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Department for Energy and Mining

Mineral Regulatory Guidelines

MG42

Air quality assessment and monitoring



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Contents

Purpose 5

Objective 5

Background 5

Roles and responsibilities 5

Air quality impacts on public health 6

Particulate matter 6
Respirable crystalline silica 6
Asbestiform minerals 7
Public Nuisance impacts 7
Total suspended particles 7
Deposited dust 8

Air quality screening 8

Preliminary screening assessment tool 8

Air quality quantitative assessment 9

Dispersion modelling 9

Selection of air quality indicators 9
Baseline data collection and background levels 9
Dispersion modelling scenarios 9
Interpretation of the modelling results 9
Validation of dispersion modelling 10

Dispersion modelling assessment criteria 10

Public nuisance 10
Chemical impacts from dust deposition 11

Air quality qualitative assessment 11

Developing outcomes and criteria 12

Measurement criteria overview 12
Leading indicator criteria overview 12

Multi-operator complex zones 12

Dust monitoring and management 13

Hot spot monitoring 13
Screening monitoring 13
Dust deposition monitoring 13
Non-continuous ground-level concentration monitoring 14
Continuous compliance monitoring 14
Hybrid monitoring networks 15
Meteorological monitoring 15

Wind speeds *15*
Publishing monitoring data *15*

Compliance **16**

Dust complaints and incidents 16

Complaint investigation *16*
Initial incident report *17*
Annual compliance report *17*

Control strategies 17

Major dust sources and control strategies *17*
Air quality management plans *18*
Trigger and response plan *18*

Toolkit **19**

Community dust diary *19*
TARP example *20*
TARP response levels example *20*
Control strategies and mitigation *21*

Index of tables *27*

Resources **29**

References **29**

Glossary **30**

Purpose

The purpose of this guideline is to assist tenement holders to undertake assessment of air quality on a mine site to protect impacted communities from impurities caused by the operation.

Objective

This guideline sets out expectations for industry to perform consistent and compliant air quality assessment and management.

The document is framed in four parts, and covers:

- air quality screening and assessment
- setting outcomes and criteria
- control strategies and compliance
- supporting material.

A note to operators that this guideline uses some technical terminology about air quality. Refer to the glossary for further assistance.

Background

The quality of the air we breathe can be affected by surrounding works from urban developments, transport emissions, industrial and agricultural activity.

Relatively low levels of air pollution can have adverse effects on our health, wellbeing and environment. It is therefore critical that management measures for dust and other air pollutants are put in place to avoid emissions and improve health outcomes for communities.

Responsible air quality management is a requirement for the South Australian resource industry to continue to deliver low carbon energy and products for future of South Australians.

Roles and responsibilities

The Department for Energy and Mining (the department) and the South Australian Environment Protection Authority (EPA) co-regulation air quality impacts related to the mineral resources industry. Both departments use a risk and outcome based regulatory approach to ensure operators are held accountable for achieving approved environmental outcomes.

The department administers the requirements of the *Mining Act 1971* (the Act), while EPA administers the *Environment Protection Act 1993* (EP Act).

Operators must comply with ambient air quality management practices, which includes screening, monitoring, assessment and reporting data findings as part of their ongoing record keeping through the life of mine.

Air quality impacts on public health

Airborne particulate matter (PM) is all solid and liquid particles suspended in the air including dust, pollen, water vapour and smoke. PM has the potential to produce poor air quality and cause adverse impacts on the human health and the environment.

Particulate matter

Elevated concentrations of fine PM can enter the upper airways, lungs and blood stream, which can cause a range of short and long-term illnesses. These fine particles are categorised by an aerodynamic diameter equal to or less than 2.5 micrometres ($PM_{2.5}$), or an aerodynamic diameter equal to or less than ten micrometres (PM_{10}).

Most PM produced from resource industry operations is PM_{10} and makes up more than 50% of total dust leaving the site. It is usually generated by physical processes such as drilling, blasting, processing, truck movements on haul roads, or from wind erosion of disturbed areas.

Generally, lower levels of PM are produced by resource industry operations, caused by combustion, for example engine and wood fire smoke and naturally in pollen.

PM_{10} is the appropriate primary environmental indicator to be measured for public health impacts generated by resource industry operations, with $PM_{2.5}$ also included as secondary measure as required.

Respirable crystalline silica

Silica is one of the most common naturally occurring compounds in the earth's crust and a major component of rocks and soil, usually found in quartz.

Respirable crystalline silica (RCS) is PM generated from fracturing rocks that contain crystalline silica minerals, to a size small enough to enter the lungs. RCS can enter the lungs and cause silicosis disease, which forms scar tissue and reduces the lung capacity over time.

Potential for community exposure to RCS is significantly lower than those that encounter it in workplaces where materials are cut, sanded or drilled, creating fine dust. The national workplace exposure limit (or WEL) for respirable crystalline silica over an eight-hour time weighted average is 0.05mg/m^3.

For more information on silica, refer to:

Interim criteria for respirable crystalline silica concentration in ambient air for mining and extractive industries, EPA.

Silicosis in mining and quarrying in South Australia, DEM.

Asbestiform minerals

Asbestiform minerals are naturally formed mineral groups known for their fibrous properties, with the most common forms of asbestos belonging to two mineral groups: serpentines and amphiboles. When disturbed and allowed to enter the atmosphere as dust, asbestos can cause a range of detrimental diseases if inhaled by humans, including cancers of the lung.

Due to these health risks, Australia imposed a total ban on the mining, manufacture and use of asbestos on 31 December 2003. However, our past use of asbestos means that asbestos-containing materials still exist in our built environment.

If asbestos is present on a site, asbestos management procedures are likely to be required in the mining program and may be required to have measurement criteria as an Air Quality Objective.

If rock types may have naturally occurring asbestos within the disturbance area, further assessment to identify the location and quantities of asbestos will be required on a case-by-case basis.

For more information on asbestos, visit Asbestos safety materials, Asbestos Safety and Eradication Agency.

Public nuisance impacts

Environmental nuisance, such as offensive odour, loud noise, dust and light, can be disruptive and interfere with daily activities when experienced by the community. Companies must comply with the General Environmental Duty (section 25 of the EP Act) to avoid environmental nuisance.

