



Environmental compliance and performance report

Management of dust from coal mines



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The *Environmental compliance and performance audits: management of dust from coal mines* was undertaken by the Department of Environment and Climate Change and Water NSW, the NSW Department of Planning and Industry & Investment NSW.

More information

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Cover images

Main: Run-of-mine coal storage area and conveyor system (W. Wickremeratne/DECCW).

Small photos, left to right: open-cut coal mine with haul trucks transporting materials on internal haul roads (B Green/DECCW); tapered element oscillating microbalance (TEOM™) used to monitor dust particulates (K Lynch/DECCW); overburden emplacement area with temporary vegetative cover (W. Wickremeratne/DECCW); dry exposed tailings dam no longer in use (R Sherry/DoP).

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Executive summary

The Department of Environment, Climate Change and Water (DECCW), Department of Planning (DoP) and Industry & Investment NSW (I&I NSW) have completed joint NSW government agency environmental compliance and performance audits focused on the management of dust from coal mines to help improve environmental performance.

The audits focused on requirements relating to dust management in environment protection licences issued by DECCW; development consents and project approvals issued by DoP; and mining lease(s), mining operations plan requirements and annual environmental management reports issued by I&I NSW. The audit process included compliance audits conducted at a selection of coal mines in the Hunter, Western and Gunnedah coalfields of NSW and research into approaches for implementing a dust management system for coal mines.

The objectives of the audits were to:

- assess the level of coal mines' compliance with statutory requirements relating to the management of dust
- assess the adequacy and appropriateness of coal mines' current management practices, procedures and monitoring activities in relation to managing dust.

About this report

This report summarises the findings of the compliance audits completed by the three agencies. It also:

- guides coal mines about how they can reduce dust and improve air quality at their premises and improve environmental performance by implementing an integrated dust management system
- informs other initiatives that the NSW Government is implementing to ensure coal mines improve their environmental performance.

Key findings

Overall it can be seen that whilst there were a number of non-compliances observed there were none of considerable environmental significance (high-risk). However, all non-compliances must be addressed and the audits present an opportunity for improvement by the industry.

The findings of the audits demonstrate that coal mines can and will need to improve their dust management practices by:

- developing and implementing dust management plans for coal mining operations
- planning activities using forecast and real-time weather monitoring data and restricting or ceasing activities during unfavourable weather conditions
- conducting local area visual checks in addition to real-time weather-monitoring data to direct the application of necessary dust controls
- properly maintaining dust-control equipment to ensure mitigation measures are available and effective
- monitoring the effectiveness of the mitigation measures implemented and feeding this information into regular reviews of dust management procedures

- ensuring that ambient dust-monitoring stations are sited and equipment is calibrated and maintained according to regulatory requirements
- ensuring staff are aware of – and implement – dust management procedures in day-to-day coal mining operations
- limiting exposed areas throughout all stages of coal mine operations including minimising pre-stripped areas, using temporary vegetation cover and implementing progressive rehabilitation.

A systematic and rigorous process of follow-up actions has been put in place by the three agencies to ensure issues identified at the audited sites are being addressed.

Related initiatives

The following related initiatives may also assist relevant stakeholders – including the coal mine industry – to identify ways in which the management of dust (and air quality) can be undertaken more effectively to reduce the impact on the environment.

- *Strategic environmental compliance and performance review – industry monitoring*

This report outlines the findings of a review undertaken by DECCW in 2009 focused on the monitoring requirements on environment protection licences across various industry types within NSW.

See www.environment.nsw.gov.au/resources/licensing/09695indmon.pdf

- *Independent review of cumulative dust impacts – Camberwell Village*

Commissioned by the Department of Planning in 2009, this is an independent review of the cumulative dust effects of mining on Camberwell Village in the Upper Hunter Valley. The report presents the review's findings relating to local air quality in and around Camberwell Village and the measures employed by surrounding coal mines in relation to air-quality management; it also reviews best management practice for dust.

See www.planning.nsw.gov.au/LinkClick.aspx?fileticket=waS1Eif7MY8%3d&tabid=70&language=en-AU

- The NSW Government is currently implementing several initiatives to better manage the impacts from coal mining in the Hunter Valley, in part, as a response to the Camberwell cumulative impact review (incorporating the above dust impacts review). These initiatives include:
 - establishing a Health Air Quality Expert Panel to provide advice on the health impacts of air quality
 - employing three Department of Planning compliance officers in the Upper Hunter to monitor mines and enforce compliance with conditions of approval, and to develop and implement strategies for sustainable coal mining in the region
 - establishing the Upper Hunter Air Quality Monitoring Network to provide real-time data on air quality in the region
 - requiring mines to employ best practice dust control measures
 - ensuring residents living close to mine sites are fully informed of the potential health impacts of mining operations.

1 Joint compliance audits

The compliance audit campaign was undertaken as a whole-of-government initiative, conducted jointly by the Department of Environment, Climate Change and Water (DECCW), the Department of Planning (DoP) and Industry & Investment NSW (I&I NSW) and focused on managing dust at coal mines in NSW.

Why have coal mines been selected for auditing?

While acknowledging the importance of the coal industry to the state economy, the NSW Government also recognises the importance of minimising the impact of coal mining on the environment. Given the potential for substantial dust emissions from mining operations, the government has identified dust as a priority area for immediate attention.

The importance of managing dust

Managing dust from coal mines is important as it can impact local and regional air quality, adversely affect local amenity and pose a risk to public health.

Protecting local and regional air quality

An important aspect of the protection of air quality from coal mining operations is to minimise dust generated from sources such as wind erosion, vehicles using unsealed roads and blasting. Coal mines are required by environment protection licence conditions and project approval conditions to meet certain criteria for ambient air quality. In order to meet these criteria, coal mines must manage the emissions of dust from their activities in a competent manner.

Community health

Health impacts of coal mine dust vary depending on the nature of the particles, their origin and their size, which is measured as particulate matter (PM). Exposure to fine particles can have potential health impacts on the respiratory system. Generally it is thought that fine particles below 2.5 microns in diameter may be of greater health concern than larger particles as they can reach the air sacs deep in the lungs (NSW Department of Health, 2010). However, coarse particles (PM 2.5 to 10 microns) could also be associated with adverse health impacts.

Infants and children, elderly people, people with existing respiratory conditions, heart disease or diabetes may be more susceptible to the health effects from fine and coarse particles. Mines should be operated with proper dust controls to ensure that people are not affected by the dust they generate and their related health effects.

Community amenity

If not properly managed, dust from coal mines can be a nuisance to local communities. Nuisance dust usually has a particle size larger than 10 microns. High levels of nuisance dust may reduce visibility and amenity. The presence of nuisance dust can also cause a perceived increase in health risk. The impact of dust from mines on local amenity depends on the distance from the mine site and climatic conditions including wind speed and direction. Concerns about amenity from mine site dust often relate to the 'visibility' of dust plumes and dust sources. Visible dust is usually due to short-term episodes of high emissions, such as

blasting. Other amenity impacts include dust depositing on fabrics (such as washing) or on house roofs, and dust transported from roofs to water tanks during rain (NSW Department of Health, 2010).

Relevant legislation

The environmental impacts from coal mining are primarily regulated through the following legislation:

- *Environmental Planning and Assessment Act 1979* – assessment and approval of new mines and extension of existing mines
- *Mining Act 1992* (and the *Mining Amendment Act 2008*) – mineral exploration licences and mining leases, including provisions for environmental management and rehabilitation
- *Protection of the Environment Operations Act 1997* – environment protection licences that regulate environmental impacts during operations.

Environmental Planning and Assessment Act 1979

Mining, like other forms of development, requires development approval under the *Environmental Planning and Assessment Act 1979* (EP&A Act). *State Environmental Planning Policy (Major Development) 2005* identifies development to which the development assessment and approval process under Part 3A of the Act applies. Under this part of the Act, the Minister for Planning determines the project application. All development for the purpose of coal mining is determined under this part of the Act.

