

# Environment Compliance Report Polymetallic mines

The *Audit Program: Polymetallic mines* was undertaken by the Environmental Audit Unit, Environment Protection Authority.

### **More information**

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ISBN 978-1-76039-497-4  
EPA 2016/ 0564  
October 2016

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## Summary

The NSW Environment Protection Authority (EPA) has completed a compliance audit program on polymetallic mines in NSW. These mines extract ores containing the metals copper, gold, lead, silver or zinc, or a combination of these. The EPA audited six of the 19 polymetallic mines in NSW that hold an Environment Protection Licence for the scheduled activity (under the *Protection of the Environment Operations Act 1997*) of 'Mining for minerals – other than coal'. Site audit inspections were undertaken during 2014 and 2015. This report summarises the audit findings.

The audits focused on assessing compliance with all of the conditions on Environment Protection Licences (EPLs) issued to these mines.

The objective of the audit program was to assess licensees' levels of compliance with the requirements of their EPLs and to improve their environmental performance.

Overall, although licencees complied with 61% to 92% of the audited requirements, a number of non-compliances were observed that had considerable environmental significance, including high to moderate risks. Whereas the high- to moderate-risk non-compliances require immediate attention by licensees, all non-compliances identified must be addressed by licensees. The audits present an opportunity for improvement by the polymetallic mining industry.

The findings of the audits demonstrate that polymetallic mines could improve their compliance and environmental performance by:

- developing and implementing effective and appropriate procedures for improving management of the storage and handling of hazardous chemicals and waste materials
- ensuring that equipment used in monitoring ground vibration is sited in locations that will produce results that are representative of the actual ground vibrations
- ensuring that mining operations are done in a way that minimises dust emissions
- ensuring that dust-monitoring equipment is sited in accordance with the relevant Australian standards
- ensuring that sampling and analytical methods and procedures used in the monitoring and analysis of dust and water discharges are in accord with licence requirements.

The findings of the audits and examples of good practice reported in this summary report provide valuable information to help the polymetallic mining industry improve its environmental performance. The EPA encourages all polymetallic mines – especially those that were not audited – to use the findings of the audit program to improve their compliance and environmental performance.



## Introduction

### Polymetallic mining

Polymetallic mining refers to mining operations that extract metals from ore that is mined. The main metals extracted are copper, gold, lead, silver or zinc, or a combination of these metals. This activity is scheduled under the *Protection of the Environment Operations Act 1997* (POEO Act) as 'Mining for minerals – other than coal'. There are currently 19 polymetallic mines in NSW that are licensed by the EPA for this activity.

Metals can be mined from both open-cut and underground mines. Blasting loosens the ore and breaks it into large fragments, which are then crushed into smaller pieces. These are then commonly moved by conveyor to a mill for further processing (photo 1). In the mill, metal balls or rods are used to grind the ore into tiny particles with the consistency of silt, sand and clay. The crushed and ground ore is mixed with water to produce a slurry, which is then processed through a process called flotation. Flotation involves the use of chemical reagents to separate the valuable metals from the minerals. The non-metallic waste slurry that is generated through flotation is then transported to large tailings dams (photo 2).

An alternative to flotation is heap leaching (photo 3), in which the ore is placed in heaps over which a diluted solution of sulfuric acid or cyanide is poured. The chemicals leach out the valuable metals, which are collected from the bottom of the heap pads. The chemical solutions are reused several times until they become too dilute to be productive. Heap leaching produces no tailings but leaves behind large deposits of spent ore. Leaching can also be done in a series of enclosed metal tanks called vats.

Waste rock that does not contain enough metal to be processed profitably is removed by trucks to nearby waste emplacement areas. These waste-rock emplacement areas are commonly visible indicators of the presence of a mine (photo 4).



Photo 1: Ore stockpile



**Photo 2: Tailings storage facility**



**Photo 3: Heap leaching**



**Photo 4: Waste-rock dump**



## Why has the polymetallic mining industry been selected for audit?

Sectors and activities targeted in the EPA's environmental compliance audit programs are chosen through an assessment of major environmental and community concerns in light of EPA corporate objectives and strategies.

EPA research and consultation have revealed that polymetallic mines have a number of high-risk environmental issues. The high-risk nature of the sector was confirmed by an analysis of a range of EPA regulatory, enforcement and engagement data. The data analysed included licence non-compliances, community complaints, regulatory actions and notices issued, as well as the compliance trends of all licensees. The review found that this sector recorded a high number of compliance issues.

The polymetallic mining sector has also not been audited under the EPA's sector-based audit program; nor has it been included in recent focused compliance audit programs.

## Premises audited

The EPA conducted internal consultations to help select the most appropriate premises for audit. The premises selected:

- covered the range of metals mined
- included different scales of activity
- represented the geographic spread of the industry sector.

A total of 19 polymetallic mines are licensed in NSW. Compliance audits were undertaken at six of these premises. The sites were inspected between December 2014 and February 2015. The sites selected for audit are listed in Table 1.