Total suspended particles

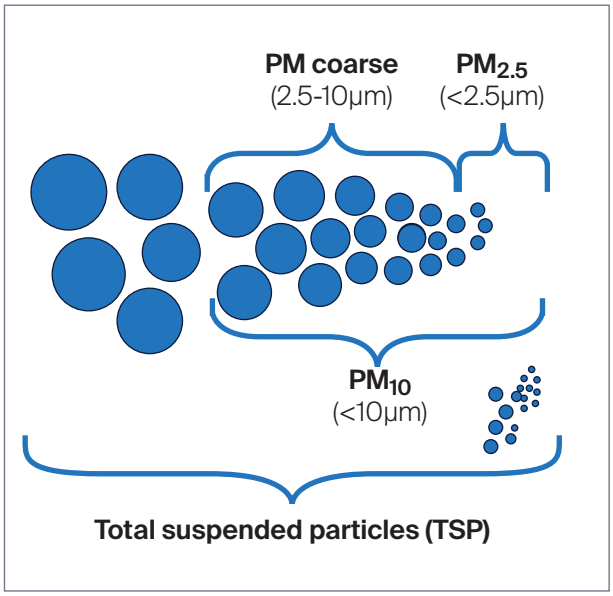
Total Suspended Particles (TSP) is the total concentration of airborne PM suspended in the atmosphere and is made of $PM_{10\text{-}2.5}$ (see figure 1).

Up to 50% of the dust generated by the resource industry is larger than PM_{10} and these larger particles are not generally associated with health impacts.

Rather, TSP can have nuisance impacts, including loss of visibility on roads, unpleasant visible dust plumes, and depositional impacts on surrounds (eg dust on nearby houses and cars).

These visual indicators are used by the community to judge the performance of the operator in controlling particulate matter emissions from a site.

Figure 1 **Particulate matter sizes**



PM sizes diagram shows the TSP size range including PM10 inhalable particles with diameter <10 µm, and fine fraction penetrative particles with diameter <2.5 µm.

Deposited dust

Deposited dust can have a range of nuisance impacts due to dust coating property, which may lead to a loss of enjoyment of the outdoor environment or a requirement for excessive cleaning of items such as cars, air-conditioning filters and outdoor furniture.

Excessive levels of deposited dust can also cause economic impacts to primary production (eg spoiling crops and plants by covering them and obstructing photosynthesis), or damage to neighbouring property like solar panels and within rainwater tanks.

Operators should use the Australian Standard 3580.10.1:2003 to provide a quantitative measure of dust deposition levels.

Air quality screening

It is recommended that proposed operations undergo ambient air quality assessments for potential impacts and identify appropriate management controls.

Air quality assessment may be required for a mining proposal, a change in operations proposal, a revised program for environment protection and rehabilitation (PEPR) or mine operation plan (MOP).

In some instances, assessment may indicate the need for further investigation of ground level impacts.

Preliminary screening assessment tool

To determine the level of assessment required for ambient air quality, it is recommended a company use the preliminary screening assessment to measure public health and public nuisance impacts. See Index Table 1 for an example of the input and output data in the preliminary screening assessment tool.

Refer to Index table 3 and 4 in the appendix for input and output examples.

Air quality preliminary screening assessment tool	
Air impact assessment required	Level 1
Distance to urban boundary (m)	5
Distances to nearest exposed sensitive receptor (m)	5
Annual production (kT)	100
Disturbed footprint (ha)	1000

Figure 2 *Sample of Preliminary Screening Assessment Tool outputs.*

The screening assessment tool with the inputs in the left column and the output fields in the right-hand column. The 'Air impact assessment required' field shows the level of assessment expected (Level 1).

Air quality quantitative assessment

Outputs from the preliminary screening assessment tool may determine that the operator should undertake further quantitative assessments.

The following will outline some of the ways operators can use quantitative methods for required assessments. Assessments allow operators, and their results, allow for operators to then introduce control strategies to keep them at safe levels.

DISPERSION MODELLING

Dispersion model scenarios (modelling) is required for each life-of-mine stage. This may include any activity with earthworks, scoping, rehabilitation, or closure plans, especially where the site has a tailings storage facility and/or a large area of disturbance.

The objective of dispersion modelling is to estimate the maximum ground-level concentration (GLC) of airborne pollutants at sensitive receptor locations. The maximum predicted GLCs are compared to assessment criteria for each indicator to determine the level of impact at each sensitive receptor location.

Selection of air quality indicators

Dispersion modelling used to predict the level of impact to human receptors should provide predicted GLCs for the following indicators:

- PM_{10}
- $PM_{2.5}$
- Dust deposition.

Modelling may also include predictions of TSP for nuisance impacts, and any additional site-specific pollutants (eg silica, asbestiform minerals) as required by the department and EPA.

Baseline data collection and background levels

Site-specific baseline data for indicators should be collected for a minimum period of 12 months to account for seasonal variation. The collection of baseline data is required to:

- determine the existing air quality prior to proposed new or modified mining or quarrying operations
- determine background GLCs to be added to the model output for each indicator in the dispersion models.

Dispersion modelling scenarios

Operators should input the maximum production rate expected for each modelling scenario to simulate the worst-case scenario for each stage. The modelling may also include a likely or average production rate for each scenario to compare with the maximum production rate.

Interpretation of modelling results

The assessment must outline any uncertainties and assumptions in the model that may affect the results eg variable production rates, water availability for dust suppression etc.

If predicted GLCs at the receptor location remain greater than the assessment criteria with the additional control strategies applied, the following alternative measures should be considered:

- Modification of the proposed production rates and/or proposed scale of operation to reduce dust-generating activities.
- Alternative location and/or operational time schedule of the activity.
- Conducting a more detailed assessment, noting that dispersion model scenarios can be overly conservative.

Validation of dispersion modelling

Where dispersion modelling is undertaken for the expansion of an existing operation, the model can be validated by monitoring.

Modelling will require meteorological inputs measured from the site at the time of monitoring. To validate the accuracy of the model of predicted conditions, consider comparing the historical conditions to the actual measured conditions.

DISPERSION MODELLING ASSESSMENT CRITERIA

Once predicted conditions are identified, they can be considered against the modelling assessment criteria. The criteria used in the quantitative assessment (dispersion modelling scenarios) are also used to identify the operational measurement and leading indicator criteria (see page 12).

The modelling shows compliance can be achieved in proposed or existing operational air quality environmental outcomes and/or objectives.

Public nuisance

An operator may need to provide a dispersion modelling scenario to show dust deposition levels at a sensitive location of no greater than 4g/m2/month and/or no greater than 2g/m2/month above background air quality.

The calculation period selected for the assessment criteria (eg monthly measurement, 4-month rolling average, 12-month rolling average) must be an appropriate timeframe to ensure potential impacts are assessed, and an explanation for the calculation period selected must be provided.

The department will make an assessment of the potential nuisance impacts based on the dispersion modelling scenario, including:

- likelihood of dust generation from the site
- effectiveness of the proposed control strategies
- monitoring and contingencies
- sensitivity of the location
- any affected views
- severity of impact on the sensitive receptors
- impact on the environment, vegetation, land and property.

These receptors are only required to be assessed when there are expected or uncertain impacts from dust deposition.

The assessment criteria that the modelling results are compared to should be developed on a case-by-case basis by a suitably qualified professional.

Operators who undertake dispersion modelling scenarios but elects not to engage a suitably qualified practitioner to develop site-specific assessment criteria should use a conservatively low criterion for deposited dust of 4g/m2/month.