Once a mining proposal or project application is approved, DoP issues a project approval under Part 3A of the Act. Some mines are still operating under development consents that were issued under Part 4 of the Act before the Part 3A provisions took effect in 2005. The project approval or development consent will include specific conditions for managing and monitoring air quality including air-quality impact assessment criteria.

Standard conditions on approvals under Part 3A for coal mining projects, comprehensively address environmental management and the management impacts, and typically include the following requirements:

- compliance with contemporary air quality criteria
- additional dust mitigation measures
- preparation and implementation of an air quality management plan
- obligations to implement best practice environmental management
- regular monitoring of environmental performance
- notification of people of risks that arise
- acquisition of premises affected by operations (on request)
- independent review of potential non-compliances
- independent environmental and compliance auditing
- reviews of all management plans to come after independent audits
- public reporting on environmental performance on mines websites.

Under the EP&A Act, departmental enforcement officers are authorised to exercise certain regulatory functions, including:

- entering and inspecting premises
- obtaining information/records and interviewing people
- issuing penalty notices
- issuing orders.

The commonly used types of orders are:

- orders to comply with a development consent
- orders to remedy or restrain a breach of Part 3A.

The DoP also has power to bring civil and criminal proceedings on behalf of the Minister for Planning.

Mining Act 1992

The *Mining Act 1992* establishes the administrative framework for obtaining rights (titles) to minerals and incorporates provisions regarding royalties, land access and the protection of the environment, among other things.

Environmental impacts from exploration and mining are primarily regulated by issuing titles subject to environmental conditions. Failure to comply with environmental conditions is an offence and may result in the issue of a direction or a penalty infringement notice, suspension of operations, prosecution or cancellation of a title.

Poor environmental performance, such as the breach of environmental conditions, may also result in the refusal of an application for a new title or the renewal of an existing title.

In addition, every titleholder is required to satisfactorily rehabilitate their site and provide a security deposit with I&I NSW to cover the full cost of rehabilitation in the event that the titleholder fails to fulfil their rehabilitation obligations. The amount of security is adjusted over time to ensure it reflects the full rehabilitation liability.

I&I NSW expects compliance with the Mining Act and strongly encourages titleholders to undertake voluntary audits of operations that review and assess the effectiveness of their environmental controls. Where a titleholder is in breach of their environmental conditions, any enforcement action will be decided on a case-by-case basis with I&I NSW consulting other government agencies to ensure a consistent, effective regulatory approach.

Mining operations plans

Mining operations plans (MOPs) describe the manner in which the leaseholder proposes to conduct mining, processing and rehabilitation in order to comply with I&I NSW's statutory responsibilities. These responsibilities are expressed in the *Mining Act 1992* and I&I's published policies and specific conditions attached to each mining title. Proposed operations must be consistent with development consents, all other government agency approvals and licences, and mine safety regulations and mine safety plans. An MOP must apply best available practice and technology to all aspects of mine operations and include strategies to control identified environmental risks.

Annual environmental management reports

Annual environmental management reports (AEMRs) are the principal tool for leaseholders to report on performance in relation to environmental management and rehabilitation. Through this document, mining leaseholders report the status of any:

- approvals
- leases
- licences
- environmental risk management and control strategies.

Leaseholders also report on activities for the previous 12-month period, including:

- mining, mine development and rehabilitation in relation to the MOP
- environmental performance in relation to the collective conditions of approvals, leases and licences
- community relations and liaison.

The AEMR may also outline any proposed improvements in environmental performance and management systems and proposed targets for the next 12-month period.

Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) allocates responsibilities for pollution prevention and control to the Environment Protection Authority (EPA), local councils and other public authorities. The EPA is the appropriate regulatory authority for:

- regulating activities listed in Schedule 1 of the POEO Act
- ensuring compliance with environment protection licences
- regulating activities carried out by the state or a public authority.

The EPA and DECCW

The EPA is part of DECCW which exercises certain statutory functions and powers (such as the determination of licence applications and other licensing functions under the POEO Act), in the name of the EPA.

Premises that undertake scheduled activities and meet the licensing threshold in the POEO Act are licensed and regulated by DECCW. Most coal mines undertake the scheduled activities of 'mining for coal', 'coal works' and/or 'crushing, grinding or separating' as defined in Schedule 1 of the POEO Act. For a full list of all the scheduled activities and the classifications under them, refer to Schedule 1 of the POEO Act – see www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N.

Environment protection licences issued under the POEO Act set environmental performance requirements. Licences may specify a required performance outcome or a specific environmental management practice. Licence conditions take into account factors such as the surrounding environmental conditions, the type of activity and the available technology. Pollution reduction programs and pollution studies are often attached to licences, requiring licensees to carry out work within a specified timeframe to comply with environmental requirements. Depending on the type of activity carried out, licensees may be required to undertake monitoring for water, noise or air, for example.

The POEO Act sets out a series of offences for actions that may pose a risk to the environment. These include water pollution (section 120), leaks and spills of substances (section 116) and air pollution (sections 124 to 132). These offences apply to industries and activities whether or not they are licensed.

Under the POEO Act, officers are authorised to exercise regulatory functions including:

- powers of entry and search
- powers to question and identify persons
- powers to issue notices.

The types of notices include:

- notices to provide information and records
- clean-up, prevention, prohibition, compliance cost and noise-control notices (see Chapter 4 of the POEO Act, 'Environment protection notices')
- penalty notices
- notices to vary environment protection licences including attaching pollution reduction programs.

2 About the audits

Audit scope and criteria

Selection of mines to audit

A range of factors were considered in selecting coal mines for this audit campaign. All coal mines audited hold current planning approvals under the EP&A Act, undertake the scheduled activity of 'mining for coal' as defined in Schedule 1 of the POEO Act and hold mining lease authorities under the *Mining Act 1992*. A risk-based approach was also used to select the specific mines to audit and this focused on two issues:

- environmental risks
- community concerns.

The selection process was jointly conducted by DECCW, DoP and I&I NSW.

Each agency assessed a coal mine's performance in managing dust using the following scope and criteria.

Scope and criteria of the DECCW audits

Compliance was assessed against the conditions of the Environment Protection Licence (EPL) issued to the mine by DECCW, which relate to the management of 'dust', including 'operating', 'monitoring', 'limit', 'reporting' and any 'special' conditions.

The scope of the DECCW audits was limited to examining the following activities in relation to the management of dust:

- drilling and blasting
- material extraction
- transport of material
- storage of material (i.e. stockpiles)
- crushing and grinding
- exposed areas
- dust monitoring.

The temporal scope of the audits was limited to:

- 24 hours prior to the end of the audit inspection – to assess 'operating' conditions relating to dust management
- 24 months prior to the end of the audit inspection – to assess all other relevant conditions relating to the management of dust.

Scope and criteria of the DoP audits

Compliance was assessed against the conditions of the relevant project approval or development consent that related to the management of air quality and, in particular, dust. The scope of the DoP audits was to examine activities at each mine in relation to the management of dust, with particular attention to:

- air quality
- compliance with conditions of approval relating to dust
- storage of material (i.e. stockpiles)
- exposed areas
- transport of material
- drilling and blasting
- rehabilitation
- observed opportunities to improve dust minimisation
- effective use of meteorological data for timing and design of dust-emitting activities
- effective co-ordination with other mines to minimise the impact of dust on other land uses
- effectiveness of any real-time dust monitoring system or other local or regional monitoring systems for dust and meteorological data.

The temporal scope of the audits was limited to the time of the audit inspection, the period covered by the most recent AEMR and the period between the last AEMR and the date of the audit inspection.

Scope and criteria of the I&I NSW audits

Compliance was assessed against the operating requirements and any environmental management procedures as required in the coal mine's mining lease(s), MOP (including any required management plans) and the mine's most recent AEMR in relation to dust management.