**Table 1: NSW polymetallic mines subjected to compliance audit, 2014–15**

Environment Protection Licence no.	Premises and location	Type	
921	Hillgrove Mine, Hillgrove	Gold, antimony	Photo 5
2688	Perilya Southern Operations, Broken Hill	Lead, zinc	Photo 6
4501	Tritton Copper Mine , Girilambone	Copper	Photo 7
5590	Cadia Valley Operations, Cadia	Gold, copper	Photo 8
11254	Tritton Copper Mine, Hermidale	Copper	Photo 9
11912	Cowal Gold Project, Lake Cowal	Gold	Photo 10



**Photo 5: Hillgrove Mine, Hillgrove (underground mine)**



**Photo 6: Perilya Southern Operations, Broken Hill (underground mining)**



**Photo 7: Tritton Copper Mine, Girilambone (open-cut mine containing underground mine entrance portal)**



**Photo 8: Cadia Valley Operations, Cadia**



**Photo 9: Tritton Copper Mine, Hermidale (underground mining)**



**Photo 10: Cowal Gold Project, Lake Cowal**

## Audit methodology

The compliance audits were done in accordance with the procedures and protocols outlined in the *Compliance Audit Handbook* (DEC 2006). Each of the site audit inspections was conducted unannounced. When an audit is completed, the findings are presented to the audited organisation in an individual compliance audit report. These individual reports are publicly available on the EPA's public register, which can be accessed via the [EPA's website](#).

The audits provide an assessment of the licensee's compliance with each condition of the environment protection licence issued to them. Audit findings were based on information from EPA files, information supplied by site representatives, and observations made during site inspections.

The audit reports contain an action program outlining any non-compliance, recommended actions, and the agreed time frames that licensees must meet. EPA officers follow up on compliance audits to ensure that licensees are implementing the actions required in the report by the agreed target date.

The findings presented in this summary report are a collation of the findings presented in the individual compliance audit reports.

## Audit objective, scope and criteria

The objective of the audit program was to assess each licensee's level of compliance with the requirements of their Environment Protection Licence and to improve licensee awareness and understanding of environmental and compliance issues.

The audits assessed the licensee's compliance with each Environment Protection Licence condition. Operating conditions were assessed for the 24-hour period before the end of the audit inspection. The temporal scope for limit, monitoring and reporting conditions and supporting documentary evidence was the last full licence reporting period and the period up until the end of the audit inspection.

## Analysing the risks

The risks associated with the non-compliances identified were assessed and coded according to environmental significance (Table 2).

**Table 2: Risk analysis matrix**

		Likelihood of environmental harm occurring		
		Certain	Likely	Less likely
Level of environmental impact	High	Code red	Code red	Code orange
	Moderate	Code red	Code orange	Code yellow
	Low	Code orange	Code yellow	Code yellow

Assessment of non-compliances as code red suggests that they are of considerable environmental significance and therefore must be dealt with as a matter of priority. Non-compliances assessed as code orange pose a significant risk of harm to the environment but can be given a lower priority than red risk assessments. A non-compliance assessed as code yellow could receive a lower priority but should still be addressed.

There are also a number of licence conditions – such as those relating to administration, monitoring and reporting requirements – that do not have direct environmental significance but are still important to the integrity of the regulatory system. Non-compliances with these conditions are allocated a blue colour code.

## Audit findings

This section of the report summarises the non-compliances and other issues identified and reported on in the individual compliance audits.

### Summary of audit findings

Non-compliances are identified as a result of a licensee not complying with the conditions of their environment protection licence. The number of non-compliances identified at each premises ranged from six to 35. The non-compliances were categorised by using the risk-analysis matrix illustrated in Table 2. The results are summarised in Table 3.

**Table 3: Summary of assessments**

	Assessment of compliance						Total
	Compliant	Code red Non-compliance	Code orange Non-compliance	Code yellow Non-compliance	Code blue Non-compliance	Not determined	
<b>No. of assessments</b>	322	2	14	19	60	54	471

### Issues identified

#### Management of dust

Control of dust from polymetallic mines is an important part of the overall environmental management of mines because of the human health issues related to dust emissions, the effects on water quality, and expectations of environmental performance. It is also part of the duty of care required of mine operators by government and the community.

Each mine should adopt a dust management system that recognises and responds to the issue of dust emissions at all stages of mining, from mine planning and operation through to mine closure. This includes systematically identifying sources, predicting dust levels, evaluating potential effects on human health and the environment, and incorporating prediction and control measures.

All mine operations that involve movement of soil or ore or exposure of erodible surfaces generate dust, including from the following:

- land clearing and removal of topsoil and overburden
- drilling and blasting operations
- operation of crushing and screening equipment
- loading and unloading of material on site and subsequent transport off site
- transport by vehicles on internal haul roads
- wind action affecting stockpiles, dry tailings dams and exposed areas of the site.

Dust emissions can be managed by carefully planning activities, designing blasts appropriately, minimising the areas disturbed, doing continuous rehabilitation, limiting traffic, using enclosed conveyors and using water sprays on stockpiles and unsealed roads.

Monitoring of weather conditions and ambient dust levels at mine sites helps to ensure compliance with air quality standards and helps manage dust.