Chemical impacts from dust deposition

Where dust deposition may contain metals or other chemicals, baseline data collection and dispersion modelling may be required to demonstrate that impacts to receptors such as aquatic environments, livestock (consuming dust-affected fodder or water), water tanks and soil quality are acceptable.

Assessment criteria for potential impacts of this nature in a mining proposal, change in operations application or MOP/PEPR revision will require development on a case-by-case basis in consultation with the department and other relevant agencies.

Air quality qualitative assessment

Some air quality impacts on receptors may only be measured using qualitative assessment. Qualitative criteria are used when an outcome cannot be measured through a quantifiable legislated or recognised standard.

A qualitative assessment of potential dust impacts must include:

- Identification of the potential sources of dust on the site.
- Control strategies to mitigate the dust from each of the sources.
- Sensitive receptor locations and the potential nuisance impacts caused by dust plume, dust deposition on property, and/or physical irritations.
- Weather conditions that may risk dust generation and create a pathway for the dust to reach the sensitive receptor weather and/or dust monitoring details.
- Contingencies that can be applied to where dust generated from the operation are predicted or observed to cause a potential impact on a sensitive receptor (see Appendix).

In these instances, operators may use the department source-pathway-receptor framework to identify potential determine qualitative control strategies for each potential impact.

For more information about dispersion modelling, refer to the EPA Ambient Air Quality Assessment Guideline.

Developing outcomes and criteria

An outcome or objective is a statement of the agreed level of impact on an environmental receptor. Each air quality impact outcome and/or objective identified by an operator in the PEPR or MOP must have associated measurement criteria that are used to demonstrate achievement of the outcome.

Measurement criteria overview

Measurement criteria must specify:

- what and how an outcome will be measured
- where the measurements are taken, and how those locations are determined
- what constitutes achievement of the outcomes (with consideration being given to any inherent errors of measurement)
- frequency of measuring or monitoring
- any background or control data that is used, and the data is acquired.

Leading indicator criteria overview

Leading indicators provide early warning that the control strategies may not result in the achievement of an outcome, giving time to respond accordingly.

Where there is a high level of reliance on control strategies to reduce risk to the environment and achieve outcomes, leading indicator criteria should be developed in accordance with Regulation 63(1)(d) of the Mining Regulations 2020.

For more information about setting outcomes, refer to MG30 Development of environmental outcomes for quarrying and mining.

MULTI-OPERATOR COMPLEX ZONES

A multi-operator complex zone (MOCZ) is a cluster of mining tenements operated by two or more proponents. The closeness of the tenements to each other can make it challenging to accurately identify specific PM sources causing offsite impacts.

Instead, regulation of operations within a MOCZ may have a greater focus on dust mitigation in the measurement criteria to demonstrate achievement of the air quality outcome. The measurement criteria may require that each operator develop a Trigger Action Response Plan (TARP) and keep records to show that the TARP has been followed.

Continuous monitoring may be undertaken at the perimeter of the zone where the risk of offsite impact is high, and the costs may be fairly distributed throughout the operators within the MOCZ. The monitoring should inform daily PM management, and trigger investigations where the Air Environment Protection Policy (EPP) maximum GLCs are exceeded.

Hotspot monitoring may also be conducted within the MOCZ to identify individual sources of PM causing a significant contribution to total load leaving the zone.

DUST MONITORING

Monitoring for PM at or nearby a mine site may be undertaken for a range of outcomes, and a range of monitoring methods exist to suit specific purposes, including:

- informing site dust management activities
- identifying sources of dust emissions (hot spots) on site
- preliminary screening monitoring to detect if a dust issue is present requiring further investigation
- measuring long-term trends in airborne and deposited dust
- monitoring for a human health indicator against a compliance standard.

Hot spot monitoring

Hot spot monitoring is used to identify specific sources of dust generated from an operation. It is conducted over short-term periods until a significant dust source is identified and managed.

Hot spot monitoring requires continuous monitors that should have a precision and bias error less than 30% for absolute measurements over a 24-hour period and must be able to effectively detect spikes in PM concentrations when they occur.

Monitors should provide a short averaging period (10 minutes or less) to identify the precise location.

Screening monitoring

Operators should use screening monitoring to investigate unresolved dust complaints. While the monitoring equipment is not required to provide accurate absolute measurements, it must provide a level of accuracy and precision to determine spikes in PM concentrations at the time that they occur.

Screening monitoring may include one or more monitors in a network to determine if:

- the PM level measured downwind of a site is significantly higher than background concentrations
- the PM level measured during site operations is significantly higher than when the site is not operational.

Screening monitors should provide a short averaging period (10 minutes or less), include real-time wind measurements, with inbuilt telemetry to communicate data to a web-based platform.

Where screening monitoring is undertaken at the request of the department and/or EPA, the monitoring will usually be requested to take place during the months with elevated risks of dust impacts for a period of at least six months.

Dust deposition monitoring

Dust deposition monitoring involves the passive collection of dust over a time for assessing rates and trends of potential public health and environment nuisance impacts.

It is a method for sampling particulate matter that is deposited from the atmosphere, and procedure for gravimetric determination of the mass deposition rate of insoluble solids, ash, combustible matter, soluble solids and total solids from ambient air.

Using this method, samples from dust deposition gauges are analysed to determine the insoluble solids, combustible material, and ash content within the total sample, which is then compared to the compliance threshold. Data collected from dust deposition gauges should be analysed at a National Association of Testing Authorities (NATA) accredited laboratory.

An operator should have at least one background gauge that cannot be impacted by operational dust (located some distance from the site in a non-prevailing wind direction) and should be configured by establishing one or more transects extending away from the potential dust generating areas on the site.

While dust deposition monitoring may be undertaken voluntarily by an operator, it may required by the department if there are ongoing complaints.

Determination of particulate matter - Deposited matter using the Gravimetric method is outlined in detail in the AS/NZS 3580.10.1:2016 Australian standard.

Refer to Table 1 in the appendix for an example of dust deposition levels and their interpretation.

Non-continuous ground-level concentration monitoring

Similar to dust deposition, non-continuous monitors cannot be paired with real-time wind measurements to determine the direction of particles during the measurement period but will provide an accurate measurement of PM concentrations over a 24-hour period.

In the case that a non-continuous monitor measures an exceedance of measurement criteria, additional monitoring or investigation may be required to determine if the associated operation is compliant with the air quality outcome/objective.

Accurate 1 in 6 day 24-hour measurements conducted using monitoring methods with a US EPA Federal Reference Method are suitable for compliance monitoring for public health outcomes/objectives in some circumstances.

The monitors provide a single measurement of particulate concentrations over the 24 hour period and can be compared to a public health standard. They could also be used as an indication of potential nuisance impacts.

Results from non-continuous monitoring can also be reviewed to identify trends in PM concentrations or used in association with leading indicator criteria to address dust issues on the site before they become a compliance issue.

Continuous compliance monitoring

Real-time continuous monitoring may be required for operations with more risk of PM emissions, or in response to ongoing complaints.

