



PROTOCOL FOR ENVIRONMENTAL MANAGEMENT

STATE ENVIRONMENT PROTECTION POLICY (AIR QUALITY MANAGEMENT)

# MINING AND EXTRACTIVE INDUSTRIES

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# MINING AND EXTRACTIVE INDUSTRIES

EPA Victoria  
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Victoria 3006 Australia

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## 1 INTRODUCTION

This Protocol for Environmental Management (PEM) is an incorporated document of the State environment protection policy (Air Quality Management) 2001 (SEPP AQM). It supports the interpretation of SEPP (AQM) and sets out the statutory requirements for the management of emissions to the air environment arising from activities undertaken in the operation of mining and extractives sites.

Best Practice is the main guiding principle in controlling air emissions and meeting the requirements of this PEM. This is a requirement of SEPP (AQM) and is not an additional requirement of this PEM. For particular hazardous air pollutants (Class 3 indicators), in addition to the application of best practice, emissions must be controlled to the maximum extent achievable (MEA).

The PEM has been developed in consultation with Government agencies and key stakeholders. It is important that this PEM be read in conjunction with the SEPP (AQM) and other relevant Protocols or Guidelines for Environmental Management<sup>1</sup>. In addition it should be noted that the Department of Primary Industries (DPI) regulates the mining and extractive industries under the *Mineral Resources Development Act 1990* and *Extractive Industries Development Act 1995*. This PEM will be used by DPI as a guide in the management of air quality impacts by mines and quarries.

### 1.1 Purpose

This PEM sets out the requirements for assessment and management of emissions to the air environment from the mining and extractive industries. It is intended to be applicable to both new developments and where significant modification or expansion of existing developments occurs.

All mining and extractive industries have a requirement to comply with SEPP (AQM). An air quality assessment in accordance with this PEM is required only for proposals requiring an Environment Effects Statement or an EPA Works Approval and Licence or where specifically required by DPI. DPI are likely to request an air quality assessment only when activities that are likely to generate increased emissions of the indicators specified in this PEM or will have significantly increased impact at sensitive locations.

Applicants for an Extractive Industry Work Authority or Mining Licence from DPI may be required to conduct an air quality assessment depending of the size and location of the proposed operation and the

type of activity proposed. Similarly, DPI may require an air quality assessment by a third party where development is proposed near a quarry or mine that would result in encroachment on the site by a sensitive use. Advice should be sought from DPI in such circumstances.

Proponents of new or expanded facilities for the activities listed in this PEM that require assessment (see section 3.1) are advised to contact EPA for guidance prior to the design phase of their proposals to ensure that the design and specifications meet the requirements of this PEM.

EPA Victoria in the execution of its statutory functions may apply the relevant sections of this PEM relating to operational control practices and monitoring to existing industries to ensure that emissions to the air environment comply with the requirements of the SEPP (AQM).

### 1.2 Scope

This PEM focuses on the requirements of the SEPP (AQM) and ensuring that the beneficial uses of the air environment defined in the Policy are protected. It does not provide guidance on meeting the requirements of other statutory processes such as those required under the *Extractive Industries Development Act 1995*, *Mineral Resources Development Act 1990* or the *Environment Effects Act (1978)*.

Proponents need to contact the Department of Primary Industries or Department of Planning and Community Development to determine what is required under this legislation.

## 2 STATUTORY DEFINITIONS AND POLICY CONTEXT

### 2.1 Statutory definitions

#### 2.1.1 Mining

'Mining' is defined as the extraction of minerals from land for the purpose of producing them commercially, and includes processing and treating ore.

'Mineral' means any substance that occurs naturally as part of the earth's crust including oil shale and coal including their hydrocarbons and mineral oils, bentonite, fine clay, kaolin, lignite, quartz crystals, zeolite, or minerals in alluvial form and excludes water, stone, peat or petroleum.

#### 2.1.2 Extractive industries

An extractive industry is defined as the extraction or removal of stone from land if the main purpose of that removal is for:

<sup>1</sup> Refer to EPA Victoria's website ([www.epa.vic.gov.au](http://www.epa.vic.gov.au)) for these documents or contact your EPA client manager.

- The sale or commercial use of the stone

or

- Use in construction, building, road or manufacturing works.

Stone means sandstone, freestone, basalt, granite, limestone, quartz (other than quartz crystals), slate, gravel, clay (other than fine clay, bentonite or kaolin), peat, sand, earth or soil, or other similar materials.

## 2.2 Statutory policy context

The air environment in Victoria is protected by two Policies:

- *State Environment Protection Policy (Ambient Air Quality)* (SEPP AAQ)
- *State Environment Protection Policy (Air Quality Management)* (SEPP AQM).

The SEPP AAQ incorporates the Ambient Air Quality National Environment Protection Measure (NEPM) standards and the associated goals and monitoring and reporting protocols. In addition the requirements of the Ambient Air Quality NEPM varied in 2003 to include advisory reporting standards for PM<sub>2.5</sub> also apply in Victoria under the provisions of the NEPC Act 1994. The SEPP AAQ also incorporates an ambient air quality objective for visibility. The SEPP AAQ standards do not apply to individual sources but to regional air quality. They apply at sites that are generally representative of the exposure of the general population not at peak sites.