The dust-related operational issues identified in this audit program were:

- Dust emissions were observed from truck movements and ore stockpiles (photo 11). Dust emissions were also likely to contain elevated lead levels, and residential areas were located nearby (one site). This site did not have a documented dust management plan, procedures or monitoring system in place to trigger the use of controls or to ensure that the controls were effective. The dust-control measures that were available for use (water cart and water sprayers) were not being used when required (one site).



**Photo 11: Large ore stockpiles such as this one from an underground mine often cause dust problems.**

- Current dust management controls and practices were not effective at minimising the generation of traffic generated dust (one site).

The dust-related maintenance issues identified were:

- Haul roads were not maintained in a way that prevented dust emissions. Trucks were observed on dry, dusty haul roads, generating excessive dust emissions (two sites).
- Spillages of dry concentrates at the filter press within the mill were not cleaned up, increasing the risk of emissions of airborne contaminants (one site).
- Milling was being done in an enclosed building to help contain dust emissions, but a number of large gaps were apparent in the walls and a door was missing, increasing the likelihood of dust escaping from the building (photo 12) (one site).



**Photo 12: Degraded mill walls, allowing fugitive dust emissions**

## Management of fuels, chemicals and hazardous materials

Storage and handling of fuels, chemicals and hazardous materials at polymetallic mines pose a significant potential risk of harm to the environment.

Mines store varying quantities of fuels, chemicals and hazardous materials, including petroleum products (diesel, hydraulic oils), ore concentrates, process reagents, acids, flotation chemicals, solvents, cleaning agents, petroleum products, sodium cyanide and mercury (for gold recovery), nitrogen compounds (for blasting), surface drainage and process effluent, compressed gases and biocides.

Wherever hazardous materials are stored and handled there is potential for air, soil, groundwater and surface water pollution to occur through spills or other releases. Other potential releases include fugitive losses or leaks from the valves, pumps, flanges and seals connected to storage and handling equipment.

To prevent the discharge of pollutants from the storage and handling of hazardous chemicals, mines should minimise the quantities stored on site, store materials in designated areas, install secondary containment facilities, conduct regular inspections, develop and implement emergency spill-management procedures, and train employees and subcontractors.

The identified operational issues associated with the management of fuels and hazardous substances were:

- storage of chemical and fuel containers (intermediate bulk containers [IBCs], drums and small containers) in areas with no, or inadequate, secondary containment (five sites)
- storage of chemical containers without labels or with incorrect labels (five sites)
- spillage of chemicals in areas with insufficient secondary containment, potentially leading to soil contamination (four sites)
- incorrect placarding and signage of chemical storage areas (four sites)
- refill points and hoses on diesel tanks and other chemical storage containers located outside the bunded area; any spills occurring during transfer would therefore not have been captured (three sites).
- site chemical-tracking processes not being maintained or not functioning properly, resulting in the exact locations of some chemicals not being known (two sites)
- inadequate vegetation buffer zones for the storage of explosives (two sites)
- storage of IBCs in temporary plastic bunds in uncovered areas, allowing the bunds to fill with rainwater and thus limiting their capacity to contain any spills (one site)
- hard copies of material safety data sheets on site not being maintained adequately to keep them current (one site)
- a bund wall of a chemical storage area not being high enough to contain potential spills (one site)
- the bunded area for the elevated storage of IBCs not being capable of containing spillages of materials or liquids if the IBCs were to be dislodged (one site).

The identified maintenance issues associated with the management of fuels and hazardous substances issues were:

- sediment, liquids and rainwater within the secondary containment area were not removed to maintain the capacity of the area (three sites)
- spill kit contents were not being maintained (three sites)



- IBCs and temporary bunds were in poor condition (photo 13), with evidence of leaks contaminating the surrounding soil (two sites)
- bunded areas of chemical storage facilities were degraded, eroded and/or cracked, increasing the risk of spills and leaks to the environment (three sites)
- a tank holding fuel was significantly corroded, with fill points and outlet taps leaking (one site)
- tank cleaning and testing were not being done at the scheduled intervals (one site)
- the oily water separator was not working (two sites)
- sumps were approaching capacity and contained other, general, waste (one site).



**Photo 13: Corroded IBCs**

## Management of chemical and hazardous wastes

Mining operations produce a number of types of waste materials, including chemical wastes, wastewater, waste rock and tailings.

Mines store and use varying quantities of fuels, chemicals and hazardous materials, which in turn produce chemical and hazardous wastes. The usual approach to managing chemical and hazardous wastes is to contain and collect them at the point of production, treat them, and then dispose of them in an environmentally friendly manner. In some cases where the waste may be classified as hazardous waste, the waste will require special handling and disposal.

The identified operational issues associated with the management of chemical and hazardous wastes were:

- storage of waste oils, batteries and waste chemicals in small containers, drums and IBCs in areas without secondary containment or with inadequate secondary containment (photo 14); evidence of spillages was also observed (four sites)
- storage of used IBCs – some with residual chemicals – on bare earth with no secondary containment (three sites)
- poor waste management practices, including inadequate screening and separating of wastes at the on-site waste disposal facility (two sites)
- storage of unknown waste oils and chemicals, with unclear or missing labelling (one site)
- storage of waste tyres and wood chips in a way that increased the risk of fire (one site)
- receiving and disposing of waste on the premises when not permitted by the licence (includes hydrogen-contaminated soil and exploration drilling waste) (one site)
- storing and disposing of lead-contaminated hazardous waste material on site when not permitted to by the licence and in a way that could lead to the emission of contaminated airborne dust (one site).