In this case, operators are required to monitor PM data at five minute or 10 minute averages, using methods with US EPA designation as Federal Equivalent Method such as Beta-Attenuation Mass (BAM) monitors, Exactus BAM (E-BAM) monitors, and Tapered Element Oscillating Microbalance analyser (TEOM). The operator must also undertake contemporaneous meteorological analysis to correlate the PM data with conditions such as wind speed and direction.

Each monitor should be equipped with telemetry so alarms can be sent to workforce responsible for dust management when elevated PM levels reach predetermined trigger values.

For more information about compliance monitors, refer to the E-BAM PLUS Particulate Monitor operation manual.

Hybrid monitoring networks

A hybrid monitoring network allows indicative monitors to complement a network of continuous compliance monitors.

Indicative monitors may be used to supplement the compliance monitoring network by filling in spatial gaps, especially for sites with a large footprint and when sensitive receptors are in several directions.

While continuous compliance monitoring is in fixed locations that are approved in the PEPR/MOP, the indicative monitors can be permanently located or used as a mobile unit to monitor a temporary potential source of PM (eg a campaign of adding to a waste-rock dump with overburden or mobile in-pit crushing near the tenement boundary).

Raw data provided by 'indicative' monitors are not suitable for measuring compliance against public health criteria. However, in certain circumstances the department and EPA may allow an indicative monitor to be used as a compliance monitor if a calibration model is applied and able to predict the absolute PM concentrations to within 10% accuracy (or with an R-squared value greater than .90 based on hourly averages) of a recognised compliance monitor.

If hybrid monitoring networks are proposed, they should be developed in consultation with the department and EPA to ensure that the network will achieve the regulatory requirements.

Meteorological monitoring

Weather conditions are a major contributing factor in the generation of dust. It is recommended operators set meteorological trigger thresholds to control air quality.

Primary meteorological variables such as wind speed, wind direction, temperature, humidity, atmospheric pressure, precipitation, and solar radiation should be monitored.

Weather stations should be installed, and methods of data collection should be followed in accordance with the meteorological monitoring for ambient air quality monitoring standard AS/NZS 3580.14:2014.

Wind speeds

Wind speeds play a key role in both the generation and dispersion of PM and should be considered in dust management planning. Each PM monitor will have an arc of influence, which is the area (or compass wedge) in which the monitor will be considered as downwind of the site (or activity) when the wind blows from a direction within the wedge.

Wind speeds influence the risk of erosion of material from disturbed areas causing an issue that must be mitigated (eg using polymer dust suppressants or reducing the disturbed area by progressively rehabilitating available areas).

To support compliance monitoring for PM, it is expected that the meteorological monitoring will achieve valid data availability of 90% or greater.

Publishing monitoring data

Where compliance monitoring is conducted, the department and EPA recommend operators publish the results from monitoring and actions taken in response to a publicly available website (this may be their company website).

By providing the measurements directly from the monitors (with appropriate disclaimers, eg, data is not verified and may have invalid values) and transparently presenting the information using charts, tables and graphics, the community will have a better understand of the performance of the operation and the effort being invested in managing PM.

For more information about ambient air quality monitoring, refer to the EPA Ambient Air Quality Assessment Guideline.

Compliance

The Mining Act Compliance and Enforcement Policy describes the department's approach to making regulatory and enforcement decisions to ensure compliance with the Mining Act and associated Regulations.

The department reinforces this by ensuring tenement holders are held accountable for managing environmental risk and taking a proactive and preventive approach to compliance to ensure protection of the environment and community interests.

DUST COMPLAINTS AND INCIDENTS

Complaints are a valuable source of information to assist government regulators in holding operators accountable for their compliance. All complaints received by the department will be investigated.

Members of the public can lodge a complaint about an operation if they have been impacted by PM in three ways, including:

- directly with the operator
- the department as the lead agency for mining regulation
- EPA as the lead agency on air quality regulation.

The most common complaints received about air quality include:

- concerns relating to public health from dust and harmful compounds/elements within the dust (eg respirable crystalline silica)
- dust deposition on property (eg cars, outdoor furniture, solar panels, washing on a clothesline
- loss of amenity from dust plumes
- loss of visibility impacts from visual dust plumes observed over or leaving an operation
- noticeable physical effects from dust (eg tasting of feeling dust on the tongue or throat, or dust in the eyes).

Operators should make contact details for site management available to local community and encourage community members to contact them directly to advise of any concerns.

Detailed complaint information will enable a comprehensive investigation into the issue, and help to inform further actions that may be required. Where possible, the following information should be provided to support a complaint:

- Date and time of the event.
- Location of the event.
- Company/people involved.
- Description of the event or activities being undertaken.
- Photos if available.

Complaint investigation

Operators are required respond to and record certain details relating to complaints. This includes the date a complaint was received, the nature of the complaint, whether it relates to a noncompliance, what actions have been taken to address the complaint, and the date the complaint has been resolved. A summary of this information must be included in the operator's annual compliance reports.

All complaints lodged with the department or the EPA will be investigated. This may include a request for information from the operator, announced or unannounced inspections and independent monitoring. Where appropriate, the department and/or EPA may require additional monitoring or improvement actions to ensure compliance.

If a complaint is not resolved to the satisfaction of the complainant, the department and/or EPA may determine a complaint has been resolved if reasonable measures have been taken to address the complaint and the operator has demonstrated they have complied with requirements of their approvals.

Initial incident report

An initial incident report should be accompanied by any relevant air quality monitoring data. Where continuous PM monitoring exists, raw data (not averaged) should be provided. For operations undertaking dust deposition monitoring against compliance criteria (including in response to unresolved complaints), the initial incident report should include the monthly measurements from each gauge in the network for the previous 12-months.

Annual compliance report

The following information will be included in annual reports submitted to the department within 45 days of the end of the calendar year:

- A review of all trigger values.
- A review of the effectiveness of all action and response strategies.
- A trend analysis of data collected.
- A review and analysis of community complaints with the exceedance of trigger values and 24 hour exceedance of PM10 and PM2.s Air (EPP) criteria.
- A review and analysis of data collected from conditions.
- Opportunities for improvement in dust management.

CONTROL STRATEGIES

Major dust sources and control strategies

To mitigate dust generation, operators should implement a range of control strategies, which must meet regulatory compliance, should be proportionate to the consequence of the potential impact, and be technically and economically achievable for the operator.

Operators should use a hierarchy of control strategies mechanisms to plan for and mitigate risk.

Operators should consider the following when designing and developing a mine or quarry:

- Locate fixed potential dust sources (for example, processing plant and stockpiles) at points of low wind exposure and avoid siting fixed dust sources upwind of sensitive receptors under predominant dry-period wind conditions.
- Design operations so that the maximum buffer between potential dust generating sources and sensitive receptors can be achieved.
- Use the natural topography as a barrier between potential dust sources and sensitive receptors or design vegetated screens and bunds. Natural barriers are also effective control strategies for noise and visual amenity impacts.
- Consider dust generation from wind erosion when developing mining and (progressive) rehabilitation plans to ensure the disturbed area (including stockpiles) is limited to the minimum footprint possible.
- Select equipment and processes in consideration of the dust generating

potential and design enclosures around fixed potential dust sources.

