing and screening	3.45		3.40	2.91			3.45		2.73	2.80		2.82		3.18			3.09	2.30	2.45		2.70	2.64	2.55
4	Plant buildings	3.13	3.13	3.00	3.07	2.92	3.20	2.60	3.25	2.93	3.08	2.47	3.00	2.93	2.93	3.00	3.00	2.20	3.00	2.67	2.33	2.53	3.00	2.53
	Stockpile	3.00						2.90		2.91	3.09		2.64			2.91				3.09				
6	Stacker/reclaimer																							
7	Reclaim tunnels	3.50	3.38			2.88	3.13	3.13	2.38			3.75	3.25	3.25	3.25	3.00	1.88		3.13			2.75	3.13	
	elevated conveyor	3.2	2.7	3	3.4	2.9	2.6	2.5	2.8	2.7	3	2.3	2.6	2.2	2.5	2.6	2.7	2.5	2.4	2.9	2.4	2.4	2.9	2.4
8	Gantries and trestles																							
9	Thickener tanks	3.11	3.22		2.89	2.75	3.11	3.33	3.56	3.33	3.00	3.00	3.11	3.00	3.11		3.00	3.00	3.00	3.33		3.33	3.00	
10	Dense medium sumps	3.13	3.13		3.13	2.86	2.75	2.63	2.75	2.75	2.71	2.38	3.00	2.63	1.88		2.75	3.00	3.00	2.63		2.63	2.00	

Some trends can be seen above:

1. Thickener tank standards were considered satisfactory at the majority of sites.
2. Reclaim tunnels were generally well designed and managed, with the majority of issues being related to spillage, ventilation/gas management, guarding of nip points and access ladder gates being self closing.
3. Wash plant building issues included significant corrosion of smaller steel sections (walkway supports, purlins, wall sheeting), poor guarding (rotating elements, low height launders/screen underpans), spillage and loose walkway retention due to vibration.
4. Coal and reject bins issues included damage to column footings due to accumulated material, impact damage to beams/braces, poor management of liner wear, corrosion of bin envelope/head house and poor guarding standards.
5. Elevated conveyor gantries issues included degradation of walkways, spillage making access difficult, damage to stockpile trestles either through impact or adverse load cases, poor guarding standards, safety pull wire lanyard compromised and modifications not being engineered

Dense/correct medium sumps issues included corrosion of sump top screen/walkway, lack of fall protection, poor confined space access management and exposed rotation shafts on pumps. While the highlighted issues were not relevant at all of the sites assessed, the findings provide some valuable information, which should be considered when sites review control measures in relation to coal handling plants, and the practices and procedures for the maintenance of CHPPs.

Notices

A total of 55 notices were issued to the facilities, outlining 563 individual items to be addressed. Where an issue identified in the notice recorded multiple items that the issue related to, e.g. guarding not secured or not requiring a tool to remove on five different conveyors, this is considered as five individual items.

Seven prohibition notices were issued with 59 items, of which 54 related to absent or ineffective guarding of conveyor pulley nip points. These facilities were as follows:

- Facility 7 - 10 areas of pulley guarding absent/ineffective.
- Facility 9 - 13 areas of pulley guarding absent/ineffective and hold down tyre rollers where guarding was absent/ineffective.
- Facility 12 - five areas of pulley guarding absent/ineffective.
- Facility 13 – five areas of raw coal conveyor pulley guarding absent/ineffective and elevated raw coal tripper crush point.
- Facility 13 - five areas of product coal conveyor pulley guarding absent/ineffective and elevated product coal tripper crush point.
- Facility 20 – 11 areas of pulley guarding absent/ineffective and two areas where sections of handrails were missing on elevated gantry walkways.
- Facility 23 – five pulleys on the mine drift conveyor where guarding was absent/ineffective.

Twenty-six improvement notices were issued relating to 293 items. The top five issues:

- Access hatch or guarding not secured or did not require tool to remove.
- Absent or ineffective guarding of conveyor pulley nip points.
- Missing or ineffective sections of walkway, handrail or cage on elevated walkway.
- Exposed section of rotating shaft or component.

- Damage, corrosion, erosion of structural members requires review by engineer.

Twenty-two notices of concern were issued relating to 211 items. The top five issues:

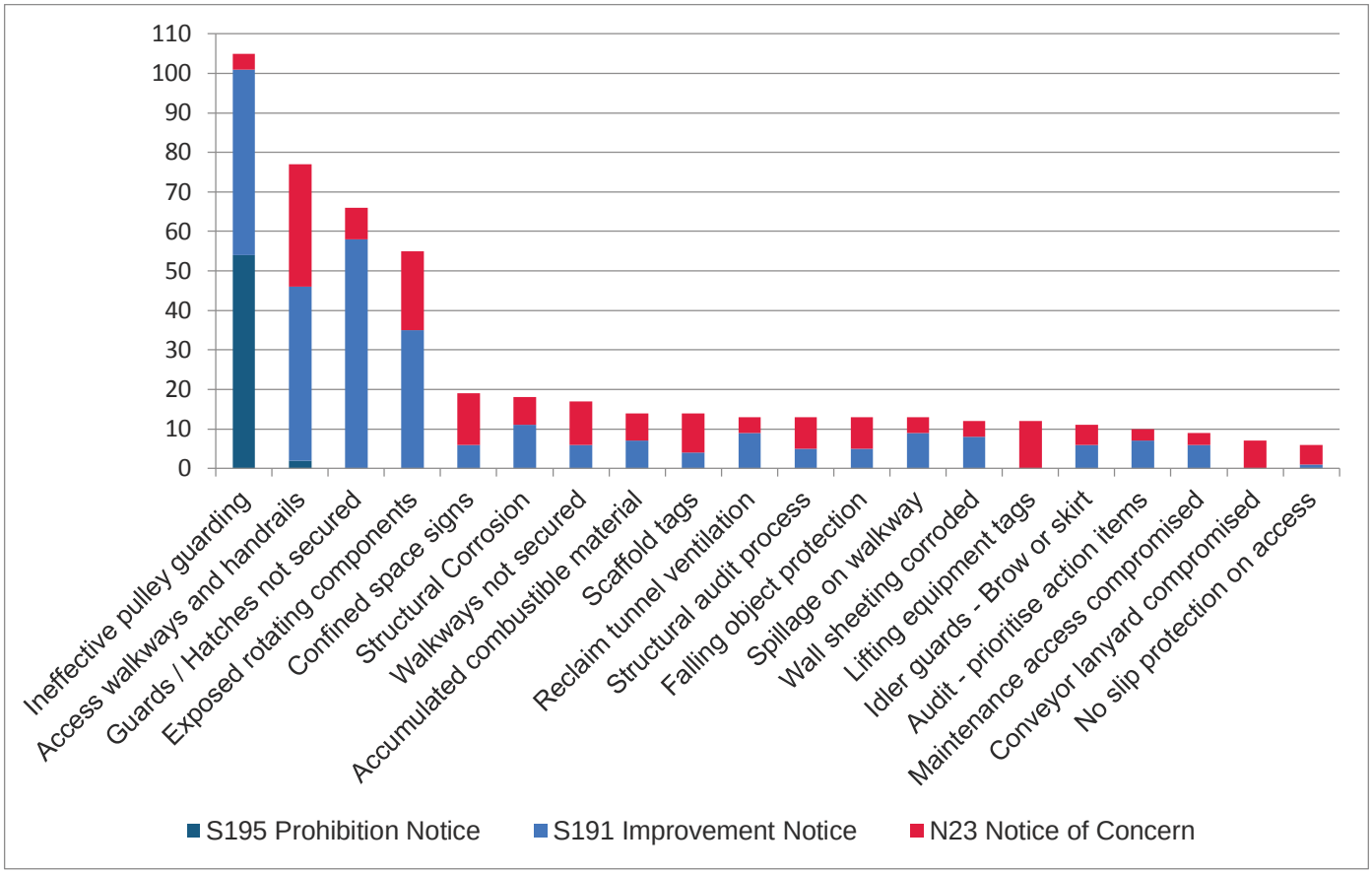
- Missing or ineffective sections of walkway, handrail or cage on elevated walkway.
- Exposed section of rotating shaft or component.
- Item not identified as confined space, or confined space accessible.
- Loose or missing walkway retainers.
- Lifting equipment inspection tag missing or out of date, or equipment damaged.

Findings

A review was carried out on the 55 notices. The issues identified in the notices are often similar in nature across the various facilities and can be grouped into 33 categories. All issues identified were correlated to the associated items for each of the notice types. This indicated the highest occurrence of issues for the plant inspection areas where discrete issues could be identified for multiple items of plant within the one facility.

The top 20 issues are shown in Graph 2 below, of which the highest four comprise 55% of all items.

Graph 2: Issue ranking including notice type.



However, for the risk management and systems review, the issue with the system was only recorded once for each site, rather than each instance of non-conformance at a site. Therefore, systems-based issues, two of which still appear in the top 20 issues, can be considered separately. These issues included the following:

Issue	Sites
• Structural audit process not consistent with COP-MECP	13
• No process for prioritising structural audit action items	10
• Structural changes made with no evidence of engineering review	5
• No process to ensure effectiveness of action item repairs	1

Table 3 provides a complete list of the categories and indicates the frequency of items identified broken down into the notice type with which it was managed.

Table 3: Issue category and frequency.

		Total	N195 Prohibition	N191 Improvement	N23 Concern
Issue	**Description**	**563**	**59**	**293**	**211**
1	Absent or ineffective guarding of conveyor pulley nip points	105	54	47	4
2	Missing or ineffective sections of walkway, handrail or cage on elevated walkway	82	2	44	36
3	Access hatch or guarding not secured or require tool to remove	66	0	58	8
4	Exposed section of rotating shaft or component	55	0	35	20
5	Item not identified as confined space, or confined space accessible	19	0	6	13
6	Damage, corrosion, erosion of structural members requires review by engineer	19	0	11	8
7	Loose or missing walkway retainers	18	0	6	12
8	Build-up of combustible material around equipment including grease, fines, etc	15	0	7	8
9	Reclaim tunnel MDG28 compliance, inadequate ventilation, or gas sensors	15	0	9	6
10	Missing or compromised protection against strike by falling objects (underpan, barricade)	15	0	5	10
11	Scaffold inspection tag missing or out of date, or scaffold compromised	14	0	4	10
12	Structural audit process not consistent with COP-MECP	13	0	5	8
13	Spillage or stowed gear on walkways compromises handrail	13	0	9	4
14	Wall/roof sheeting or purlin security compromised by damage or corrosion	12	0	8	4
15	Lifting equipment inspection tag missing or out of date or equipment damaged	12	0	0	12
16	Absent conveyor brow roller or fixed skirting guards	11	0	6	5

17	No process for prioritising structural audit action items	10	0	7	3
18	Maintenance inspection access compromised by temporary guarding or barrier	9	0	6	3
19	Conveyor pull wire lanyard compromised	7	0	0	7
20	Ineffective or absent anti slip protection on inclined walkway, stair, or ladder	6	0	1	5
21	No protection over Alsinite or polycarbonate wall panels	6	0	3	3
22	Harness attachment points absent, not certified or not used	6	0	2	4
23	Structural changes made with no evidence of engineering review	5	0	4	1
24	Electrical equipment access not secured, or isolated or signposted	5	0	2	3
25	Stockpile management plan ineffective, or stockpile handling equipment not set up	4	0	3	1
26	No second egress from elevated plant or equipment	4	0	1	3
27	Absent or ineffective protection around collection sumps	4	0	0	4
28	Spillage jammed in conveyor (burning smell), conveyor idler collapsed, Non FRAS belt	4	0	2	2
29	Walkways narrow, obstructed, or restricted clearance	3	0	0	3
30	Tripper crush point	2	2	0	0
31	Concrete will potentially increase structural corrosion of columns	2	0	1	1
32	Absent guarding for conveyor hold down rollers	1	1	0	0
33	No process to ensure effectiveness of action item repairs	1	0	1	0

A particular issue may appear on different types of notices at different facilities depending on how severe the issue was considered. Inspectors formed this opinion during the assessment at each facility.