The scope of the I&I NSW audits was limited to examining the activities undertaken at each mine in relation to dust management, focusing on:

- timing, scheduling and sequencing of rehabilitation
- vegetative cover and quality in completed areas
- landform shape in compliance with the MOP
- topsoil management
- spontaneous combustion management
- general compliance with dust controlling commitments identified in the MOP.

Where to find relevant regulatory instruments

DECCW's public register contains details of all licences issued under the POEO Act. It is available at www.environment.nsw.gov.au/prpoeoapp/searchregister.aspx.

DoP project approvals or development consents issued by the Minister under the *Environmental Planning and Assessment Act 1979* are available at <http://majorprojects.planning.nsw.gov.au/page/determinations/>.

I&I NSW mining leases can be obtained from the Titles Administration System (TAS) database and graphics from TASMap at www.dpi.nsw.gov.au/minerals/titles/title_searches/title_records

Copies of mines' MOPs and annual AEMRs are available for review at I&I NSW regional offices.

The temporal scope of the audits was limited to the time of the audit inspection and the period covered by the most recent AEMR.

Coal mines audited

Nine coal mines regulated by DECCW, DoP and I&I NSW were audited (see Appendix A).

The individual coal mines selected for auditing were located in the Hunter Coalfield (seven mines); in the Western Coalfield (one); and in the Gunnedah Coalfield (one). DECCW and I&I NSW audited all nine mines, while DoP audited seven in the Hunter Coalfield. All audits were conducted jointly by the participating agencies.

The audited mines varied in their scale of operation from 1 million to 14 million tonnes of run-of-mine coal generated per annum. Most mines operated solely using open-cut methods, but some mines included an underground (i.e. long-wall) operation. The coal mines' production details and statistics are available in the I&I NSW *Coal Industry Profile 2009*.

A number of the mines selected are currently expanding or are planning to expand in the future.

Audit methodology

In carrying out the compliance audits, all agencies followed the procedures and protocols in DECCW's *Compliance Audit Handbook*. See www.environment.nsw.gov.au/resources/licensing/cahandbook0613.pdf.

The audits reviewed each coal mine's compliance with the legislation or statutory instruments administered and issued by each agency relating to the management of dust. Audit findings were based on information from agency files, information supplied by site representatives and observations made during audit inspections.

Following an audit, each agency's findings were presented to each mine as an individual compliance audit report. DECCW compliance audit reports are publicly available in DECCW's library on level 15, 59 Goulburn Street, Sydney, phone (02) 9995 5000. DoP compliance audit reports are available for public review at the DoP library, located at level 8, 10 Valentine Avenue, Parramatta NSW 2150, phone (02) 9860 1042. I&I NSW compliance audit reports are available for public review in the I&I NSW Maitland office, located at 516 High Street, Maitland, phone (02) 4631 6666.

The audit reports contain an action program outlining any non-compliance, recommended actions and agreed timeframes for compliance. In line with their particular statutory requirements, each agency will follow up on the recommended actions to ensure the mines are implementing the actions by the target date outlined in each report. A systematic and rigorous monitoring program that tracks these follow ups is being used to ensure that each coal mine completes all the required actions.

Opportunities for improved environmental performance that did not constitute non-compliances were also identified by each agency and listed as 'observations' in the audit reports.

The findings presented in this report are a collation of those presented in the individual compliance audit reports completed by each agency.

Risk analysis of non-compliances

The risks associated with the non-compliances identified were assessed and ranked according to their environmental significance. The ranking process coded each non-compliance as high-, moderate- or low-risk in accordance with the following process.

Non-compliances were assessed against two criteria: the likelihood of environmental harm occurring and the level of environmental impact.

The likelihood of environmental harm was determined by assessing:

- past environmental performance
- current environmental performance
- potential contributing factors.

The level of environmental impact was assessed by considering factors such as the quantity and toxicity of the material and the sensitivity of the receiving environment.

After these assessments were made, information was transferred into the risk analysis matrix shown in Table 1.

Table 1 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

A non-compliance assessed as 'code red' suggests it is of considerable environmental significance and therefore must be dealt with as a matter of priority. An orange risk assessment for non-compliance is still a significant risk of harm to the environment, however it can be given a lower priority than a red risk assessment. A non-compliance assessed as 'code yellow' suggests that it could receive a lower priority but still must be attended to.

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

3 Audit findings

This section of the report collates and summarises the various issues identified and reported on the individual compliance audits conducted by DECCW, DoP and I&I NSW. This section also highlights good practices (outlined in text boxes) observed during audit inspections that contributed to competent dust control. This information is provided to encourage all mines, where appropriate, to consider adopting these practices to minimise their environmental impact.

Risk categories of non-compliances identified

Non-compliances identified during the audits were categorised using the risk-analysis matrix illustrated in Table 1.

The percentages of non-compliances found in each category during the audit process are shown in Table 2. The audits focused on compliance with the regulatory and statutory requirements relating to the management of dust, as administered by each agency.

Overall it can be seen that whilst there were a number of non-compliances observed there were none of considerable environmental significance (high-risk). However, all non-compliances must be addressed and the audits present an opportunity for improvement by the industry.

Table 2 Percentage of non-compliances found in each risk category (by agency)

Colour code of issue	Code red (high risk)	Code orange	Code yellow	Code blue	Total
Percentage of issue – DECCW	0%	0%	26%	74%	100%
Percentage of issue – DoP	0%	13%	22%	65%	100%
Percentage of issue – I&I NSW	0%	0%	92%	8%	100%

Drilling and blasting

The process of drilling overburden has the potential to generate considerable dust emissions, depending on the soil type and climatic conditions. Blasting is also a significant activity that can generate dust from coal mining. Controlling dust from drilling and blasting activities is important to ensure that the contribution to cumulative impacts is minimised and local community amenity is protected from excessive dust particulates.

The following issues were identified:

- no permit system was in place to assess current weather conditions prior to undertaking blasting at one mine – a blast checklist can include important checks such as assessing weather conditions prior to permitting a blast.
- a blast was scheduled using weather forecast data rather than real-time meteorological data and was undertaken in unfavourable weather conditions, resulting in dust generation at one mine.

Good practices observed during audit inspections that contributed to competent dust control

- Use of pre-blast environmental checklists, real-time weather monitoring data and stringent controls on blasts carried out in sensitive areas
- A no-blast arc is automatically calculated for the nearest private residence based on the latest relevant weather conditions, including wind speed and direction, temperature inversions and the amount of atmospheric turbulence (i.e. stability category) before the blast can be fired



It is good practice to use wind speed and wind direction in deciding when to blast (photo: N Wilmot/DECCW).

Material extraction

In open-cut coal mines the initial operation is the removal of topsoil, overburden and interburden by mobile excavation equipment such as bulldozers, front-end loaders, drag lines and haulage trucks. Stripped material is relocated to emplacement areas. Soil disturbance due to extraction, loading, transport and dumping has the potential to cause dust. Strategic planning of the configuration and early stabilisation of emplacement areas can limit the impact of dust on sensitive local receptors.

Dust may also be generated during the removal of the coal seam. Even though coal can be quite moist when extracted, the moisture content is variable.

Dust generation may increase when material is extracted during dry and windy weather conditions. Scheduling activities to coincide with favourable winds and weather conditions is a proactive option in controlling the generation of dust. Water carts and water cannons are commonly used to minimise dust emissions from material extraction operations.

The following issues were identified:

- overburden was being removed during high wind conditions in exposed areas without adequate dust controls in place, resulting in dust generation at one mine
- visual monitoring was not being carried out on a regular basis, reducing the effectiveness of dust management practices associated with material extraction at several mines.