- Where sensitive receptors are located nearby, factor lost production time due to necessary shut down during adverse weather events into production estimates (for example very dry and windy days).
- Ensure management strategies are in place and all staff are well-trained on what dust management actions are required under adverse weather conditions. Failing to cease conducting dust generating activities due to a site manager being away from the site and/or uncontactable will not be an acceptable reason for causing offsite dust impacts.

Refer to examples in the toolkit for a list of dust sources and control strategies.

Air quality management plans

An air quality management plan (AQMP) is a useful tool to help operators set out their comprehensive dust management practices.

An AQMP demonstrates to the regulator and community that potential risks of PM impacts have been adequately identified and assessed and that the operator has effective plans in place to manage the PM to avoid offsite impacts.

DMPs should be regularly updated to include management of emerging risks and new/improved control strategies and monitoring.

Trigger and response plan

TARPs are an effective tool for operators to predetermine a correlation between results from monitoring and the implementation of control strategies.

A TARP uses inputs from weather forecasts, visual observations, and PM and/or meteorological monitoring to categorise a range of conditions and assigns the minimum set of actions required by the operator to prevent, reduce and/or eliminate the potential for offsite impacts.

The TARP may also incorporate triggers and responses relating to worker exposures onsite combined into one plan. They should:

- be simple and robust
- be adequately resourced with personnel and equipment
- focus on prevention and control through early detection and risk factors
- set appropriate trigger thresholds based on sound knowledge of the monitoring systems
- establish multiple response levels that increase in urgency based on the potential to be causing unacceptable impacts
- be regularly reviewed and revised as necessary to ensure control strategies are implemented early enough to prevent offsite impacts.

Refer to the TARP template in the Toolkit section.

Toolkit

This toolkit contains:

- Community dust diary
- TARP example
- TARP response levels example
- Control strategies and mitigation

A tool for preliminary assessment screening can be found on the DEM website.

Community dust diary

Name			Location of observations		
Obs. #	Date	Time	Wind conditions*	Impact type	Description of the observations

*Describe the wind direction if known, and the estimated wind speed using the Land Beaufort Wind Scale in the table below

Land Beaufort Wind Scale

Wind speed	Characteristics
Calm	Dust rises vertically
Light air	Direction of wind shown by dust drift only
Light breeze	Wind felt on face, leaves rustle, vanes moved by wind
Gentle breeze	Leaves and small twigs in constant motion, wind extends light flag
Moderate breeze	Raises dust, loose paper, small branches move
Fresh breeze	Small trees in leaf begin to sway
Strong breeze	Large branches in motion, umbrellas used with difficulty
Near gale	Whole trees in motion, inconvenience felt walking against the wind
Gale	Breaks twigs off trees, impedes progress
Strong gale	Slight structural damage occurs
Storm	Considerable damage occurs

TARP example

Operators are recommended to use a TARP as part of their control strategy planning. Below is an example of the trigger levels, and corresponding responses.

Response level	Description
Normal state	Low risk weather conditions and no observations of dust being generated with the potential to cause offsite impacts. Normal operations and standard dust management practices apply.
Level 1	Cautionary level that indicates moderate risk weather conditions and/or observations/ measurements of dust being generated with the potential to cause offsite impacts. Additional dust controls may be implemented, and ongoing monitoring of the situation is required.
Level 2	Alert and action level that indicates high risk weather conditions and/or observations/ measurements of dust being generated that are likely to cause offsite impacts. Urgent intensification of dust controls and ongoing monitoring of the situation are required. Some dust generating activities may need to cease until conditions improve.
Level 3	Emergency action level that indicates severe risk weather conditions and/or observations/ measurements of dust being generated and are expected or confirmed to be causing offsite impacts. All available dust controls to be initiated and ongoing monitoring of the situation are required. All dust generating activities may need to cease until conditions improve to avoid complaints and non-compliance.

TARP response levels example

Another table may also be included that applies specific dust controls to each potentially dust generating activity at the operations. These tables are useful to provide to staff to improve the awareness of what is required under each TARP response level. The following table provides two examples of controls to two activities as a guide for completing the full table.

Activity	Normal state	Level 1	Level 2	Level 3
Haul roads and access tracks	Apply water as required. Speed limit 40km/h	Water cart directed to dust generating sections of road.	Water cart directed to dust generating sections of road. Traffic directed away from dust generating sections of road. Speed limit decreased to 25km/h.	Water cart directed to dust generating sections of road. All load and haul from the pit to the ROM to cease. All non-essential traffic movements to cease.
Waste rock dump	Normal operations. Visual monitoring of dust generation by truck operator.	Sprinkler systems engaged. Visual monitoring of dust generation by mine supervisor/ manager.	Sprinkler systems engaged. Visual monitoring of dust generation by mine supervisor/ manager. Redirect dumping to areas protected by winds, or Cease dumping if dust cannot be effectively controlled.	Sprinkler systems engaged. Visual monitoring of dust generation by mine supervisor/ manager. Cease dumping until Normal State level returns.

Control strategies and mitigation

Below are a range of example tables for operators to consider when planning for air quality control strategies.

Haul road and access track control strategies and considerations.

Control strategy	Considerations
Construct roads using materials and design principles that reduce dust generation potential.	Consult an engineer to assist with haul road design. Properly constructed roads have higher initial costs but will generate less dust and require less road and vehicle maintenance.
Controlling vehicle speeds on unsealed roads.	The faster a vehicle travels on an unsealed road, the greater the amount of dust generated by wheel energy and turbulence.
Maintaining unsealed roads.	It is essential to maintain roads to reduce the build-up of loose material (bulldust) at the surface. Heavily trafficked sections of roads, and sections of roads with bends should be regularly monitored to determine if resurfacing is required.
Water application on unsealed roads.	Water can be applied by sprinkler systems, or more commonly via a designated watercart. Water prevents dust lift-off on most road types but requires continuous application due to the surface drying out. The availability of water, water storage capacity and the water supply rate must be considered when selecting water as the primary dust suppression to ensure dust suppression is effective.
Salt solution application on unsealed roads.	Calcium chloride (CaCl2) and Magnesium chloride (MgCl2) can be applied with water to unsealed roads. The chloride compounds attract moisture from the air to the material at the surface of the road to prevent dust generation.
Polymer application on unsealed roads.	Both synthetic and natural polymers can be applied to haul roads to reduce dust emissions by binding the surface particles together.
Sealing high use roads.	Sealing high use areas with bitumen or concrete reduces dust from the road surface. While this option has a high initial cost, it will remove the requirement for ongoing dust suppression.
Re-routing vehicle movements.	If a problem section of road is observed, re-route vehicles away from the area until the issue is rectified. During adverse weather conditions, vehicle movements can be re-routed to sections of road where dust suppression is being focused.
Ensure trucks are not overloaded with material.	Material should not be loaded above the height of the truck trailer to avoid material falling out of the trailer or blowing off the top.
Wet down stockpiled materials prior to handling.	Where processing allows for some moisture within the material, wetting down material stockpiles before and during operations can help fine materials to hold together and reduce dust emissions during loading and unloading.
Ensure drop heights are minimised when loading trucks.	The greater the distance material falls, the more dust that is produced. Taking care to slowly unload material from the lowest practical height can reduce the amount of dust produced from loading.
Do not dump material over the edge of waste stockpiles during windy conditions.	Waste landforms are often several tens of metres high and tipping dry material over the edge during windy conditions can cause fine materials to be removed by the wind and potentially blown offsite.