**Photo 14: Waste oils and other chemicals being stored with no secondary containment. There is evidence of leaks and spills and unlabelled containers.**

## **Management of wastewater, including contaminated stormwater**

Wastewater is produced in a number of ways at mine sites, and it can vary in quality and in its potential for environmental contamination.

Management of stormwater at mines is important to prevent the discharge of contaminated materials from mining areas. A key aspect of an effective stormwater management strategy is to segregate clean and dirty areas on the mine site and to prevent dirty water sources from becoming mixed with stormwater. Water at mine sites is monitored frequently. Various water management strategies have been developed to reduce the amount of mine water produced and treat the water before it is discharged to the environment.

The identified operational issues associated with the management of wastewater were:

- transportation of process wastewater in an unsealed system of drains and dams, thus increasing the risk of water and groundwater contamination (one site)
- sediment and erosion control measures not being effective in minimising the movement of sediment, rocks and boulders, particularly during periods of heavy rainfall (one site).

The identified maintenance issues associated with the management of wastewater were:

- not maintaining the clay liner of the containment dam that captured potentially contaminated stormwater from the 'run of mine' pad, the coarse ore stockpile and the processing plant; erosion rivulets were evident – these could potentially result in the formation of conduits to groundwater (one site)
- not maintaining the septic pit effluent pipeline or other wastewater pipes, thus causing leaks (one site).

## **Management of waste rock**

Waste rock is material that contains minerals in concentrations considered too low to be extracted economically. Management of waste rock generally involves storage in heaps or dumps on the mine site. Waste rock dumps are generally covered with soil and revegetated after the mine closes.

An environmental issue associated with the management of waste rock is a process called acid mine drainage. This process occurs naturally when rocks containing metal sulfide minerals are exposed to oxygen and water, or when this type of rock is disturbed and exposed to oxidation as a result of mining. Mining and processing of these types of rocks greatly boost the acid-generating process, because they rapidly expose those substances to oxidising conditions. If waste rock contains a lot of sulfide minerals and has a high potential for the development of acid drainage, it may be stored underwater with tailings or encapsulated in non-acid-forming waste rock.

Within the scope of the audit, no issues were identified with the management of waste rock at the six mines audited.

## **Management of tailings**

Tailings are finely ground rock and mineral waste products of mineral processing operations. Tailings can also contain leftover processing chemicals. They are usually deposited in the form of a water-based slurry into tailings storage facilities. The water that separates from the tailings slurry can be recycled and reused for mineral processing, or treated and discharged into the environment. Tailings are also sometimes used as backfill in underground mines. Successful management of tailings is based on selecting appropriate waste storage locations, as well as on proper material characterisation, including the accurate prediction of long-term chemical behaviour. A tailings storage facility needs to provide safe and stable containment of tailings that minimises risks to public health, safety and the environment during operation and post-closure.

The risks to the environment associated with the operation of tailings storage facilities include:

- rupture of the tailings slurry delivery pipelines or decant water return pipelines
- discharge of contaminated water to surface waters
- erosion of the outer tailings face, usually from rainfall
- failure of the containment walls
- overfilling of the tailings storage facility with tailings
- seepage through the containment wall
- entry of contaminated seepage into the foundations, thus affecting the groundwater
- particulate (dust) or gaseous emissions (e.g. radon, hydrogen cyanide)
- exposure of birds, wildlife or livestock to potentially contaminated decant water within the tailings storage facility
- exposure of wildlife or livestock to soft tailings, in which they may become trapped.

The identified issues associated with tailings management were:

- not containing or promptly cleaning up a spill of tailings water that had occurred in an area that was uncontained, thus potentially causing soil and groundwater contamination (one site)
- not maintaining the tailings pipeline in a proper and efficient condition. Spills and escapes of tailings had occurred in areas that were not contained, and the spills had gone undetected (photo 15); spillages have the potential to contaminate the soil and groundwater (one site).



**Photo 15: Tailings spill**

### **Management of operational noise**

Some aspects of mining – in particular, drilling and blasting, operation of excavation equipment, on-site haulage and handling, and loading of ore on the premises – can be noisy. Management of noise impacts from mining activities on the neighbouring community requires:

- effectively maintaining plant and equipment (e.g. equipment exhaust systems)

- restricting certain operations when meteorological conditions are not favourable
- using noise abatement measures, such as constructing mounds or walls, ensuring sufficient buffer zones and limiting speed on haul roads
- limiting the hours in which various mining operations may take place, and monitoring noise from mining activities.

Within the scope of the audit, no issues were identified with the management of operational noise at the six mines audited.

### **Management of blasting activities**

When blasting is done, airblast overpressure (air disturbance) and ground vibration occur. Good blasting practices are based on the use of appropriate explosive material and detonation sequencing. Responsible operation ensures that blasting is not done during bad weather. The magnitude of blasts should be monitored to ensure compliance with relevant blast limits and help minimise impacts.