As an example, a conveyor pulley may have been unguarded, or inadequately guarded, at a site and considered to be a systemic issue that posed an immediate or imminent risk to health and safety requiring a prohibition notice.

Another facility may have had a conveyor pulley guard in place that would likely prevent inadvertent access if a worker slipped and fell against it, but did not fully prevent access to the nip point if a worker were to try and reach past the guard. This may not have been considered an immediate safety risk, but still required addressing, so an improvement notice was issued. Alternately a guard may have been designed to a previous version or superseded standard where it may have been considered safe, but there was a technical non-compliance, in which case a notice of concern may have been issued.

Outcomes

In general, the site representatives involved in the planned inspection program were positive about the regulator's proactive approach to hazard identification and management. The program identified good practices as well as opportunities for improvement and the statutory mechanical engineers reacted positively when issues needed to be addressed.

Areas of good practice

The assessment process noted 55 good practices that were grouped into 13 categories.

Table 4: Good practice category and frequency.

Good practices		55
1	Good functional design of plant item, mounting, operability, tool etc	12
2	Good functional design of safety, guarding or isolation equipment	9
3	Well designed access to equipment to inspect or maintain	6
4	Plant well maintained and/or operated	6
5	Good standard or procedure for job or isolation	5
6	Reclaim tunnel well designed and maintained	4
7	Good bin discharge gate safety functionality	3
8	Harness attachment points or fall protection system well designed	3
9	Good system for security of walkway retention	3
10	Good access to structural joints and/or column bases	1
11	Good system for corrosion protection	1
12	Good system for managing or replacing cladding, purlins, etc	1
13	Good maintenance system	1

Some specific items of good practice included:

- mesh or handrails across sections of Alsinite or polycarbonate wall sheeting to prevent falling through
- reclaim tunnels were compliant and well laid out, clean and easily accessible
- functional and effective isolation points were installed for pneumatic isolation
- well engineered harness attachment points
- bin discharge gates upgraded to mechanical fail safe arrangement.

Figure 1: Handrail protection at polycarbonate sheeting.

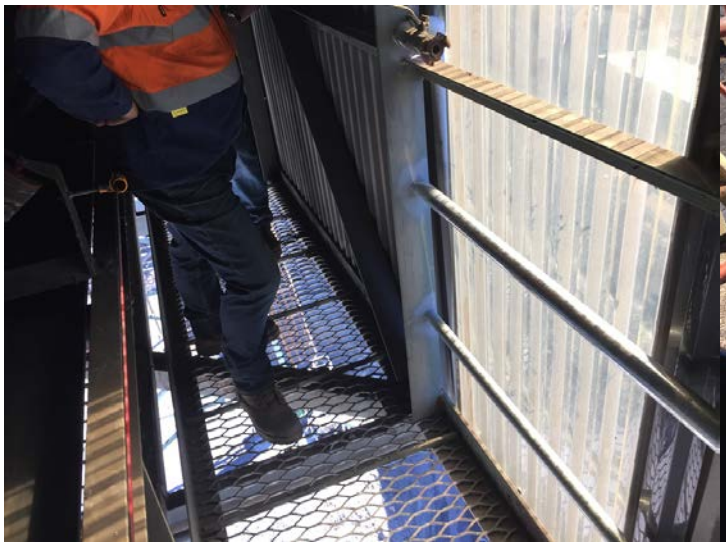


Figure 2: Stair access to stockpile reclaimer away from rakes.

Figure 3: Pneumatic isolation board.

Figure 4: Poly conveyor gantry wind/weather cover.

Areas for improvement

As part of the inspection process, 55 notices were issued to the 23 facilities. The notices were as follows:

- Seven prohibition notices issued under section 195 of the *Work Health and Safety Act 2011*
- Twenty-six improvement notices issued under section 191 of the *Work Health and Safety Act 2011*
- Twenty-two notices of concern issued under section 23 of the *Work Health and Safety (Mines and Petroleum Sites) Act 2013*

The prohibition notices primarily related to the systemic absence of, or inadequate standard of, guarding around conveyor pulleys such that an immediate or imminent risk of entanglement was considered.

Following the issuing of the first two prohibition notices, a letter was sent to all remaining facilities to be inspected advising of the findings to date to allow sites to assess and implement remedial controls before the planned inspections. In the later part of the inspection program, it was apparent that sites had commenced reviews, and although this in itself is a good outcome, the use of temporary barricading in the form of scaffolding and crowd control fences to isolate whole areas of plant introduced its own issues:

- Luffing boom conveyors were barricaded near the pivot rather than in proximity to the unguarded jib pulley. Therefore running maintenance of the conveyor, such as identification of failing or failed idlers, could not be performed. Consequently this increased the risk of bearing failure, conveyor damage or fire.
- Scaffolding used as localised or area barrier was installed by scaffolding companies but did not adhere to the site requirements for scaffolding. Inspections were missed and maintenance personnel had to remove and reinstall barriers to access areas for maintenance.
- Temporary scaffold planks over areas of degraded walkway made kick rails and handrails non-compliant for heights as per AS1657.
- Temporary scaffold bars created trip hazards across walkways and stairs.
- Area guarding on primary machine access ways required operators and maintenance personnel to use alternate routes to access plant. Instead of stairs and platforms, personnel were using rung ladders and narrow walkways for extended periods of time.
- Areas were barricaded around identified hazards without communication to the operators and maintainers to reach agreement on the best approach to manage access for inspections. In some instances the route required to access items of plant changed daily as a result of the barricades.
- Areas were barricaded, then given a low priority to remedy, so the temporary barricades were in place for months.
- Areas were barricaded around conveyors so that cleaning of spillage was not effective and conveyors became non-compliant in terms of operating clearances. This increased the risk of conveyor fire.

The following sections relate to specific areas for improvement identified at a majority of the facilities.