Processing plant control strategies and considerations.

Control strategy	Considerations
Ensure screens are not overloaded with excessive feed rate or large surges of material.	Overloading can cause excessive wear of components reducing the efficiency of the operation and potentially increasing dust emissions.
Ensure processing plant is not allowed to operate without product rock in the system.	Allowing plant to run without product material within the system can cause excessive dust emissions depending on the equipment being used. Operations that have processing plants that produce dust when operating empty should have procedures in place to ensure a constant flow of material enters the plant, or that the plant is switched off when empty.
Install enclosures over processing plant.	Enclosures over an entire processing area are very effective in preventing dust from entering the atmosphere. Where a total enclosure is not achievable, crushers should have enclosures over the feed-side, screens and air-separators should be fully enclosed and fitted with sealed covers over maintenance access points. Transfer points and conveyors can also be covered to effectively prevent dust entering the atmosphere.
Install water or chemical dust suppression in the plant.	Spraying systems can be installed to a variety of locations including bins, crushers, screens, conveyors/stackers, and transfer points. While the application of water and/or chemical dust suppressants assists by causing particles to stick together, large water particles will not capture fine dust particles and excessive water may cause blockages in screening plant. The use of misting and fogging sprays produces finer water droplets that are more effective at colliding with fine dust particles and pulling them out of suspension and may use less water.
Install a dust extraction system in the processing plant.	Where the product specifications require low moisture or a market exists for fine dust produced as a by-product from the processing plant (agricultural fertilisers), dust extractions systems can be installed to enclosed areas to remove fine particles either into a storage bag, or into a stockpile ready for sale.
Ensure good housekeeping practices are employed in the plant area.	Good housekeeping includes ensuring loose, dry material on and below plant is cleaned by hose or collected with a bobcat/skid steer, ensuring that water sprayers are not blocked and that covers are working effectively and do not have gaps. Keep conveyor belts clean to avoid carry back by installing scrapers or brushes, or by hosing the belt.

Drag out and road trucks control strategies and considerations.

Control strategy	Considerations
Install a wheel wash near the site exit.	Automated wheel wash bays with water sprayers targeting the tyres, wheels, mud flats and undercarriage of vehicles to remove mud collected from unsealed surfaces within the operation. The entrance to the automated wheel wash bays should be well signed to ensure drivers do not bypass the bay on exiting the site.
Install a manual wheel wash bay.	A manual wheel wash includes a high-pressure hose for truck drivers to manually spray mud from the wheels and other surfaces. Both manual and automated wheel washes must consider silt laden water runoff, and where possible, should recycle water used in the system.
Seal exit tracks with bitumen or concrete.	Sealing roadways near the exits prevents material collecting on vehicles before they exit the site. This control works effectively after vehicles have been cleaned by a wheel wash and can also be cleaned by a street sweeper.
Conduct street sweeping at the exit point and along the public road.	Street sweepers use a combination of water and heavy duty bristled sweepers in conjunction with vacuum systems to collect sediment from sealed road surfaces. Sweeper attachments can be fitted to front-end loaders or designated sweeper vehicles can be used, but operators must ensure that traffic safety is considered, and the activity is appropriately authorised if sweeping is to occur on public roads.
Install a rock ramp/pad on the exit track out from the site.	Where a wheel wash or road sealing is not feasible or practicable, operators can install a rock ramp or pad to remove sediment from vehicles. The rock pads consist of crushed rock of uniform sizes (50 to 75 mm or 100 to 150 mm) and must be long enough to ensure sediment is effectively removed. A filter base and drainage must be considered in the design.
Install a vibration grid along the site exit track.	Vibration grids are formed by separated strips of metal angle elevated above a sediment catchment chamber. The vibration caused by the uneven surface causes sediment to detach from the vehicle into the chamber. The grid should be maintained to ensure sediment capture chamber does not fill up to capacity. The grids are most effective in dry weather and work well in combination with rock ramps/pads.
Ensure that all loads entering the roadway are effectively tarped.	Dust may blow off a truck's load if not wet down or covered by a tarp. Effective load covering is a compulsory control strategy to ensure dust or rocks do not enter the roadway with the potential to impact pedestrians, cause poor visibility or damage other vehicles.
Prevent road vehicles from accessing muddy areas.	During and following periods of rainfall, dragout can be prevented by ensuring muddy areas are not accessible to vehicles that use public roads. Where usually trafficked areas become muddy, vehicles should be re-routed until the drainage issue is rectified.
Be prepared to conduct emergency clean-ups if required.	If excessive dragout occurs near the site exit (eg if a truck tailgate is not effectively closed and caused rock to fall over a public road), operators should respond immediately to remove the material. Effective traffic management should be implemented to ensure the safety of road users and the workers conducting the clean-up. The material should be physically removed by a bucket or square-edged shovel, broom and/or industrial vacuum cleaner. Material should only be hosed from the road as a last resort.

Drilling and blasting control strategies and considerations.

Control strategy	Considerations
Drill rigs utilise a wet drilling dust suppression.	Wet suppression works by introducing water into the bailing air that is sent down the drill stem. This allows the dust particles and drill chippings to stick to each other, making them less airborne as they are bailed out of the drill collar.
Drill rigs utilise dry drilling dust suppression.	Dust particles and drill chippings escape from the drill collar with the aid of the bailing air and are contained within the drill deck and shroud. The dust collector system establishes negative pressure within the shroud and draws the dust particles into the dust collector system. The dust collector system is composed of the fan exhaust, which creates the negative pressure, and the filters, which separate the dust from the air. Most filtering systems are self-cleaning. They use regular pulses of compressed air to remove the dust from the filter surface and allow the dust to drop through the bottom of the collector and onto the ground.
Do not conduct blasting under adverse weather conditions.	Where possible, the forward forecast should be reviewed for the upcoming week to ensure that blasting is not planned during weather conditions that are likely to lead to adverse offsite impacts.
Pre-wet as many surfaces of possible in the blast area.	Wetting down the areas where blasted rock falls onto can prevent dust lift-off caused by the falling rock.