The SEPP AQM sets out the framework for managing emissions into the air environment. Emissions are managed in such a way as to ensure that the air quality objectives of the SEPP AAQ are met, and continuous improvement in Victoria's air quality occurs, in accordance with the State's other environmental, social and economic development goals.

The SEPP AQM identifies the beneficial uses of the air environment to be protected as:

- life, health and well-being of humans
- life, health and well-being of other forms of life, including the protection of ecosystems and biodiversity
- local amenity and aesthetic enjoyment
- visibility
- the useful life and aesthetic appearance of buildings, structures, property and materials
- climate systems that are consistent with human development, the life, health and well-being of humans and the protection of ecosystems and biodiversity.

The following air quality indicators are defined for the purposes of the policy:

- Class 1 indicators*: common or widely distributed air pollutants which are established as environmental indicators in the SEPP AAQ and may threaten the beneficial uses of both local and regional air environments;
- Class 2 indicators*: hazardous substances that may threaten the beneficial uses of the air environment by virtue of their toxicity, bio-accumulation or odorous characteristics;
- Class 3 indicators*: extremely hazardous substances that are carcinogenic, mutagenic, teratogenic, highly toxic or highly persistent, and which may threaten the beneficial uses of the air environment; and
- Unclassified indicators*: indicators of local amenity and aesthetic enjoyment, namely odour and total suspended particles (nuisance dust).

Emissions of all these indicators to air must be managed to ensure that the beneficial uses of the air environment are protected and that continuous improvement in air quality is achieved. For all indicators, emissions must be reduced by the application of best practice (see section 4). In addition, for Class 3 indicators emissions must be reduced to the maximum extent achievable (MEA). In accordance with the Policy Principles, consideration must be given to the wastes hierarchy where avoidance of emissions is the primary aim and is preferable to treatment and discharge of wastes.

The wastes hierarchy as set in the *Environment Protection Act (1970)* and SEPP (AQM) states that wastes should be managed in accordance with the following order of preference:

- 1 avoidance
- 2 reuse
- 3 recycling
- 4 recovery of energy
- 5 treatment
- 6 containment
- 7 disposal.

## 2.3 Best practice and maximum extent achievable (MEA)

SEPP (AQM) defines **best practice** as:

*'the best combination of eco-efficient techniques, methods, processes or technology used in an industry sector or activity that demonstrably minimises the environmental impact of a generator of emissions in that industry sector or activity'.*

**Maximum extent achievable** is defined in the SEPP (AQM) as:

*“a degree of reduction in the emission of wastes from a particular source that uses the most effective, practicable means to minimise the risk to human health from those emissions and is at least equivalent to or greater than that which can be achieved through application of best practice.”*

In determining what may constitute best practice or MEA for a specific site the following information should be considered:

- the most recent documented definition, expression or application of ‘best practice’ for the industry sector from national and international sources
- the most recent documented definition, expression or application of ‘best practice’ for the industry sector in the Victorian context (if any)
- performance standard or benchmarks for the industry, in terms of the management of emissions, wastes, energy and resources, and their impacts
- any constraints that may apply to each situation (e.g. in the availability, affordability or practicability of technological options)
- comparison of different approaches currently used in the industry.

Based on these comparisons, a plan to demonstrate that best practice (or MEA) is being proposed for the premises must be developed.

In addition the following sources should be consulted:

- peak bodies or organisations for the sector (e.g. industry associations)
- other members of the industry or activity sector, including producers, operators, suppliers and clients
- industry and environmental consultants and other experts/specialists
- overseas sources such as international agencies, industry bodies and consultants
- relevant reports and publications, both in printed form and on the internet
- relevant regulations

Generators of emissions of Class 3 indicators must consider opportunities for going beyond what is considered best practice for their premises to demonstrate that the requirement for MEA for control of emissions is being met. This is done by investigating options at each site for further emission reduction such as innovative processes or more stringent housekeeping regimes.

### 3 ASSESSMENT OF AIR QUALITY IMPACTS FROM NEW OR EXPANDED MINING AND EXTRACTIVE INDUSTRIES

#### 3.1 General assessment requirements

Assessment of air emissions arising from mining and extractive industries must be managed in accordance with the requirements of the SEPP (AQM). The level of assessment required is dependent on:

- the scale or size of the operation
- the location of the site.

Irrespective of the level of assessment emissions must be controlled by the application of best practice and where Class 3 indicators are emitted these must be controlled to the Maximum Extent Achievable (MEA). In some situations extensive monitoring and modelling data may be required to assess the level of impact that emissions from the operations on site may have on the beneficial uses of the air environment defined in the policy.

A **level 1** assessment is required when developments are located close to residential areas or urban areas and have the potential to give rise to significant off-site impacts. These assessments are the most rigorous and require the most extensive modelling and monitoring data.

A **level 2** assessment is required when the proposed development is in a rural location with residences in close proximity or where a small operation is located in an urban area.