Guarding of plant

Issue	Response
Guarding at conveyor pulleys, or vee belt drives, or exposed sections of rotating shafts was absent, or did not extend far enough to prevent access to nip points and potential entanglement.	A person conducting a business or undertaking must ensure, so far as is reasonably practicable, the provision and maintenance of safe plant and structures.[2] Where guarding is used as a control measure in relation to plant, if access to the area of the plant requiring guarding is necessary during operation, the person with management or control of the plant must ensure that the guarding is an interlocked physical barrier that prevents access to that area when the area prevents a risk i.e. during operation.[3] Refer to AS4024.3610 Safety of machinery – conveyors – general requirements - Section 2.13 safeguards.
Guarding systems or access hatches used on plant in areas presenting a risk (e.g. rotating pulley shafts) were not secured	The person with management or control of the plant must ensure that the guarding used is a physical barrier that can only be altered or removed by the use of a tool.[4] It is recommended that mine operators engage an appropriately qualified

[2] *Work Health and Safety Act 2011*, section 19(3)(b)

[3] Work Health and Safety Regulation 2017, clause 208(2)(b)

[4] Work Health and Safety Regulation 2017, clause 208(2)(c)

and did not require a tool to facilitate their removal.	external auditor to review conveyor guarding on site in accordance with the *NSW Code of practice: Mechanical engineering control plan*, which references AS4024:3610 and AS4024:3611, and implement a program of rectification based on the audit findings and recommendations.[5]
Guards, underpans, or barricades absent or compromised to protect against personnel being struck by falling objects.	WHS(M&PS) Regulation schedule 2 clause 2(4)(b) - the protection of persons near or travelling under a belt conveyor against the risk of being struck by falling objects. Refer to AS4024.3610 clause 2.13.2.6 - falling materials safeguards shall be provided. Consideration should be given to the height, mass, size and speed of material being conveyed.
Temporary guards or barricades compromise access for maintenance, inspection, or cleaning.	Refer to AS4024.3610 clause 2.4.2 - design for safe access includes for operation, maintenance and inspection. As stated above in many instances the use of temporary barricading was compromising the safe operation of the equipment.

Examples of absent or ineffective guarding of conveyor pulley nip points and vee belt drives

Figure 5: Drift conveyor jib pulley.

Figure 6: Drift conveyor LTU pulley.

Figure 7: Luffing stacker jib pulley.

Figure 8: Luffing stacker bottom bend pulley.

Figure 9: Crusher vee belt drive cover left off while operating pulley.

Figure 10: Corroded head chute allows access to snub.

Figure 11: Exposed rotating shafts on conveyor drive.

Figure 12: Guard mesh and part of frame corroded.

Examples of access hatch or guarding not secured or not requiring a tool to remove

Figure 13: Toggle retainer does not require tool to remove.

Figure 14: Access hatch beside pulley nip point not secured.

Underpans or guarding/barricades missing to prevent injury from falling objects

Figure 15: No protection to access road/storage area below.

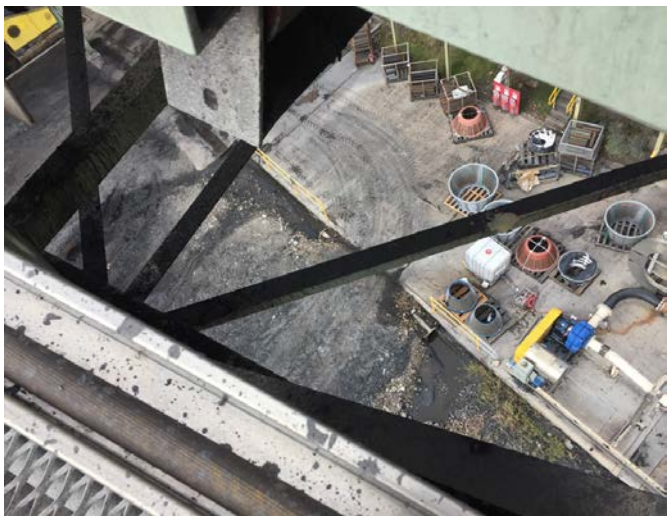


Figure 16: No protection if test weights dropped.

Maintenance inspection access compromised by temporary guarding or barrier

Figure 17: Temporary site fencing restricts cleaning.

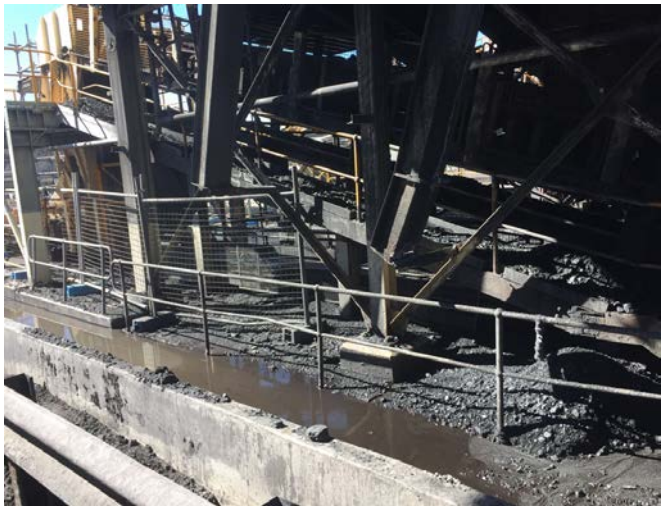


Figure 18: Tapeused as barrier around low cyclone underpan.