Wind erosion control strategies and considerations.

Control strategy	Considerations
Reduce fall height between conveyor discharge points to stockpiles.	The discharge height from the stockpiler/stacker to the stockpile should be as low as practicable. The higher the distance the material falls, the greater speed the material hits the surface below. Large fall heights also allow opportunity for winds to blow fine material from the material stream causing dust and potentially a loss of product. Fall height can also be effectively reduced using chutes hanging from the end of the stacker.
Install overhead storage bins and truck loading facilities.	Storing material in overhead bins instead of stockpiles reduces several potential dust sources including dust caused by material falling onto a stockpile, wind impacting material in freefall onto a stockpile, wind erosion from the exposed stockpile and dust generation from retrieving material from the stockpile and loading it into a truck.
Apply water to stockpiles and disturbed areas prone to wind erosion.	Water can be applied to stockpiles and disturbed areas through sprinkler systems or a water cart with a spray bar and/or a cannon attached above the tank. Water is a low-cost option but needs frequent reapplication particularly on hot days with high evaporation. Furthermore, after periods of low rainfall, water availability for dust suppression may be limited.
Apply hydromulch or hydroseed on overburden stockpiles and disturbed areas prone to wind erosion.	Hydroseed and hydromulch are sprayed onto disturbed areas and provide a barrier to wind erosion. The seeds within the solution begin to develop and the roots then act to bind the surface and create a long-term solution for dust management. The solution is applied using a cannon and is suitable for hard to access and/or steep landforms.
Apply chemical dust suppressants on stockpiles and disturbed areas prone to wind erosion.	An alternative to the use of plain water is to add chemicals (wetting agents) to the water to improve moisture distribution, moisture retention, or particle agglomeration. Other chemicals are designed to develop a wind-resistant crust on the surface of the stockpile to prevent wind erosion. Crust-forming agents such as Lignosulfonates, polymers, and resins, can be applied to disturbed areas and low turnover stockpiles to bind and coat materials to form a crust or film on the surface areas of stockpiles, which reduces wind erosion. Any products used should come with documentation certifying that the chemicals will not cause residual impacts to the environment.
Install water sprayer systems to stockpiles.	If continuous loading onto the stockpile is occurring with a conveyor belt, traditional-type sprays can be installed to wet the product prior to and during discharge from the conveyor. Another option is to install a circular spray manifold that discharges water around the perimeter of the discharged product stream at the end of a conveyor. A water curtain is formed around the product to minimise wind impact as product drops through the air and provides wetting as the product hits the stockpile.
Install a telescopic loading spout on stockpile stackers.	Loading spouts are designed to extend down from the end of the conveyor on a stacker to the top of the stockpile. The device prevents wind from blowing dust away from falling material, and when fitted with a vacuum system, can extract dust created from the material landing on the top of the stockpile back up the spout and into a storage bag.
Undertake vegetation rehabilitation.	Progressive rehabilitation is an effective dust control as it can reduce the disturbed area that is vulnerable to wind erosion. This includes the planting of trees that can create wind breaks at the site to lower wind speeds on the site.

Management system control strategies and considerations.

Control strategy	Considerations
Operator training and education	Staff training is an essential element of daily dust management to ensure staff know how and when to implement control strategies, and who is responsible for ensuring dust control strategies are effectively implemented. Inductions for contractors working on the site should also instruct on relevant dust controls such as vehicle speed limits.
Trigger and Response Plans (TARPs)	TARPs are simple plans that outline triggers from proactive (weather forecast) or reactive (visual observations, real-time measurement) monitoring and assign them to a level of response. Each response level will have corresponding control strategies to be carried out until the potential impacts are mitigated or conditions improve.
Toolbox meetings	An agenda item for toolbox meetings should be a review of the weather conditions to determine what dust controls may be required during the shift or if operations need to be modified due to high dust risk conditions.
Community engagement	Engaging with residents and interested stakeholders (such as local councils) can help to remove assumptions that inadequate efforts are being made to control dust from an operation and reduce the likelihood of impacts and associated complaints being made to the regulating agencies.
Dust management audits	Conducting self-audits or engaging a consultant to conduct an independent audit of dust management activities is an effective strategy for identifying improvements and preventing potential offsite impacts from occurring.
Dust monitoring	Monitoring is essential for providing feedback into dust management strategies and the methods and equipment should be selected with consideration of the size of the operation and the distance and direction of sensitive receptors from the operation.
Work scheduling	Avoid planning potentially dust generating activities such as earthworks to remove and stockpile overburden in the hot and dry months of the year. Schedule plant maintenance to days where high dust risk conditions are forecast.

INDEX OF TABLES

Table 1 *Example of data from each transect and its interpretation.*

Dust deposition levels	Transect interpretation
Decrease with distance	The operation is most likely generating much of the dust.
Increase with distance	Another source of dust in the direction of a transect is likely generating most of the dust.
Gauge is the same at each transect	When the gauge on the transect are the same or similar and is like the background gauge, most of the dust is likely caused by regional dust.

The preliminary assessment tool requires four sets of input data to assess potential for adverse air quality impacts associated with the proposed operations. Below is an example of the type of input data an operator may use.

Table 2 *The screening assessment input tool example.*

Impact assessment data	Description	Measurement	Qualification
Maximum production rate	The highest level of annual anticipated amount of material extracted from the mine/quarry. Eg the combined total of product, tailings, and overburden.	Thousand tonnes (kt) per annum.	Typical positive correlation between the production rate and potential dust generation at the site.
Maximum exposed area footprint	The greatest amount of disturbed area associated with operations that has the potential to generate windblown dust at any point in time during the life of the operation.	Hectares (ha) disturbed at a point in time.	Typical positive correlation between the disturbed area and the potential for windblown dust generation at the site.
Proximity to sensitive receptor	PM concentrations decrease with distance from the source as it disperses in the atmosphere. The greater the distance between a sensitive receptor and the emission source, the lower the expected concentrations are at the receptor(s) location.	The shortest distance in meters (m) between a potential dust source on the site (eg the edge of the area disturbed by mining) and the nearest sensitive receptor location.	–
Proximity to urban area or town	Densely populated areas increase the likelihood of receptors that are sensitive to air quality impacts and the community may be more likely to expect dispersion modelling to be undertaken than a single receptor.	The shortest distance in meters (m) between a potential dust source on the site (eg the edge of the disturbed area) and the edge of the urban area or township.	–

The tool determines three levels of output that categorise potential for adverse air quality impacts associated with the proposed operations. Below is an example of the types of measurement criteria which can be used for each which may be used according to the grade level.