Good practices observed during audit inspections that contributed to competent dust control

- Low or in-pit dumping of overburden during high wind conditions

Transport and transfer of material

Material extracted is usually loaded in haul trucks within the pit and then transported along graded haul roads to the run-of-mine (ROM) stockpiles or directly to the coal-handling and processing plant (CHPP). Haul roads are a major source of dust emissions from coal mines. The design, maintenance and management of haul roads plays an important role in minimising dust emissions. The level of fugitive dust emissions from haul routes is dependent on the total distance travelled, the nature of the road surface, the speed of trucks, the frequency of application of dust suppressants and the types of dust suppressants used. If transported by haul truck, the ROM coal is dumped into a hopper or bin that feeds into the plant housing crushers and screening equipment.



Water carts are often used to help suppress dust from haul roads (photo: J Pope/DoP).

At the mines audited, washed coal (product) is transported offsite mainly by rail. The coal is usually conveyed from product stockpiles to a train-loading facility or railroad storage area before being loaded into rail wagons.

In most cases ROM coal and product coal has sufficient inherent moisture content to prevent dust generation. However, the length of time coal is stockpiled needs to be taken into consideration along with climatic conditions. Control strategies are required for heavy vehicle and light vehicle haul roads and access roads usually involving the application of water and chemical dust suppressants.

In other areas, such as conveying coal, control strategies are required usually involving the application of water, chemical dust suppressants, total or partial enclosure of conveyor systems or extraction systems.

The following issues were identified:

- inadequate number of water carts deployed to effectively minimise the dust generated along haul roads at one mine
- automatic sprays to minimise dust generation at the ROM bin hopper located at ground level and not effective in minimising dust generation at one mine
- alternative dust control, such as slowing the tipping speed of coal into the ROM bin hopper when water sprays are inoperative, not being used resulting in dust generation at one mine
- reject materials dumped at exposed elevated tip faces during unfavourable weather conditions resulting in dust generation at one mine
- inadequate maintenance of trafficable and vehicle manoeuvring areas on haul roads resulting in an accumulation of fine materials with the potential to generate dust at one mine
- water sprays used for controlling dust at a coal stockpile in the rail-loading area inoperative due to inadequate maintenance, increasing the likelihood of dust emissions during unfavourable wind conditions at one mine
- visual monitoring not being carried out on a regular basis, reducing the effectiveness of dust management associated with the transport and transfer of material at several mines.

Good practices observed during audit inspections that contributed to competent dust control

- Use of a global positioning system as a tool to track the locations of mining and dust suppression equipment (e.g. water carts) and cross-referencing this information with real-time weather monitoring to assist with dust control
- Use of water sprays at each contact or transfer point along the conveyance system which have adjustable rates of application (low, medium and high) depending on dust levels
- Automatic water sprays installed at the ROM hopper bin that produce a fine mist to suppress dust generated with the triggering of sensors when a truck enters the dump zone and automatic sprays activated until a set time following the departure of the truck
- Use of a reclaim tunnel at the product coal stockpile and an enclosed conveyor to transfer coal to the rail loader, both of which minimise dust generation
- Use of a retractable telescopic chute with curtains to load coal into train carriages



Minimising the height between the discharge point and the top of the coal stockpile reduces the potential for dust emissions (photo: R Sherry/DoP).

Storage of material

Material storage areas at coal mines include fine reject material (tailings), coarse reject and overburden, topsoil and coal stockpiles. Stockpiles are often dusty during the movement of materials to and from the stockpiles and are also a source of dust during windy conditions.

Some stockpiles form a crust, which reduces dust formation; other storage areas are managed using water carts and sprinkler or spray systems which may be activated when a pre-determined wind speed and wind direction is reached. The generation of dust can also be minimised by reducing the height of stockpiles; minimising the distance between the end of a conveyor belt and the top of the stockpile; and temporary vegetation.

Orientation of stockpiles so they offer the minimum cross-sectional area to prevailing winds could minimise dust generation. Locating stockpiles behind natural or manufactured windbreaks and the working area on the leeward side of the active piles could also help in minimising wind erosion of the stockpile.

The following issues were identified:

- ineffective use of water carts to reduce dust generation on trafficked areas and at overburden emplacements; due to the height and size of the emplacements and no alternative dust controls available at one mine
- water sprays used for controlling dust at the coal stockpile in the rail-loading area inoperative due to irregular maintenance resulting in dust generation at one mine
- coal stockpiles not provided with an effective water spray system to minimise dust generation at one mine

- no visual monitoring of stockpiles on a regular basis, reducing the effectiveness of dust management at one mine
- a dry tailings dam to reduce potential dust generation and no dust control measures in place to minimise/prevent the emission of dust during unfavourable weather conditions at one mine
- activities under way at several mines in areas outside those approved for mining and thus not currently being regulated may increase the cumulative environmental impact of operations
- coal spills not being removed regularly which could result in dust generation at several mines
- topsoil stockpiles with substantial weed infestation instead of being free of weed and vegetated according to the relevant management plans at several mines
- roads constructed on topsoil stockpiles and machinery operated on these stockpiles at one mine, this disturbance reducing the stability of stockpiles and increasing the potential for wind erosion
- topsoil stockpiles stored at a height greater than 3 metres increasing the potential for wind erosion at several mines, potentially affecting soil viability and the success of rehabilitation and thus increasing the potential for wind erosion.

Good practices observed during audit inspections that contributed to competent dust control

- Automatic sprays installed around the perimeter of the ROM stockpile activated when the wind speed is >6 mm/sec (averaged over 15 minutes)
- Finished product stockpiles formed on an as-needs basis with stockpiled coal loaded out by rail within 24 hours
- A tree windbreak located downwind of the prevailing wind direction to minimise dust from the finished product stockpiles
- Topsoil handling and storage procedures including stockpile inventory, vegetative cover and signage to optimise rehabilitation and minimise wind erosion
- Successful trialling of a chemical dust suppressant on haul roads resulting in a considerable reduction in the amount of water used for dust suppression on haul roads

Exposed areas

During the life of a coal mine large areas of land are disturbed. Areas exposed by mining are significant sources of dust generation. Minimising open areas by strategic planning and rehabilitating mined areas reduces the area available for dust generation.

MOPs prepared and approved under the *Mining Act 1992* require mines to make commitments in relation to the progressive rehabilitation (rehabilitation sequencing) of disturbed areas. The MOP provides an area of rehabilitation the mines are required to achieve on an annual basis and during the total period of the MOP. Rehabilitation of mined areas is a key phase of open-cut mining and involves the use of overburden to refill mined areas, reshaping these areas, replacing topsoil and sowing vegetation.

Inadequate vegetation (less than 70 percent cover) on rehabilitated areas may result in erosion and dust generation from the premises. Selection of vegetation species will depend on the intended land use.

Topsoil is stripped prior to mining and then used as the final layer in rehabilitation areas for the establishment of vegetation. Soil handling and storage needs to follow established best management practices, which include keeping stockpiles less than 3 metres high and weed-free. If weeds are established and they drop seed on topsoil stockpiles, the success of rehabilitation is compromised. This seed contaminates newly completed rehabilitation areas, which leads to vegetation failure and further expensive weed control. It may also lead to greater surface disturbance during maintenance. When establishing vegetation it is important to obtain a good permanent cover quickly to minimise bare ground and the potential for dust emissions.



Progressive rehabilitation minimises dust from exposed areas (photo: S Brooks/I&I NSW).

The following issues were identified:

- exposed areas of overburden emplacement not kept to a minimum or effectively vegetated, increasing the risk of wind erosion, and dust being generated at a number of mines
- inadequate controls in place for managing dust from exposed areas at a number of mines
- additional exposed and disturbed areas observed at one mine which were due to mining activities being carried out in areas beyond those identified in the MOP
- stripping topsoil 12 months in advance of mining without adequate dust controls in place at one mine
- some mines had rehabilitative areas with a high weed content and this can lead to failed vegetation cover that will not provide long-term stabilisation against water and wind erosion
- a lack of signage on stockpiles to ensure minimal disturbance and identification of the stockpiles for future use
- inconsistent recording of quantities of topsoil stockpiled to ensure sufficient topsoil is available for areas to be rehabilitated for the life of the mine.