No systematic approach to structural audits, inspection programs and remedial works

Issue	Response
There was no specific system for defining the scope of, or initiating, the routine structural inspection program.	The mine operator must ensure that arrangements are in place for the regular inspection of the working environment of the mine for the purposes of the WHS laws. In the making of the arrangements, the mine operator must ensure that the following are taken into account: ➢ the procedures for conducting inspections ➢ when inspections are to be carried out ➢ the persons competent to conduct inspections ➢ the number of competent persons required to conduct each inspection[6] The mine operator of a coal mine must ensure that an inspection plan is prepared and that inspections are carried out in accordance with that plan.[7]
There was no system or process defined for assigning priority to action items from the structural audit, or developing a schedule for completing remedial repair works in a suitable timeframe	The inspection of plant should be conducted in accordance with a regular maintenance system to identify any: ➢ potential problems that were not anticipated during plant design or task analysis ➢ deficiencies in plant or the equipment associated with use of plant, for example wear and tear, corrosion and damaged plant parts ➢ adverse effects of changes in processes or materials associated with plant, and ➢ inadequacies in control measures that have been previously implemented. [8]
The was no documented process to sign off remedial action items from the structural audit as completed, or verify the effectiveness of remedial works	Any control measures implemented, such as guards and warning devices, must be regularly inspected and tested to ensure they remain effective.[9]

Suitably qualified engineer to review plant and structures

Issue	Response
Structures damaged due to corrosion from spillage around members, or placement of concrete that will exacerbate the potential	WHS(M&PS) Regulation schedule 2 clause 2 (e) - A mechanical engineering control plan must set out the control measures for the following risks to health and safety associated with the mechanical aspects of plant and structures at the mine or petroleum site taking into account the matters set out in subclause (3):

[6] Work Health and Safety (Mines and Petroleum Sites) Regulation 2014, clause 37

[7] Work Health and Safety (Mines and Petroleum Sites) Regulation 2014, clause 85

[8] Managing risks of plant code of practice, page 18

[9] Managing risks of plant code of practice, page 18

for corrosion.	(e) the catastrophic failure of plant and structures MECP code of practice clause 4.4.5 includes the following catastrophic failures: - inadequate periodic inspection system - degradation from corrosion or fatigue
Structures modified on site without evidence of input by suitably qualified engineers	MECP code of practice clause 4.4.5 includes the following catastrophic failures: - site alterations

Site degradation of structural members

Figure 19: Bin column base corrosion.

Figure 20: Hopper beams distorted due to load, some repaired.

Figure 21: Corrosion of wall purlins.

Figure 22: Full thickness corrosion of platform floor plate.

Site modifications without engineering input

Figure 23: Modification to gantry structure.

Figure 24: Section removed from walkway not secured.

Figure 25: Access platform added without ladder.

Figure 26: Platform added mounted to handrail.

Handrails

Issue	Response
Inadequate or missing handrails on sumps.	A person conducting a business or undertaking must ensure, as far as is reasonably practicable, the health and safety of workers while the workers are at work in the business or undertaking. This obligation includes the provision and maintenance of safe plant and structures and the provision of safe systems of work.[10] WHS Regulation clause 78(1) states a person conducting a business or undertaking must manage, in accordance with part 3.1, risks to health and safety associated with a fall by a person from one level to another that is reasonably likely to cause injury to the person or any other person
Handrails were badly corroded.	AS1657 Fixed platforms, walkways, stairways and ladders – design, construction and installation clause 3.3.3 corrosion protection - notes walkways shall be manufactured from materials that are corrosion resistant, or shall be treated to minimise corrosion. The design shall minimise the potential for corrosion
Barriers or handrails were not installed to prevent walking into, or falling onto, moving conveyors	Handrails/guard railing shall comply with the requirements of AS1657 Fixed platforms, walkways, stairways and ladders – design, construction and installation - clause 4.4 and section 6 AS4024.3610 clause 2.4.2.2 - walkways - notes that where there is a potential for a person to be injured by falling on the conveyor, a means shall be provided where practicable to prevent people falling on the conveyor

Missing or inadequate handrails

Figure 27: Sump with no protection or signs.

Figure 28: Handrail does not fully protect against falling

[10] *Work Health and Safety Act 2011*, section 19(3)(b)-(c)

Figures 29 and 30: No protection against falling into cyclone underpan or beside reclaim tunnel vibrating feeder.

Figure 31 and 32: No protection against falling into screen underpans.

Corroded or broken or ineffective handrail

Figure 33: Handrail corroded and fallen off.

Figure 34: Rope and unistrut are ineffective to prevent falling.

Issue	Response
Loose or missing walkway retainers	A person conducting a business or undertaking must ensure, as far as is reasonably practicable, the health and safety of workers while the workers are at work in the business or undertaking. This obligation includes the provision and maintenance of safe plant and structures and the provision of safe systems of work.[11]
Corroded walkways	AS1657 Fixed platforms, walkways, stairways and ladders – design, construction and installation clause 3.3.3 corrosion protection - notes walkways shall be manufactured from materials that are corrosion resistant, or shall be treated to minimise corrosion. The design shall minimise the potential for corrosion
Obstructed walkways, including scaffolding, or spillage on conveyor gantries, making walking difficult.	A person conducting a business or undertaking must ensure, as far as is reasonably practicable, the health and safety of workers while the workers are at work in the business or undertaking. This obligation includes the provision and maintenance of safe plant and structures and the provision of safe systems of work.[12]
Spillage or storage of	WHS Regulation clause 78 (4) a PCBU must provide safe means of

[11] *Work Health and Safety Act 2011*, section 19(3)(b)-(c)

[12] *Work Health and Safety Act 2011*, section 19(3)(b)-(c)

equipment on elevated walkways making kickrails and handrails ineffective and non-compliant	access to and egress from the workplace SafeWork NSW – Managing the risk of falls at workplaces code of practice section 10.3 requires safe access to and egress from work areas and amenities, including the provision and placement of stairways, ladders, catwalks, guardrails and barriers

Walkways compromised

Figures 35 and 36: Spillage makes kickrails ineffective and handrail heights non-compliant, as well as difficult to negotiate.

Figures 37 and 38: Conveyors were still operating at time of inspection, but were shut down.

Figure 39: Walkway plates not secured on bin platform.