Table 3 *The screening assessment output tool example.*

Assessment grade	Measurement criteria
Level 1 High impact potential	Dispersion modelling is to be undertaken in accordance with the EPA Guideline. The dispersion modelling background levels are to be determined after a minimum of 12-months of site specific or representative baseline monitoring for PM and meteorological data. Where 12 months of site specific or representative baseline monitoring data are unavailable, suitable background PM levels and meteorological data or modelling predictions should be determined by a qualified practitioner. Stakeholder engagement required to inform the community of potential impacts to the community and existing land uses.
Level 2 Moderate impact potential	If required, dispersion modelling and background data collection should be undertaken as described in Level 1. If not required, the assessment requires a review of the existing air quality conditions, local meteorology, and estimated dust sources in comparison to receptor locations. A detailed description of operational dust sources, receptors and proposed control strategies and monitoring is to be included. It is expected that stakeholder engagement is undertaken to inform the community of potential impacts on the community and existing land uses.
Level 3 Low impact potential	A review of the existing air quality conditions, local meteorology, and the potential dust sources and estimated dust generation from operations in comparison to receptor locations.

Table 4 *Example of a control strategy.*

Control priority	Control strategy	Control mechanism
Primary	Elimination and substitution (prevention) controls	Use site design principles that remove dust producing activities where possible and select methods and equipment that produce no/less dust.
Secondary	Design/engineered controls	Site design decision or physical control to create a barrier that prevents dust from entering the atmosphere.
Tertiary	Management system controls	Manage the risk through procedures and the methods by personnel.

Resources

Legislation and policy

- Mining Act 1971, South Australian legislation, DEM.
- Mining Act Compliance and Enforcement in South Australia (2016), DEM.
- Environment Protection (Air Quality) Policy 2016, South Australian legislation, EPA.
- Environment Protection Act 1993, South Australian legislation, EPA.

Relevant department guidelines

- MG1: Guidelines for miners: mining approval processes in South Australia.
- MG2a: Preparation of a mining application for metallic and industrial minerals.
- MG2b: Preparation of a PEPR for metallic and industrial minerals.
- MG30: Development of environmental outcomes for quarrying and mining.
- MG31: Engagement, negotiating and agreement-making.

Relevant EPA guidelines

- Environment Protection (Air Quality) Policy 2016.
- EPA Ambient Air Quality Assessment (AAQA) Guideline.
- Evaluation Distances for Effective Air Quality and Noise Management.

References

The Environment Protection Authority (EPA), SA, 2023, *Air Quality.*

The Environment Protection Authority (EPA), SA, 2016, *Ambient Air Quality Assessment.*

The Environment Protection Authority (EPA), NSW, 2019, *Dust Assessment Handbook.*

The Environment Protection Authority (EPA), VIC, 2007, *Protocol for Environmental Management State Environment Protection Policy (Air Quality Management) Mining and Extractive Industries.*

Department of Water and Environmental regulation, WA, 2011, *A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities.*

World Health Organization (WHO), 2014, *Chrysotile Asbestos.*

United States Environmental Protection Agency, 2014, *Air Sensor Guidebook.*

Glossary

Aerodynamic diameter	Measurement used to define particle sizes in air. The diameter of a spherical particle of unit density that exhibits the same aerodynamic behaviour as the particle.
Air toxics	Air toxics are gaseous, aerosol or particulate pollutants which are present in the air in low concentrations with characteristics such as toxicity or persistence so as to be a hazard to human, plant or animal life.
ALARP	As low as reasonably practicable.
Ambient air	The external air environment. It does not include the air environment inside buildings or structures.
Background concentrations	Concentrations of a pollutant in ambient air that would exist were the mine or quarry not present.
Dust	Small, dry, solid particles projected into the air by natural forces, such as wind, volcanic eruption, and by mechanical or man-made processes such as crushing, grinding, milling, drilling, demolition, shovelling, conveying, screening, bagging, and sweeping.
Equivalent aerodynamic diameter (EAD)	The diameter of a spherical particle density 1000kg/m3 that exhibits the same aerodynamic behaviour as the particle in question.
µg/m^3	Microgram per cubic metre referenced to a temperature of 0 degrees Celsius and an absolute pressure of 101.325 kilopascals.
Federal Equivalent Method	Method for measuring the concentration of an air pollutant in the ambient air that has been designated as an equivalent method.
Fugitive dust	Dust which could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening.
Native vegetation	Any native vegetation refers to any naturally occurring local plant species that is indigenous to South Australia, from small ground covers and native grasses to large trees and water plants. It also includes naturally occurring regrowth and in certain circumstances, dead trees.

Particulate matter (PM)	Particulate matter is the sum of all solid and liquid particles suspended in air many of which are hazardous. This complex mixture includes both organic and inorganic particles, such as dust, pollen, soot, smoke, and liquid droplets.
PM_{10}	PM_{10} tells us how big the particles are, in micrometres (or millionths of a metre) as an equivalent aerodynamic diameter. This is written as 10 µm. PM_{10} means that the biggest particles in a sample are about 10 µm in diameter. Name given to particles in the air that are small enough for us to be able to breathe them in. Some of the larger particles may only reach as far as our throats, while others may travel right down into our lungs. A sample of PM_{10} particles may also contain $PM_{2.5}$ particles.
$PM_{2.5}$	$PM_{2.5}$ means that the largest particles have sizes of around 2.5 micrometres or µm as an equivalent aerodynamic diameter. Name given to particles in the air that are so small that when we breathe them in, they can travel right down into the deep parts of our lungs. Common types of $PM_{2.5}$ particles are smoke and exhaust fumes from vehicles.
Sensitive receptor	Fixed location such as a house, building, other premises, or open area where health, property or amenity is affected by emissions that increase the concentration of the emitted parameter above background levels. These are generally fixed locations, including dwellings, workplaces, schools, community centres, commercial areas, and recreation areas.
Source	The source of an impact (the mining operations) which has the potential to cause harm to an environmental receptor.
Suitably qualified and experienced practitioner person	A suitably qualified and experienced practitioner may be an individual or organisation that can demonstrate the specific skills, experience, and technical expertise to successfully complete the work required.
Telemetry	Telemetry automatically collects, transmits and measures data from remote sources, using sensors and other devices to collect data. It uses communication systems to transmit the data back to a central location. Subsequently, the data is analysed to monitor and control the remote system.
Total suspended particles (TSP)	All particles suspended in the atmosphere and includes the fine, respirable particles (PM_{10} and $PM_{2.5}$) and larger size particles that may settle out of the air causing nuisance impacts, usually measured as those particles having an equivalent aerodynamic diameter of fifty micrometres or less.

ACKNOWLEDGEMENT OF COUNTRY

As guests here on Kaurna land, the Department for Energy and Mining (DEM) acknowledges everything this department does impacts on Aboriginal country, the sea, the sky, its people, and the spiritual and cultural connections which have existed since the first sunrise. Our responsibility is to share our collective knowledge, recognise a difficult history, respect the relationships made over time, and create a stronger future.
We are ready to walk, learn and work together.

FURTHER INFORMATION

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SOUTH AUSTRALIA

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Department for Energy and Mining

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