Good practices observed during audit inspections that contributed to competent dust control

- Successful trialling of broadacre temporary rehabilitation of unshaped overburden emplacement areas by aerial sowing of a cover crop, providing an established vegetative stabilisation to minimise the potential for windblown dust generation
- Constricting the areas and time of exposure of pre-strip clearing in advance of mining development

Management of spontaneous combustion

Some coal types are susceptible to spontaneous combustion where the coal or interburden layers burn without an ignition source being provided. Once burning, these areas often emit strong odours that can be detected off site. All mines need to manage their sites to prevent the occurrence of spontaneous combustion.

The following issues were identified:

- lack of management of areas affected by spontaneous combustion as required by one mine's management plan, specifically in terms of placing inert soil over affected areas
- not all areas affected by spontaneous combustion at one mine adequately mapped – the size and location of all areas prone to spontaneous combustion should be recorded through surveys and maps to ensure that they are appropriately monitored and managed
- one mine not managing all outbreaks of spontaneous combustion around the tailings storage facility on its land
- spontaneous combustion identified as a life-of-mine management problem at one mine due to the nature of the mined coal seams – although management of the issue on the site was noted to have improved over time several isolated outbreaks were observed during the audit inspection, including several within rehabilitation areas.

Bushfire management

Bushfire management in coal mines is an important element in any environmental management plan for a coal mine. Most mines have significant buffer land areas with restricted access and this affects the ability of the Rural Fire Service to manage fires, should they break out on mine-owned land. Should these areas burn in an uncontrolled fashion, significant areas of bare ground will result, creating the potential for dust emissions.

The following issues were identified:

- not all controls in bushfire management plans were implemented at some mines, including lack of consultation with the Rural Fire Service on risk assessments, plans and emergency response procedures at one mine – poor preparation for bushfires can lead to wildfires, which cause air pollution and leave significant areas of exposed bare ground with the potential to generate dust
- one mine lacked a bushfire management plan
- not constructing the required number of bushfire breaks as outlined in its bushfire management plan of one mine
- bushfire breaks constructed at one mine not being maintained and cleared of weeds which could diminish the effectiveness of these breaks in the event of a fire.

Annual environmental management report response action

I&I NSW conducts annual inspections of mines to review their environmental performance. Where improvements are required, these are listed for action in an AEMR inspection report. Should any actions not be completed, a mine's overall environmental performance may be compromised.

The following issue was identified:

- accessible bare and disturbed areas not sown with seed to promote vegetative cover as required in the AEMR action list of one mine and no indication of plans to remedy these areas or other areas of low or flat relief which had the potential for dust to be generated.

Dust monitoring and reporting

It is important that dust emissions from mining operations are regularly and reliably monitored so the level of impact on the surrounding environment can be determined. Dust-monitoring programs are designed to provide quantitative information on ambient dust levels and, providing they are well planned, should also provide information on background dust levels.

Dust levels in the air are commonly measured in two ways:

- concentration – the weight (in micrograms) of dust in one cubic metre of air ($\mu\text{g}/\text{m}^3$); total suspended particles (TSP), PM_{10} and $\text{PM}_{2.5}$ are measured in this manner
- dust deposition rate – the weight (in grams) of dust falling on one square metre over time, usually expressed as $\text{g}/\text{m}^2/\text{month}$.

Concentration can be measured using instruments which draw air through the unit so the dust is collected on filter paper. The most commonly used are the high-volume sampler (hi-vol) and the tapered element oscillating microbalance (TEOM™). Dust deposition gauges also measure how much dust is deposited over time and involves collecting dust within a funnel and bottle. Coal mines should use a combination of these methods to analyse the air-quality impacts of their operations.

Best practice management of dust emissions requires an assessment of the impact of mining activities on dust levels in the surrounding environment and the effectiveness of the controls that may be applied.

Dust monitoring can be used to assess the effectiveness of measures implemented to prevent or minimise dust. A regular review of dust-monitoring data encourages adaptive management and continuous improvement.

The following issues were identified:

- monitoring by one or more of the three methods – PM_{10} TEOM; PM_{10} high-volume samplers; and dust-depositional gauges – not undertaken at the frequency required by the regulatory requirements at several mines
- TEOM, PM_{10} and TSP high-volume samplers and dust-depositional gauges not sited in accordance with the siting requirements contained in regulatory requirements and relevant Australian Standard at several mines
- suspended particulate matter exceeding the concentration levels at one mine
- TEOM PM_{10} monitors and TSP and PM_{10} high-volume samplers not calibrated at the required frequency contained in the relevant Australian Standard at several mines
- TSP not analysed using the test method as specified in the Australian Standard at one mine

- monitoring results not made available online as required and, where results were provided, not updated as required by the relevant approval conditions at one mine
- a brochure outlining potential health and amenity issues associated with exposure to particulate matter not updated and distributed within the specified timeframe at one mine
- monitoring data not recorded in the annual environmental management report at one mine
- quarterly monitoring results not reported to the relevant council as required at one mine
- the telemetry of continuous real-time PM₁₀ monitoring data from a TEOM site was operational intermittently affecting the ability of the mine to make effective operational decisions to minimise potential dust problems
- air quality management procedures using real-time monitoring (TEOM and weather) data to inform the planning of daily operational activities not followed at several mines
- some monitoring results difficult to locate on one mine company's website.



Monitoring equipment collects data and information to help manage site activities and operations (photo: E Howard/DECCW).

Weather monitoring

Real-time weather monitors (e.g. wind speed, direction and rainfall) can be used to manage daily operations and a good understanding of local weather conditions assists in adjusting activities to efficiently and proactively control dust from mining activities. A weather-monitoring system can provide environmental clearance prior to blasting to assist in assessing dumping heights and the location of overburden stockpiles.

A weather station combined with real-time dust monitors can match dust events to both complaints and activities at the mine site. To make accurate decisions, sampling, collection and recording of weather data must be undertaken accurately.

The following issue was identified:

- continuous weather data, such as daily rainfall and wind direction, not recorded to inform any required changes to site operations or to minimise offsite impacts on the surrounding environment at one mine.

Good practices observed during audit inspections that contributed to competent dust control

- Some premises had comprehensive dust-control systems where sprinkler systems to suppress dust on coal stockpiles were controlled by a computer link to a weather station. Contingency plans for dust suppression are also available if automatic controls fail.

Complaints and incidents recording

Complaint registers commonly record the details of public complaints to mine sites. It is important to record the time, nature of the incident, location and action taken to ensure that all supporting documentation and observations are kept for future reference and to better manage the incident. The results of complaint investigations and subsequent follow-up action should also be recorded.

It is good practice to match complaint data with data on both meteorology and ambient dust levels.

The following issue was identified:

- details of when a complaint was received recorded by one mine as required by the statutory instrument.

Management plans

A management plan is a formal document, required in the development approvals process that defines how the project will be executed, monitored and controlled. It may be in summary or detailed and composed of one or more subsidiary management plans or procedural guidelines.

Management plans can ensure effective controls are in place to monitor and proactively address potential air quality issues.

The following issues were identified:

- management plans not available on one mining company's website as required
- some management plans not updated since the original approval was granted, despite a requirement to review and update them within the specified timeframes provided by the approval
- management plans not updated to reflect operational changes at one mine, such as the installation of newer monitoring equipment.