No operational issues within the scope of the audit were identified with the management of blasting activities at the six mines audited.

### **Limit, monitoring, reporting and recording conditions**

Mining activities that are close to residential developments are the cause of various environmental and amenity issues, such as contaminated water discharges, dust emissions, noise and blasting disturbance and visual impacts. There is also the issue of cumulative impacts of mining on the environment and the need for monitoring data to be collected about the extent and nature of these impacts. The information provided by monitoring is also valuable for other environmental and management activities (e.g. for optimising processes, protecting sensitive ecosystems, and informing the public of the effectiveness of environmental protection measures). Licences issued to mines require the monitoring of discharges to the environment. These licences also specify concentration and volume limits that mines must comply with.

**Water discharge limit conditions.** The issues identified were:

- exceeding pollutant concentration limits for discharge to waters (two sites)
- discharging to waters when prohibited by a licence condition (one site).

**Water monitoring.** The following issues were detected in relation to the monitoring of water pollutants in accordance with [Approved Methods for the Sampling and Analysis of Water Pollutants in NSW](#) (DEC 2004).

- not using the methods specified in the Approved Methods document and not seeking approval from the EPA for the use of alternative methods of sampling or analysis (five sites)
- not monitoring discharged pollutant concentrations or volumes at the required frequency (four sites)
- failure to use a laboratory that was accredited by an independent accreditation body acceptable to the EPA to perform the analysis of those pollutants (three sites)
- exceeding the recommended time for holding a water sample before it was measured for particular analytes (two sites)
- not recording the correct units of measure for the volume of wastewater discharged (one site)
- not using the correct method to monitor the flow discharged (one site).

**Dust emissions monitoring.** Air pollutants must be monitored in accordance with the licence conditions and *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (DEC 2004). The issues identified were:

- not recording the required details for dust samples that were taken (i.e. date or time, name of person taking sample, location) (three sites)
- not using a laboratory that was accredited by an independent accreditation body to do those analyses (three sites)
- not siting dust-monitoring equipment in accordance with the siting requirements contained in regulatory requirements and relevant Australian standards (two sites)
- not monitoring dust-deposition rates at the required frequency (two sites)
- not using the approved methods for analysing dust and the pollutants in it (two sites)
- not using an alternative analysis method that was approved in writing by the EPA for sampling and analysis of dust samples (one site)
- not completing dust analysis reports in accordance with the requirements of the Australian standards (i.e. not including details such as time of sampling, type of sampler used, meteorological conditions, location of the sample, and uncertainty factors) (two sites)
- not reporting the analytical data in accordance with the reporting requirements of the approved methods (one site).

**Weather monitoring.** Weather data are used by the industry for operational planning and to manage the impacts of mining activities on the environment. This includes managing dust, making decisions about irrigation, and monitoring weather extremes to ensure that effluent ponds do not overflow. Therefore, the sampling, collection and recording of weather data must be done precisely.

The following issues were detected in relation to the monitoring of meteorological parameters:

- not siting a weather-monitoring station in accordance with the siting requirements contained in regulatory requirements and the relevant Australian standards (one site)
- not using the units of measure specified to record weather parameters (one site)
- not maintaining the rainfall gauge, resulting in erroneous results (one site).

**Monitoring noise and blasts.** Environment Protection Licences set blasting limits for airblast overpressure and ground vibration. Operational noise limits may also be set. Monitoring of operational noise and blasts will help to determine compliance with relevant limits and help minimise impacts.

The issues identified were:

- not monitoring operational noise at all of the required noise-monitoring locations (one site)
- not siting operational noise-monitoring equipment in locations that provided results that were representative of the potential impacts (one site)
- not siting blast-monitoring equipment in locations that provided results that were representative of the actual ground vibration levels from the underground mine blasts (one site)
- exceedence of operational noise limits at nominated monitoring locations on 18 out of 19 occasions (one site).

**Reporting requirements.** Mines are required by their Environment Protection Licence conditions to submit various monitoring reports to the EPA, including an annual return and written details of incidents causing, or likely to cause, environmental harm.

The issues identified were:

- not providing written details of notifications of environmental harm to the EPA within 7 days of the date of an incident occurring (two sites)
- not submitting an investigative report or a management plan as required by special licence conditions (two sites)
- not submitting an annual return within the specified time period or with the required information (one site).

### **Managing complaints**

All holders of an Environment Protection Licence are required to advertise and operate a dedicated complaints line on which any interested person can make a complaint about the environmental performance of the mine. There are certain details that need to be recorded for each complaint made.

The issues identified were:

- not notifying the public of the complaints line telephone number (two sites)
- not notifying the community that the site's community hotline number could be used for the purpose of making a complaint (two sites)
- not recording the date and time when complaints were made (one site).