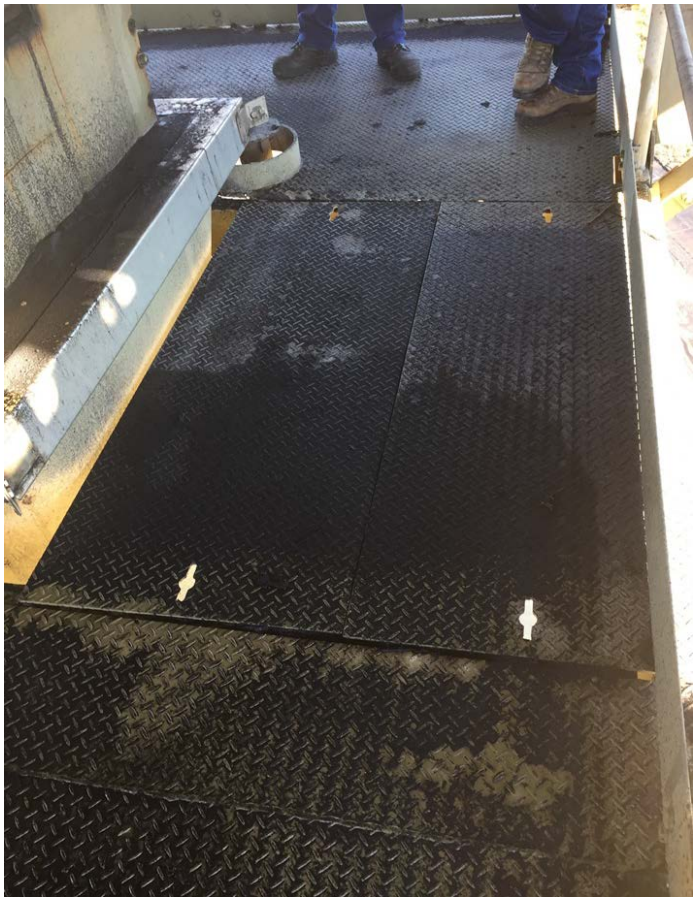


Figure 40: No fall protection on ladder.

Figures 41 and 42: Significant corrosion of stair treads compromises structural integrity and creates trip hazard.

Figure 43: Material and rubbish stored on walkways.

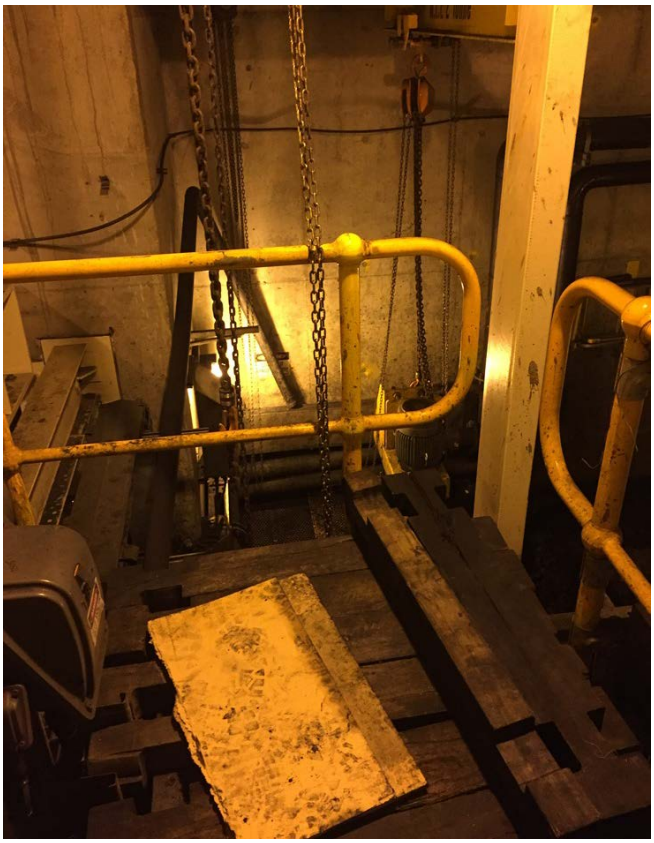
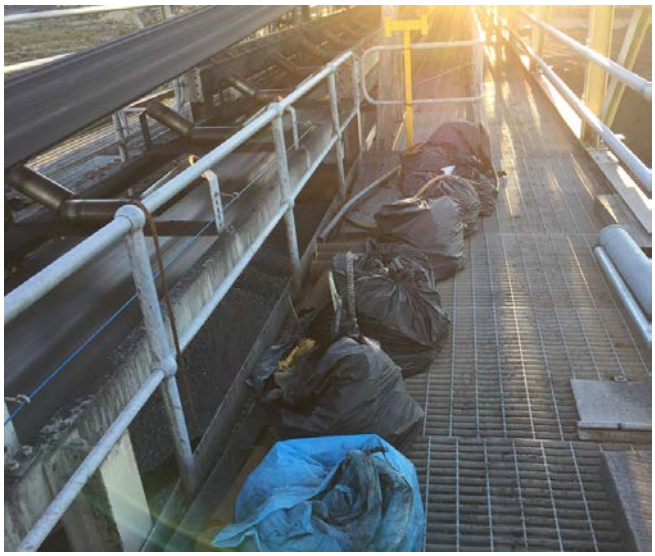
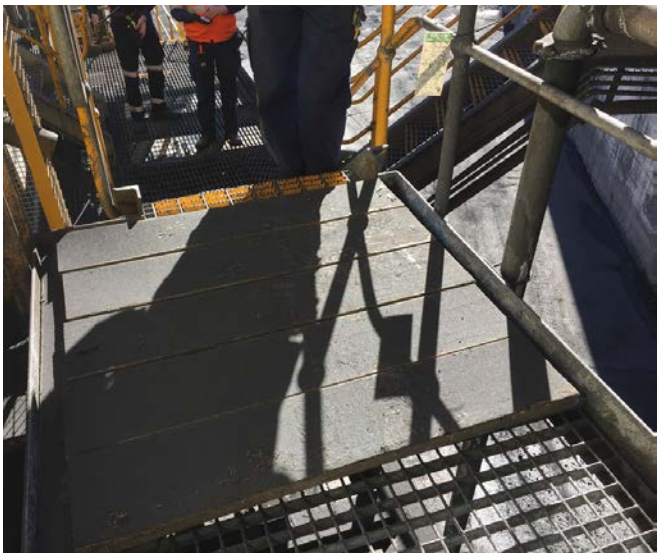


Figure 44: Scaffold knee rail and walkway makes handrails non-compliant height.