Good practices observed during audit inspections that contributed to competent dust control

- Development of a dust-risk register identifying activities and areas with a relatively high risk of generating dust and the controls used to minimise or mitigate the risk
- Implementing a dust management plan that encourages proactively managing dust generation, such as using dust- and weather-monitoring data and trends identified to plan daily operations
- Implementing a dust management plan identifying reactive management measures, such as relocating equipment or modifying or ceasing mining operations until conditions are alleviated

4 After the audits

Follow up

DECCW, DoP and I&I NSW require any issues identified during the compliance audits to be dealt with by the coal mines to improve their environmental performance. These include:

- ensuring real-time weather data is used to schedule and undertake blasting
- ensuring a sufficient number of water carts are used to minimise dust on haul roads
- providing adequate controls – and ensuring they are implemented – to minimise dust while loading of coal into ROM hoppers and removing any overburden during high-wind conditions
- reducing the tipping speed of coal into the dump hopper when water sprays are inoperative to minimise excessive dust emissions
- dumping coarse reject material and overburden at lower levels or within the pit during unfavourable weather conditions
- undertaking regular maintenance of trafficable and vehicle manoeuvring areas to minimise traffic-generated dust due to the build-up of fine material
- ensuring the progressive shaping and revegetation of overburden emplacement areas, and minimising the exposure behind active mining areas to reduce dust generation
- scheduling the maintenance of water spray systems on coal stockpiles to ensure they are effective
- maintaining tailings dams and trafficable and vehicle manoeuvring areas to reduce the potential for dust emissions
- providing sufficient dust controls (for example, water carts) and establishing temporary vegetation to control and prevent dust from emplacement areas during unfavourable wind conditions
- undertaking regular cleaning of coal spills from haul roads, conveyor-belt lines and loading areas to minimise dust generation
- vegetating topsoil stockpiles to prevent weed infestation and maintaining the best practice height to protect soil viability and prevent wind erosion according to the relevant management plans
- ensuring topsoil stockpiles are identifiable by signage to minimise disturbance by vehicles and machinery
- staging mining activities according to MOPs and keeping exposed areas to the minimum required for mining activities
- promptly rehabilitating exposed and disturbed areas according to the relevant MOP schedule
- managing (including mapping and monitoring) areas prone to spontaneous combustion and sealing heating outbreaks according to the spontaneous combustion management plan
- developing bushfire management plans in consultation with the Rural Fire Service, ensuring controls within the plan are implemented and maintaining bushfire breaks free of weeds
- ensuring listed actions in the AEMR are completed on time and monitoring data is recorded in the AEMR

- collecting data and undertaking dust monitoring at the required frequency to determine any actual or potential environmental impacts
- analysing particulates using the specified test method, and siting and calibrating dust-monitoring equipment as required by the relevant Australian Standards to ensure the accuracy of data collected
- reporting monitoring data to the relevant council and making monitoring data accessible by posting monitoring results on the mine's website
- recording and using real-time monitoring data to inform any required changes to site operations or to minimise offsite impacts
- recording all complaint information as required to assist investigations
- updating management plans to reflect changes that have taken place and making them available on each mine's website.

The follow-up actions have been incorporated into individual DECCW, DoP and I&I NSW work plans to ensure that all issues identified by the audits are being addressed by the mines. A number of mines are already addressing many of these issues as a result of the individual audit report process.

Concurrently with the joint review, DECCW, DoP and I&I NSW have commenced a compliance campaign of all coal mines to ensure the requirements of licences, development approvals and mining leases are being met.

Integration with regulatory reviews

DECCW, DoP and I&I NSW will use the findings of this review to guide the review of environment protection licences, development approvals and mining leases. Section 78 of the POEO Act requires DECCW to review environment protection licences once every five years.

These regulatory reviews:

- focus on desired environmental outcomes
- enhance consistency between regulatory instruments issued to an industry
- improve the effectiveness of the regulatory system
- strengthen each department's accountability to stakeholders.

Integrating these reviews with other regulatory activities, such as inspections, assessments and compliance audit programs, results in a holistic approach to regulation of industry.

The audit findings will also help DECCW, DoP and I&I NSW assess any future applications for new licences, development approvals and mining leases. They will also make sure the regulatory requirements effectively deal with any potential environmental impacts.

5 Dust management system for coal mines

Mining companies should adopt a dust-management system which recognises and responds to the issue of dust emissions at all stages of mining from mine planning, establishment 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.

This section of the report outlines an approach for implementing a dust-management system incorporating best environmental management practices for managing dust from coal mining operations. Further information on techniques available for managing dust from coal mines is contained in the publication prepared by Katestone Environmental Pty Ltd, *NSW mining benchmarking study: international best practice measures to prevent and/or minimise emissions of particulate matter from coal mining*.

Best environmental dust-management practices provide coal mines with demonstrated techniques in monitoring and control. They encourage proactive community consultation regarding dust issues. The success of best practice dust management depends on a joint commitment by management and workers to adopt dust-control techniques which recognise and respond to the potential health and environmental impacts, and take into consideration the concerns of neighbouring communities. In practice, effective dust management requires dust-management responsibilities to be set for all levels of personnel, incorporating dust management within standard operating procedures, and routine inspection, corrective action, audit and review to ensure a process of continual improvement.

Approaches to dust management

Generally there are two types of controls used for managing dust from coal mines: **management controls** and **engineering controls**.

Management controls – avoidance

Coal mines can prevent or minimise dust generation by avoiding certain coal mining activities or restricting such activities to certain areas or at certain times. It is important to use real-time and forecast weather information to plan activities and anticipate conditions that may give rise to dust emissions. It is also important to monitor the effectiveness of the mitigation measures implemented and feed this information back into regular reviews of dust-management procedures.

However, not all coal mining activities can be avoided or restricted at all times and therefore management controls should be integrated with engineering controls to provide an efficient dust management approach to prevent or minimise dust from coal mining activities.

Engineering controls

Engineering controls are generally divided into three different approaches: containment, suppression and collection.

Dust containment

Containment is the mechanical control and confinement of dust at the source. It is the most fundamental step in controlling dust emissions. By incorporating effective systems to contain dust at the source, overloading of the dust-suppression and dust-collection systems can be avoided, improving their chances for success.

Dust-suppression systems

Dust suppression is the application of water or chemically treated water in some manner of spray or fog to prevent fine particulates from being emitted off the surfaces of haul roads, stockpiles, conveyors, dump hoppers, etc. into the air. There are a number of mechanical systems used for this purpose, ranging from water carts and manually operated sprinklers, to automated sprinkler systems triggered by wind speed or vibration.

Dust collection

This involves passing the air carrying dust from the source through some form of filtration system. There are passive systems, which merely allow the air to pass through the filters, and active systems, which pull the air in like a vacuum cleaner to remove solids.



Automated sprays are used at a ROM hopper to reduce fugitive emissions (photo: B Green/DECCW).

Coal mines should evaluate all three engineering controls separately and together to determine the most effective and efficient way to manage dust from each coal mining activity, and then integrate them into a dust management system that forms a combined defence to act together with management controls that prevents or minimises the emission of dust. It is important to incorporate this system of dust management into standard operating procedures and implement ongoing staff training.

Table 3 summarises the best practice management and engineering controls that could be used in an integrated way to establish and implement a dust-management system to minimise dust from coal mines.