### **Other issues identified**

The program also identified a number of issues of environmental concern that did not strictly relate to the scope of the audit or assessments of compliance. The following further observations were noted:

- Not analysing and interpreting the collected dust monitoring data and using the results to make informed decisions about site operations (three sites).
- Not making the licensee's Pollution Incident Response Management Plan publicly available on the licensee's website (as per the requirements of the Protection of the Environment Operations Regulation 2009) (two sites).
- Not containing potentially contaminated stormwater within the licensed premises (one site).
- Not publishing pollution-monitoring data on the corporate website of the premises as per the legislative requirements (one site).
- Having inadequate systems for managing environmental information. This included a lack of documentation regarding management practices, such as inspections and dust suppression activities. There were no procedures to ensure that corrective actions were recorded or 'closed out' (one site).
- Inconsistencies in records relating to Dangerous Goods kept on site. Local records kept by the licensee differed from the records submitted to WorkCover. This involved some substances not being recorded, volumes recorded being inconsistent, and recording of the wrong storage locations of substances (one site).
- Discharge of polluted waters to an onsite pond that was used as a water source for travelling stock (one site).

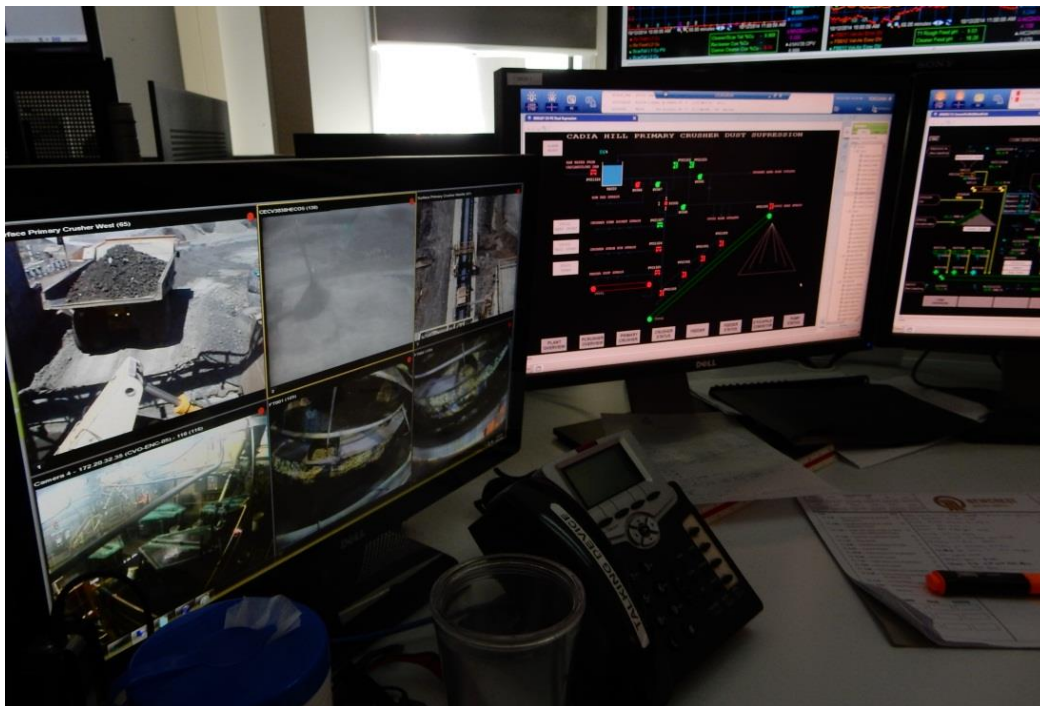
- Storage of a large number of waste tyres at the premises. The number was estimated to be close to the threshold amount that would require the premises to hold a licence as a waste facility under the new waste regulations that came into effect on 1 July 2015 (one site).
- Not recording weather monitoring data (i.e. wind direction and speed) when reporting noise-monitoring results (one site).

## Good practices observed during the audit

### Comprehensive monitoring and video surveillance of operations

One licensee had a comprehensive video surveillance network (photo 16) that monitored operational activities remotely from the operations centre, which is staffed 24 hours a day, seven days a week. Live video footage from across the site, including from above-ground and underground processes, is streamed to individual monitors, allowing many areas to be viewed at the same time. Operators communicate with personnel on the ground via radio and phone.

Sprinklers located on the end of conveyors can be activated by staff in the operations centre. On-ground supervisors can request water carts, level-sensor information in ponds can be viewed, and alarms for various items of equipment are routed to the emergency desk. This includes alarms on the water balance tank, the pipelines, and the dust-monitoring equipment. Once alarms are triggered, ground staff are directed to inspect each issue.



**Photo 16: Video surveillance footage and monitoring station within the operations centre at a mine**

### Alarm system in place for dust and noise/blast monitoring

At the above-mentioned premises, alarms for dust and noise are received by key staff via SMS and emailed to a shared company email address, as well as to the continuously staffed site operations centre. Emails and SMS are checked continuously and investigated immediately.



PM<sub>10</sub> (particulate matter) dust generated from the project is monitored by using tapered element oscillating microbalance (TEOM) equipment located outside the mining lease. This measures the ambient dust concentration of PM<sub>10</sub>-sized dust particles in five-minute blocks continuously. Software associated with the TEOMs provides a warning alarm service to alert the site of elevated dust levels being received at the TEOM monitors. A text message is sent to the supervisor when an alarm is triggered, and this is followed up by the shift supervisor.