Figures 45 and 46: Rubbish, materials and scaffold boards become trip hazards, especially at the top of stairs





Reclaim tunnel atmosphere

Issue	Response
Inadequate airflow in stockpile feeder voids	*MDG 28 Safety requirements for coal stockpiles and reclaim tunnels* - clause 4.1.3 atmospheric contamination - methane can displace oxygen in low airflow. If the tunnel is not adequately ventilated the risk of methane layering can occur. Clause 4.2.1 - minimum controls includes ventilation to all parts of the reclaim tunnel to prevent accumulation of gas
Absent gas monitoring systems to ensure respirable atmosphere	Clause 4.2.1 minimum controls includes: • methane detectors shall be placed at strategic points within the reclaim tunnel including all valves/feeders within the reclaim tunnel o roof of vaulted/recessed areas o ventilation exit point • methane detectors in the reclaim tunnel should have the following alarms and action set points o 0.5% alarm to control centre and stop feeding coal o 1.25% remove power to non-explosion protected equipment • carbon dioxide detectors shall be placed in the following locations where the presence of the gas is deemed to be a risk o low areas and sumps o ventilation exit point

Other areas of note

These items were found during the site visits, but were not necessarily associated with the subject of the planned inspection.

Issue	Response
Build-up of combustible material that poses a potential fire risk	Reference is made to *NSW Code of practice: Mechanical engineering control plan* section 5.1.2 Accumulations of explosive dust on plant and structures; section 4.5.16.6 Operation of belt conveyors areas of material spillage at transfer chutes and along the conveyor; and section 5.2.1 Conveyors with accumulated spillage of coal and coal dust as well as lubricant, with respect to detecting hazards likely to cause fire. Although referring specifically to underground coal mines, the accumulation of combustible material, especially fine coal dust, poses a significant fire risk.
Items not identified as confined spaces, or confined spaces that were readily accessible	WHS Regulation part 4.3 refers to confined spaces and the requirements for managing them in the workplace, including their identification and controlling access to them.

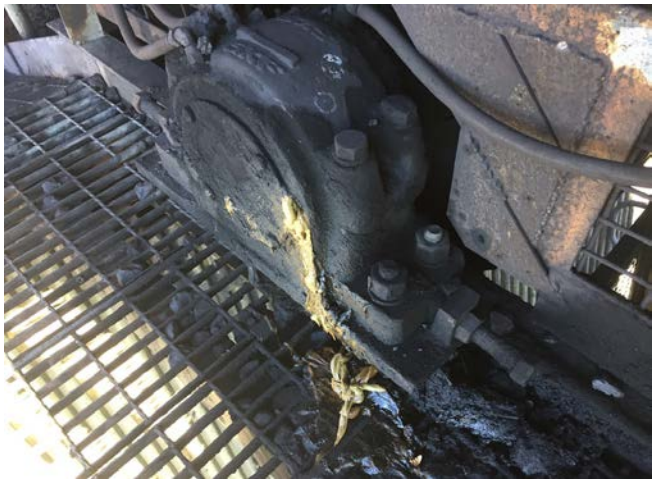
Non-structural corrosion	WHS(M&PS) Regulation Schedule 2, Part 2 MECP clause (3)(b) maintenance of structures, and (f) the identification, assessment, management and rectification of defects that affect the safety of plant or structures.
Lifting equipment inspection tag missing or out of date	WHS Regulation clause 219(2) requires that the plant used is specifically designed to lift or suspend the load. *NSW Code of practice Mechanical engineering control plan* section 4.7 under lifting and carnage requires the MECP to ensure plant is designed to lift and suspend the loads required. As lifting equipment is referred to in legislation as plant it shall also be included under section 4.5.5 Inspection and testing of plant.
Control panels mounted without regard for proximity to moving components	WHS Regulation Schedule 2, Part 2 MECP clause (2)(a) injury to persons caused by the operation of plant or by working on plant or structures, and (3)(d) safe work systems for persons dealing with plant or structures. AS4024.3612:2015 section 4.5 Measures for protection against mechanical hazards, specifically clause 4.5.2.1 - accessible drawing in points, crushing and shearing points which arise because of the return of the driven and carrying elements or because of the movement of the pushing element shall be avoided by design or safeguard up to a height of at least 2700 mm.
Operability of conveyor safety pull wire lanyards compromised by guards	AS4024.3610:2015 section 2.10.6 Pull wire emergency stops, specifically 2.10.6.3 (b) and (c) note the lanyard must be readily accessible and outside any readily removable guard.
Guarding of conveyor brow rollers	AS4024.3611:2015 section 2.10 Safeguards, specifically 2.10.2 (f) refers to nip and shear points shall be guarded to carry and return idlers at convex curves (brow positions) where downward force on the idler presents a potential for injury.

Build-up of combustible materials poses a potential fire risk

Figures 47 and 48: Conveyor drive was still operating.

Figure 49: Grease leaking out of bearing seal on walkway.

Figure 50: Fine dust build-up on pulley bearing guard.



Confined spaces

Figure 51 and 52: Centrifuge not identified as confined space and covers not secured against inadvertent access to rotating parts.

Non-structural corrosion

Figure 53: Door frame rusted through on both sides. Figure 54: Lip of dense medium sump corroded to a knife edge.

Lifting equipment inspection

Figure 55: Lifting gear tags.