Table 3 Summary of approaches to dust management for coal mining activities

Approaches	Control measure	Dust source/activity
Avoidance	<p>Training and implementation of standard operating procedures</p> <p>Plan activities using forecast and real-time weather-monitoring data</p> <p>Real-time weather monitoring data and local activity-based observations of dust emissions should be used to direct the application of dust controls</p> <p>Restrict activities or cease activities during unfavourable weather conditions</p> <p>Limit exposed areas, minimise pre-strip, minimise out-of-pit dumping and maximise in-pit dumping</p> <p>Inspect and maintain dust-suppression equipment regularly and keep spares on site for critical items</p> <p>Design haul roads to take the most direct route, add speed humps and enforce speed restrictions</p> <p>Orientate stockpiles to offer the minimum cross-sectional area to prevailing winds</p> <p>Revegetate disturbed areas through active planting</p>	<p>Exposed areas/land clearing and topsoil stripping</p> <p>Blasting</p> <p>Haul roads</p> <p>Transfer of materials</p> <p>Maintenance of dust-control equipment</p> <p>Dumping to emplacement areas</p> <p>Stockpiling</p> <p>Rehabilitation</p>
Containment	<p>Provide a cover of temporary vegetation on stockpiles not being used for extended periods</p> <p>Use enclosures to contain dust emissions around a dust source, such as screens and crushers</p> <p>Partially or fully enclose conveyors</p> <p>Minimise dump height and rate from trucks or by using telescopic chutes for loading</p> <p>Regularly resurface high-traffic areas to reduce build-up of fine materials</p> <p>Install or establish artificial or natural wind breaks such as trees or bund walls</p>	<p>Exposed areas</p> <p>Haul roads</p> <p>Stockpiling</p> <p>Crushing/screening</p> <p>Conveying materials</p> <p>Coal loading</p> <p>Rehabilitation</p>

Approaches	Control measure	Dust source/activity
Suppression	<p>Apply water as a dust suppressant at all stages of coal mining as required</p> <p>Use water carts equipped with sprinkler systems and water cannons</p> <p>Use automatic sprinklers that are triggered by wind speed/direction or vibration</p> <p>Use appropriate chemical dust suppressants</p>	<p>Land clearing and topsoil stripping</p> <p>Haul roads (transport of material)</p> <p>Drilling</p> <p>Stockpiles (topsoil/overburden/coal)</p> <p>Conveying materials</p> <p>Coal loading</p> <p>Rail loading</p> <p>Exposed areas</p> <p>Rehabilitation</p>
Collection	<p>Equip drilling rigs with dust-collection devices such as bag filters or filter cartridges</p> <p>Equip crushing/screening equipment with dust collection devices such as cyclones and bag filters</p> <p>Equip return-ends of conveyors with collection systems to ensure that spills are collected and properly disposed</p>	<p>Drilling</p> <p>Crushing/screening</p> <p>Conveying materials</p> <p>Coal loading</p> <p>Rail loading</p>

6 Related initiatives

The coal mine audit campaign on dust management sits within a broader strategic framework for the control of dust emissions and managing dust impacts from the coal mining industry. Related initiatives are outlined here.

Strategic environmental compliance and performance review – industry monitoring

In 2009 DECCW completed a review of industry monitoring, focusing on monitoring requirements on environment protection licences across various industry types within NSW.

A summary report on the review includes:

- guidance on how industry – including the coal mining industry undertaking dust monitoring – can improve its environmental performance by implementing best environmental management practices for undertaking monitoring, including collecting and recording data, analysing and converting data, assessing information for reporting and communicating results
- information on how industry can use data to manage site operations.

Further information

For further information about the *Strategic environmental compliance and performance review: industry monitoring*, see www.environment.nsw.gov.au/resources/licensing/09695indmon.pdf

Independent review of cumulative dust impacts – Camberwell Village

An independent review of regional mining impacts (including dust) on Camberwell Village in the Upper Hunter Valley was commissioned by the Department of Planning in 2009. The report presents the findings of the review in relation to local air quality in and around Camberwell Village. It identifies the measures employed by the surrounding coal mines in relation to air quality management and reviews best management practice for dust.

Further information

Independent review of cumulative dust impacts – Camberwell Village, is available on the DOP website at: www.planning.nsw.gov.au/LinkClick.aspx?fileticket=waS1Eif7MY8%3d&tabid=70&language=en-AU

Recent government initiatives

The NSW Government is currently implementing several initiatives to better manage the impacts from coal mining in the Hunter Valley in response to the Camberwell cumulative impact review. These initiatives include:

- establishing a Health Air Quality Expert Panel to provide advice on the health impacts of air quality

- employing three Department of Planning compliance officers in the Upper Hunter to monitor and enforce compliance with conditions of approval and develop and implement strategies for sustainable coal mining in the region
- establishing the Upper Hunter Air Quality Monitoring Network to provide real-time data on air quality in the region
- requiring mines to employ best practice dust-control measures
- ensuring residents living close to mine sites are fully informed of the potential health impacts of mining operations.

NSW regulatory initiatives

Industry & Investment NSW

I&I NSW is currently implementing the reforms brought about by the *Mining Amendment Act 2008* (some parts have already commenced). The key objectives of this Act are to:

- incorporate the principles of ecologically sustainable development within the Act
- broaden the definition of the environment to identify all potential impacts of activities
- strengthen certain environmental management conditions by making them statutory requirements
- strengthen enforcement provisions of the Act, consistent with similar provisions in other legislation
- streamline administration of mining in NSW and reduce unnecessary red tape.

The amendments are intended to provide greater certainty to industry and stakeholders regarding the rights and obligations associated with carrying out mining and exploration activities in the state. The amendments also ensure that the regulation of mining is consistent with contemporary environmental standards, community expectations and recent developments in the NSW environmental regulatory framework.

Amendments were made to the *Mining Act 1992*. A small number of these commenced on 1 August 2008. Most of the remainder of the amendments commenced on 1 November 2010. These are all contained within the *Mining Amendment Act 2008*. Other provisions are yet to commence. They include those relating to approvals for exploration activities, rehabilitation and environmental management, and compensation agreements for mineral claims. These will start at a later date.

The rehabilitation and environmental management plan (REMP) is contained in those provisions which have not yet commenced. This REMP is intended to be a comprehensive and detailed management plan. Among other things, it will identify how and when impacts from mining will be rehabilitated. The REMP is the fundamental tool by which the *Mining Amendment Act 2008* aims to achieve improved environmental outcomes. The REMP provisions are intended to replace the existing requirements for mining operations plans and subsidence management plans. However, commencing the provisions in the *Mining Amendment Act 2008* relating to REMPs has been delayed so that further consultation with other government agencies can occur with the purpose of achieving a consistent, whole-of-government approach to rehabilitation and other aspects of environmental management of mining.

For further information, refer to www.dpi.nsw.gov.au

Appendix A: Coal mines audited

Individual compliance audit reports for these premises are publicly available in DECCW's library (level 15, 59 Goulburn Street, Sydney, phone (02) 9995 5302), DoP's public library (Level 8, 10 Valentine Avenue, Parramatta NSW 2150, phone (02) 9860 1042) and I&I NSW Maitland Office (516 High Street, Maitland, phone (02) 4631 6666).

Accountable party	DECCW Environment Protection Licence no.	DoP Development Approval no. (DA) Major Project Approval no. (MP)	I&I NSW Mining Lease no. (ML) Consolidated Lease no. (CL)*
Anglo Coal (Drayton Management) Pty Ltd (Drayton coal mine)	1323	MP 06_0202	ML 1531, CL 229, CL 395
Ashton Coal Operation Pty Ltd (Ashton coal mine)	11879	DA 309-11-2001-i	ML 1437
Boggabri Coal Pty Ltd (Boggabri coal mine)	12407	–	CL 368
Camberwell Coal Pty Ltd (Camberwell coal mine)	3390	DA 86/2889, MP 06_0073	ML 1630, CL 357
Coal & Allied Operations Pty Ltd (Hunter Valley Operations)	640	MP06_0261	ML 1634
Glennies Creek Coal Management Pty Ltd (Glennies Creek Colliery)	7622	DA 105/90, MP 06_0057, MP 06_0213	ML 1437, ML 1518, 1525
Hunter Valley Energy Coal Pty Ltd (Mt Arthur Coal)	11457	DA 144-5-2000, MP 06_0091, MP 06_0108	ML 1487, ML1548
Thiess Pty Ltd (Mt Owen coal mine)	4460	MP 14-1-2004	ML 1355, ML 1561, CL 363
Wilpinjong Coal Pty Ltd (Wilpinjong coal mine)	12425	–	ML 1573

*Note: For relevant MOPs refer to I&I NSW's individual audit reports.