### **Zero discharge of wastewater**

The wastewater management process in place at two of the premises audited focuses on re-use. All wastewater generated at the premises is re-used in the process plant, and there are no discharges of wastewater to receiving environments. There are no licensed discharge points, as all wastewater is eventually evaporated or encapsulated as moisture in the tailings storage facilities.

### **Dust management**

One licensee co-funded (with local council) the sealing of nearby roads to help minimise the potential for dust to be generated from traffic (particularly of haul trucks). Dust complaints relating to these roads have stopped since the roads were sealed.

## After the audits

### Follow-up by the EPA

The EPA has required the mines audited as part of this program to rectify any non-compliances identified, and it will be following up to make sure that the mines are complying with their licence requirements.

In many cases, the comments received from licensees as part of the audit process indicated that the licensees had already started a review of their processes and procedures to improve performance and address any non-compliances.

Since the individual audit reports were finalised, most of the required actions have been completed by the licensees audited in this program, to ensure that compliance is achieved. However, progress, within the required time frames, is still being made on some of the required actions. The actions that are still in progress relate to:

- licensees liaising and negotiating with analytical laboratories and the EPA about sampling and monitoring methods. This process will help ensure that compliance can be achieved and that the most appropriate monitoring and analytical methods are used.
- licensees engaging with suitably qualified experts to design and implement new management practices to ensure that environmental controls meet regulatory obligations. A staged approach is used for this process to ensure that issues are fully investigated and researched and appropriate management plans and measures are designed and implemented by the licensees. One licensee has already completed work costing \$218,000 and committed to additional work estimated at \$1,557 million to address all the issues identified.

The EPA encourages the polymetallic mines that were not audited in this program to use this report and individual audit findings to inform their review of processes and procedures and improve their compliance and environmental performance.

## Related initiatives

The following related initiative may also help the relevant stakeholders to manage the environmental issues associated with mines:

- *Environmental compliance and performance report: Management of dust from coal mines*

In late August 2010, the EPA started a joint compliance audit program on managing particulate-matter emissions from coalmines in partnership with the then Department of Planning and Infrastructure and Department of Trade and Investment, Regional Infrastructure and Services.

The objectives of the program were to assess levels of compliance with the requirements – contained in statutory instruments issued by each of the three agencies – to manage fugitive particulate matter emissions and to encourage improved environmental performance with reference to best management practice.

A total of nine coal mines were audited (seven in the Hunter Valley and one each in the Gunnedah and Western coalfields).

The [Environmental compliance and performance report](#) can be found on the EPA's website.

## Glossary

<b>Acid mine drainage (AMD) (also known as acid and metalliferous mine drainage)</b>	The outflow of acidic water from metalliferous mines or coalmines. AMD occurs naturally in some environments, but it is exacerbated by large-scale earth disturbances characteristic of mining, usually within rocks abundant in sulfide minerals.
<b>Audit</b>	A systematic, independent and documented verification process of objectively obtaining and evaluating evidence to determine whether specified criteria are met.
<b>Audit criteria</b>	Defined requirements against which the auditor compares collected audit evidence. Criteria may include regulatory requirements, standards, guidelines, or any other specified requirements.
<b>Audit evidence</b>	Evidence collected for the purpose of assessing compliance, including documentary evidence and any evidence collected during an audit inspection of the premises, such as auditors' observations, photographs, videos and evidence provided by the licensee during interviews.
<b>Audit inspection</b>	The step in the audit process when auditors visit the licensed premises to conduct meetings and interviews, observe the operational systems, and collect evidence against which compliance will be assessed.
<b>Audit scope</b>	The extent and boundaries of the audit, including locations, organisational units, activities and processes to be audited, and the time period covered by the audit.
<b>Code blue</b>	Non-compliance with licence conditions that do not have direct environmental significance but are still important to the integrity of the regulatory system. These conditions relate to administrative, monitoring and reporting requirements.
<b>Code orange</b>	A non-compliance that has environmental significance but can be dealt with at a lower priority than a code red.
<b>Code red</b>	A non-compliance that has considerable environmental significance and must be dealt with as a matter of priority.
<b>Code yellow</b>	A non-compliance that can receive a lower priority than a code red or code orange, but that is still important and must be addressed.