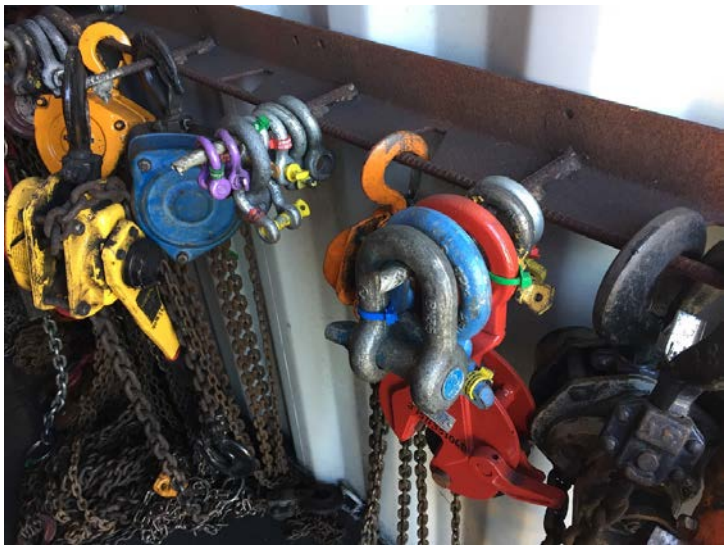
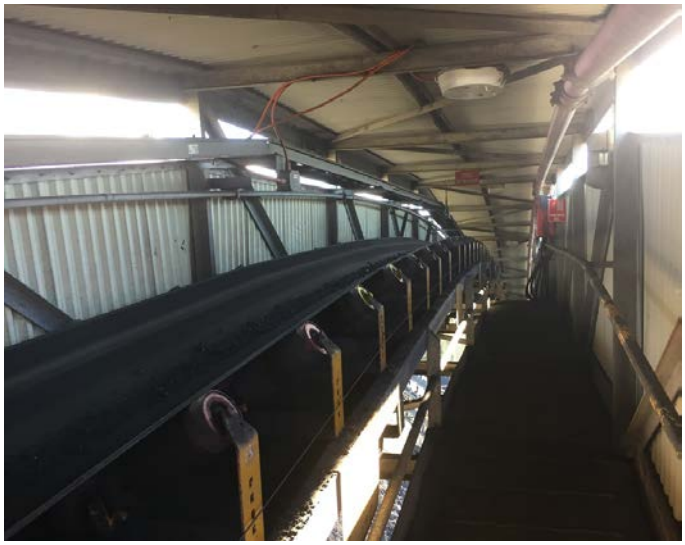


Figure 56: Position of controller relative to moving components

Conveyor safety pull wire lanyards

Figures 57 and 58: Lanyard not able to be effectively operated due to proximity to or positioned behind guard mesh.

Figures 59 and 60: Guarding of conveyor brow rollers.



Where to now?

Planned inspections provide an account of the issues observed at particular sites at a particular time. Some of the findings resulted in notices being issued, including

- notices of concern, under section 23 of the WHS (M&PS) Act,
- improvement notices, under section 191 of the WHS Act
- prohibition notices under section 195 of the WHS Act

The matters addressed by the notices reflect the findings of the Resources Regulator inspectors. By way of example these findings included:

Notice	In relation to
Prohibition notices, s195	• No guarding on conveyor pulleys. • Missing handrail sections above stockpile. • Inadequate guarding at several locations along the conveyor system. • Absent or inadequate guarding on stackers, washery feed conveyor, and reject conveyor.
Improvement notices, s 191	• The access ladders were damaged and the cage did not fully enclose the ladder, potentially allowing personnel to fall from the ladder over the handrail to the stockpile area below. • No handrails or guarding to prevent personnel from falling onto conveyor. • Guards adjacent to loop take up pulleys on conveyor did not prevent access to the nip points. • Conveyor pulley guarding insufficient and/or undersized for compliance with Australian Standards in relation to inadvertent access to nip points and potential entanglement, and there were

	many exposed rotating shafts of pulleys that were not sufficiently guarded. • The side guards on both sides of the top loop take up pulleys did not extend sufficiently above the level of the LTU pulleys, or have a cover over the pulleys, to eliminate inadvertent access to the nip point between belt and pulley so as to prevent entanglement. • Airborne and accumulated dust around ROM receival area. • Significant quantities of accumulated fine float dust on infrastructure flat surfaces, considered to pose a fire hazard. • Significant quantities of airborne dust emanating from coal loading operations into the hopper at the ROM load point, as well as wind and/or personnel liberating settled float dust on the infrastructure, considered to be a hazard to health. • No evidence of engineering design for site additions of gantry access, and equipment access platforms. Gates to access the washery hoist well were not adequately secured, and areas of conveyor guarding were non compliant. • No specific system for defining the scope of, or initiating, the routine structural inspection program.
Notices of concern, s 23	• Deteriorated/corroded underpans on conveyor gantries. • A lack of documented communication of the audit rectification works plan/progress to the statutory engineers. • A number of conveyor jib pulley guards required extending and/or strengthening. • A number of guards did not require a tool to open. • Anti-slip bars on a number of aerial gantries were rusted away and required replacing.

All mine operators involved in the planned inspections have indicated that they would respond to the notices and other issues identified through the inspections. Where significant issues were identified, these will be followed up with the individual mines.

The planned inspections identified several common issues around the approach taken by the sites to manage the risk to workers of coal handling and preparation plants being structurally unsound.

The regulator expects that all mines will review their practices and procedures in consideration of the findings in this report.

Issued by

Garvin Burns
Deputy Chief Inspector
NSW Resources Regulator
NSW Department of Planning and Environment

Further information

For more information on planned inspection programs, the findings outlined in this report, or other mine safety information, please contact the Resources Regulator's Mine Safety branch. You can find the relevant contact details below.

Type	Contact details
Email	mine.safety@industry.nsw.gov.au
Phone	02 4931 6666
Incident reporting	To report an incident or injury call **1300 814 609**
Website	resourcesandenergy.nsw.gov.au/safety
Address	Resources Regulator, Mine Safety 516 High Street Maitland NSW 2320

Appendix A: Legislative requirements relating to managing risks of plant

The appendix provides a list of certain legislative requirements relating to managing risks of plant referred to in this report as provided by the *Work Health and Safety Act 2011*, the Work Health and Safety Regulation 2017 and the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014.

Legislation, section/clause	Legislative requirements
WHS Act, section 19	Primary duty of care
WHS Regulation, Part 4.3	Confined spaces
WHS Regulation, clause 208	Guarding
WHS Regulation, Clause 219(2)	Plant that lifts or suspends loads
WHS Regulation, clause 213	Maintenance and inspection of plant
WHS (M&PS) Regulation Clause 37	Inspections
WHS (M&PS) Regulation Clause 85	Inspection plan
WHS (M&PS) Regulation Schedule 2	Principal control plans - matters to be addressed