Glossary

Ambient (dust) monitoring	Ambient monitoring is the systematic, long-term assessment of pollutant levels by measuring the quantity and types of certain pollutants in the surrounding, outdoor air
Annual environmental management report (AMER)	Annual reporting of the coal mine's progress against the MOP
Appropriate regulatory authority	The EPA, a local authority or a public authority prescribed for the purposes of section 6(3) of the POEO Act
Audit	A systematic, independent and documented verification process of objectively obtaining and evaluating audit evidence to determine whether specified criteria are met
Audit criteria	The audit criteria are defined requirements against which the auditor compares collected audit evidence and criteria may include regulatory requirements, standards, guidelines or any other specified requirements
Calibration	The act or process of calibrating; to measure and check the accuracy of an instrument
Coal works	Any activity (other than coke production) that involves storing, loading or handling coal (whether at any coal loader, conveyor, washery or reject dump or elsewhere) at an existing coal mine or on a separate coal industry site
Compliance	There is sufficient and appropriate evidence to demonstrate the particular requirement has been complied with and is within the scope of the audit
Conveyor system	Mechanical handling equipment (which may include a belt, chain or shaker) used to move coal or other materials from one location to another
Cyclone	A piece of pollution control equipment that removes particulates from an air stream using a high-speed rotating air flow within a cylindrical or conical container without the use of filters
Deposited matter	Any particulate matter that falls from suspension in the atmosphere
Development consent	Consent under Part 4 of the <i>Environmental Planning and Assessment Act 1979</i> or an approval under Part 3A of that Act to carry out development and includes, unless expressly excluded, a complying development certificate

Drag line	A type of excavating equipment that casts a wire rope-hung steel bucket a considerable distance; it collects the dug material by pulling the bucket toward itself on the ground with a second rope, elevates the bucket and dumps the material on a spoil bank, in a hopper, or on a pile.
Dust	Dust is a generic term used to describe fine particles that are suspended in the atmosphere. The term is non-specific with respect to the size, shape and chemical make-up of the particles. Particles as small as a few nanometres and as large as 100 microns (μm) have been measured in the atmosphere. Dust is formed when fine particles become entrained in the atmosphere by the turbulent action of wind, the mechanical disturbance of fine materials or through the release of particulate-rich gaseous emissions. The concentration of particles in the atmosphere can range from a few micrograms to hundreds of micrograms per cubic metre ($\mu\text{g}/\text{m}^3$) in highly polluted areas.
Dust depositional gauge	Apparatus to collect particles that settle from the ambient air. Usually collected over a given sampling period to determine the mass deposition of dust from ambient air.
Emplacement area	<p>(a) Any pile, heap, hole, excavation or place in which, or on which, reject (whether in a solid state or in a solution or suspension) is piled, heaped, dumped, accumulated, deposited or placed, and</p> <p>(b) Any wall or other structure that retains or confines reject, whether or not that wall or structure is itself composed of reject but does not include an accumulation or deposit of reject situated underground.</p>
Environment Protection Licence (EPL)	A licence that authorises the carrying out of scheduled development work or scheduled activities or controls water 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
Fugitive dust	Dust derived from a mixture of not easily defined sources. Examples include dust generated from vehicular traffic on unpaved roads, materials transport and handling and unvegetated soils and surfaces. Mine dust is commonly derived from such non-point sources.
Global positioning system (GPS)	A satellite-based navigational system permitting the determination of any point on Earth with high accuracy
Haul roads	Roads used to transport extracted materials by truck around a mine site

High-volume sampler (HVS)	A device for sampling large volumes of an atmosphere for collecting the contained particulate matter by filtration. Consists of a high-capacity blower, a filter to collect suspended particles and a means for measuring the flow rate (PM ₁₀ or TSP).
Hopper	A vessel into which materials are fed, usually constructed in the form of an inverted pyramid or cone terminating in an opening through which the materials are discharged (not primarily intended for storage)
Interburden	Material of any nature that lies between two or more bedded ore zones or coal seams. This term is primarily used in surface mining.
Leeward	The direction downwind from the point of reference
Measurement	The act or process of assigning numbers according to a rule. It is the process of estimating the magnitude of some attribute of an object, such as its length, weight or depth relative to some standard (unit of measurement), such as a metre or a kilogram. The term is also used to indicate the number that results from that process.
mg	Milligram ($g \times 10^{-3}$)
Micron	Unit of measure – also referred to as a micrometre, μm (metre $\times 10^{-6}$)
Mining for coal	Meaning the mining, processing or handling of coal (including tailings and chitter) or related mining activity at underground mines or open-cut mines
Mining lease	A lease granted under Part 5 of the <i>Mining Act 1992</i> ; includes a consolidated mining lease
Mining operations plan (MOP)	A plan documenting site activities and progress towards the required environmental and rehabilitation outcomes
Monitoring	To be 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.
Non-compliance	Clear evidence has been collected to demonstrate the particular requirement has not been complied with and is within the scope of the audit
Nuisance dust	Dust which reduces environmental amenity without necessarily resulting in material environmental harm. Nuisance dust generally comprises particles greater than 10 micrograms.

Open-cut (mining)	Mining carried out on, and by excavating, the Earth's surface for the purpose of extracting ore/coal, but does not include underground mining
Overburden	Material of any nature that overlies a deposit of useful materials, ores or coal – especially those deposits mined from the surface by open cuts
PM₁₀	Particulate matter (PM) less than 10 microns in size
PM_{2.5}	Particulate matter (PM) less than 2.5 microns in size
Project approval	An approval to undertake a development project issued by the Minister for Planning, or delegate, under Part 3A of the <i>Environment planning and Assessment Act 1979</i>
Reclaim tunnel	A tunnel used to reclaim coal from an open stockpile. The open stockpile sits on top of the reclaim tunnel and coal falls by gravity through valves or reclaim ports to the reclaim transport device below (usually a belt conveyor). Some of the coal will be reclaimed by gravity alone, with the remainder needing to be pushed into the chutes/ reclaim ports by dozer.
Run-of-mine (ROM)	Ungraded coal of mixed sizes as it comes from the mine
Sample	A portion, piece or segment that is representative of a whole
Scope (of the audit)	The scope defines the extent and boundaries of the audit such as locations, organisational units, activities and processes to be audited, and the time period covered by the audit
Seam	A stratum or bed of coal or other mineral; generally applied to large deposits of coal
Siting (of air quality monitoring equipment)	The selection of a sampling location(s) to determine the influence of emissions at the nearest sensitive receiver(s)
Strategic environmental compliance and performance reviews	Reviews that combine assessing compliance with legislative requirements and reviewing best environmental management practices to encourage improved environmental performance
Tailings dam	A waste storage area often used to store washed coal reject (coarse and/or fine reject). The waste material is often stored as a slurry and may be dewatered to recover water and, in some instances, any viable coal.
Tapered element oscillating microbalance (TEOM™)	A method which provides a direct measure of the mass concentration of particles

Telescopic chute	A chute consisting of parts which slide within one another like the tubes of a jointed telescope, and thus capable of being extended or shortened. Used to direct, and minimise, the fall height of material being loaded or stacked.
Temperature inversion	An increase in the temperature of the air with increasing height. Low-level inversions often occur with fogs, and they also act like a lid to trap pollutants including dust, resulting in localised air pollution.
Test method	Means a test method prescribed by the <i>Approved methods for the sampling and analysis of air pollutants in NSW</i>
Total suspended particles (TSP)	Particulate matter with a diameter up to 50 microns
µg	Microgram ($\text{g} \times 10^{-6}$)
µm	Micrometre or micron ($\text{metre} \times 10^{-6}$)

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