<b>Compliance</b>	Where there is sufficient and appropriate evidence to demonstrate that a particular requirement has been complied with and is within the scope of the audit.
<b>Decant water</b>	Body of water that has separated from the tailings solids in the tailings storage dam, plus any rainfall runoff collected on the dam.
<b>Environment Protection Licence (EPL)</b>	A licence that authorises the carrying out of scheduled activities or that controls pollution arising from non-scheduled activities, being a licence issued under Chapter 3 of the <i>Protection of the Environment Operations Act 1997</i> and in force.
<b>Environmental harm</b>	Includes any direct or indirect environmental alteration that has the effect of degrading the environment and, without limiting the generality of the above, includes any act or omission that results in pollution.
<b>Facility</b>	Any premises where scheduled or non-scheduled activities are undertaken.
<b>Flotation</b>	A process that uses the fact that different minerals have different affinities for certain chemicals to separate the valuable minerals from the valueless ones. The chemicals loaded with minerals are removed from the slurry by air bubbles.
<b>Heap leach (process) and heap leach pad</b>	Heap leaching is the process of extracting precious metals from the ore by placing them on a pad (a base) in a heap and sprinkling a leaching solvent, such as cyanide or acids, over the heap. This process dissolves the metals; they collect at the bottom of the pad, where they are then further processed.
<b>Intermediate bulk container</b>	A reusable industrial container designed for the transport and storage of bulk liquid or granulated substances. These containers are stackable and designed to be moved with a forklift.
<b>Licence conditions</b>	Stipulations listed on the Environmental Protection Licence outlining the requirements the licensee must comply with.
<b>Licensed premises</b>	Any premises where a scheduled activity is undertaken for which the licensee has obtained a licence to do so.
<b>Monitoring</b>	Generally means being aware of the state of a system. The process of monitoring involves data collection, data analysis and interpretation of the data to determine the state of the system and how the system is changing.
<b>Monitoring data</b>	Data collected for the purpose of characterising changes in an event as the result of a direct observation or experiment. The data are usually numbers that reflect the results of a measurement obtained from observations or experiments.

<b>Monitoring frequency</b>	The frequency with which licensees are required to collect samples, as required by their Environmental Protection Licence.
<b>Non-compliance</b>	When clear evidence has been collected to demonstrate that a particular requirement has not been complied with and is within the scope of the audit.
<b>Not applicable</b>	When a particular requirement is not relevant to the licensee's facilities or operating conditions or the scope of the audit.
<b>Not determined</b>	When insufficient evidence is available to allow an evidence-based assessment of compliance to be made.
<b>Ore</b>	A type of rock that contains sufficient minerals with important elements, including metals that can be economically extracted from the rock.
<b>Overburden</b>	Also called waste or spoil and made up of soil, gravel, and other loose materials that cover the surface of a mine site.
<b>Particulate matter</b>	Solid or liquid particles 10 micrometres or less in diameter (refer to PM <sub>10</sub> and PM <sub>2.5</sub> ).
<b>Polymetallic mine</b>	A mine that extracts metals from the ore that is mined.
<b>PM<sub>10</sub></b>	Particles between 10 and 2.5 micrometres in diameter, commonly referred to as 'coarse'.
<b>PM<sub>2.5</sub></b>	Particles less than 2.5 micrometres in diameter, commonly referred to as 'fine'.
<b>POEO Act</b>	The NSW <i>Protection of the Environment Operations Act 1997</i>
<b>Pollution</b>	Means water pollution, air pollution, noise pollution, or land pollution.
<b>Public register</b>	<p>Under section 308 of the POEO Act, an online searchable database, which contains:</p> <ul style="list-style-type: none"><li>• Environment Protection Licences</li><li>• applications for new licences or to transfer or vary existing licences</li><li>• Environment Protection and Noise Control Notices</li><li>• convictions in prosecutions under the POEO Act</li><li>• results of civil proceedings</li><li>• licence review information (submissions regarding licence review can be made at any time)</li><li>• exemptions from the provisions of the POEO Act or Regulations</li><li>• approvals granted under clause 9 of the POEO (Control of Burning) Regulation</li></ul>

	<ul style="list-style-type: none"> <li>• approvals granted under clause 7A of the POEO (Clean Air) Regulation.</li> </ul>
<b>Reagent</b>	A substance used for its chemical activity.
<b>Remedial action/Action program</b>	An action or series of actions that the licensee is required to take in order to correct an identified non-compliance. It is issued in association with an expected completion date.
<b>'Run of mine' ore</b>	Ore in its natural, unprocessed state, just as it is when blasted (also known as ROM ore, and can be stored on the ROM pad)
<b>Scheduled activity</b>	An activity listed in Schedule 1 of the POEO Act.
<b>Scheduled (premises)</b>	<p>Premises (as defined in the POEO Act) where an activity listed in Schedule 1 of the POEO Act is carried out. The person or company undertaking the activity is required to hold an Environment Protection Licence to carry out the activity.</p> <p>'Premises' includes:</p> <ul style="list-style-type: none"> <li>• a building or structure or</li> <li>• land or a place (whether enclosed or built on or not) or</li> <li>• a mobile plant, vehicle, vessel or aircraft.</li> </ul>
<b>Tailings</b>	A mixture of water and finely ground rock that is left over once the mineral concentrate is removed.
<b>Tailings storage facility</b>	<p>A large area, usually located in a natural hollow or valley, where tailings are stored. In most cases, dam walls are constructed to contain the tailings material. Once placed in a storage facility, the finely ground rock and water that together make up the tailings will separate.</p> <p>The solids portion of the tailings will settle to the bottom. The tailings water that accumulates at the surface can be an important water source for mine operations. Tailings water is usually pumped back to the mill to be reused in the milling process.</p>
<b>Waste rock</b>	The solid material that is removed from a mine but does not contain enough minerals to be considered ore and is not economically viable to extract. This material is stored on site and may be re-used on site to construct mine facilities (such as roads and dam walls).

## References and further reading

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