A **level 3** assessment is required when the development is in a rural location with no residences nearby. A level 3 assessment is the least onerous due to a lower potential risk arising from emissions from the proposed operations compared to operations requiring a level 1 or level 2 assessment. A level 3 assessment may be required when the development is small, in a location remote from residences, or where it is considered that the off-site impacts would be small compared to sites requiring level 1 or level 2 assessments.

For mines and quarries with less than 50,000 tonnes/yr extraction, no modelling assessment of air quality is required but emissions on site must be controlled by the application of best practice site management.

The requirements for each level of assessment are discussed in detail in the following sections and summarised in Table 3. Table 1 shows an overview of the requirements for determining the level of assessment for the mining and extractive industries:

**Table 1: Criteria for determining level of assessment required.**

	<b>Large Mine or quarry greater than 500,000 tonnes/yr extraction</b>	<b>Medium Mine or quarry between 150,000 tonnes/yr and 500,000 tonnes/yr extraction</b>	<b>Small Mine or quarry between 50,000 tonnes/yr and 150,000 tonnes/yr extraction</b>	<b>Mine or quarry with yearly extraction below 50,000 tonnes/yr extraction</b>
Urban area	Level 1	Level 1	Level 2	No assessment – application of best practice management
Rural area close to residences (less than 500m from the limit of work described in the approved DPI work plan or final EES)	Level 1	Level 2	Level 3	No assessment – application of best practice management
Rural area (residences more than 500m from the limit of work described in the approved DPI work plan or final EES )	Level 2	Level 3	No assessment – application of best practice management	No assessment – application of best practice management

Notes: 1. Criteria apply where EPA or DPI determine that an assessment is required (refer to section 1.1) or when an Environment Effects Statement is required.  
 2. A level 1 assessment is the most rigorous.

For the purposes of this PEM extraction means:

- for quarries the amount of soil and rock that is moved or extracted per year
- for above-ground mines the amount of soil, rock and ore moved on the site
- for underground mines the amount of soil rock and ore moved above ground and brought to the surface of the mine. Any emissions from ventilation shafts of the mine must also be taken into account in the estimates of emissions where the shaft is part of the premises.

**3.2 Indicators to be assessed**

For air emissions from mining and extractive industry operations, the major pollutants of concern are related to dust and specific substances that may be contained within the dust (eg., crystalline silica or heavy metals).

For all proposals requiring an air quality assessment the following indicators must be assessed:

- PM<sub>10</sub> (Particles with mean aerodynamic diameter less than 10 microns)
- PM<sub>2.5</sub> (Particles with mean aerodynamic diameter less than 2.5 microns)
- Respirable crystalline silica (defined as the PM<sub>2.5</sub> fraction).

Depending on the location of the mining or extractive operations other substances may require assessment. These include:

- arsenic
- heavy metals (e.g., antimony, lead etc)
- hydrogen cyanide and CN
- polycyclic aromatic hydrocarbons [PAHs](as benzo-a-pyrene [BaP])
- naturally occurring asbestos
- radionuclides.

PM<sub>10</sub> and lead are identified as a Class 1 indicator under the SEPP (AQM) and PM<sub>2.5</sub>, antimony and cyanide are Class 2 indicators. Control practices for emissions of these indicators require the application of best practice for the industry.

Respirable crystalline silica, arsenic, PAHs, asbestos, radionuclides and hydrogen cyanide are Class 3 indicators and require control to the Maximum Extent Achievable (MEA) due the seriousness of the potential health effects associated with exposure to these substances. MEA goes beyond best practice and considers what can be done on a site-specific basis rather than an industry wide scenario. Best practice and MEA go beyond consideration of technological control and include application of the wastes hierarchy with avoidance being the primary aim.

As many dusts from quarrying and mining can be expected to contain silica, the MEA provisions apply to those activities that give rise to emissions of silica (eg crushing). Arsenic and its compounds are also listed as class 3 indicators and this provides an additional justification for the application of MEA to dusts from mining operations in gold mining areas where natural crustal arsenic levels are likely to be elevated.

Naturally occurring asbestos has been identified in several areas in Victoria. If the proposed development is in an area where asbestos deposits have been identified and is likely to intercept such deposits, then an assessment of potential emissions of asbestos arising from the mining or quarrying activities and the potential off-site impact must be undertaken. Emissions must be controlled by application of MEA.

Not all of these indicators will be relevant for each site. For example, arsenic is common in gold mining areas but is unlikely to be found at significant levels at other locations. Cyanide is used in processes for the extraction of gold and is likely to be specific to gold mining operations. PAHs arise from combustion sources including generators and vehicles on the site.

The identification of indicators that may be present at individual sites needs to be undertaken in the early stages of planning and prior to the air quality assessment being commenced to ensure that the appropriate indicators are included in the assessment. Advice from EPA should be obtained at this early stage. Schedule A of the SEPP (AQM) should be consulted to identify potential substances that may require assessment. If an assessment is not to be undertaken for key indicators, such as respirable crystalline silica, then supporting evidence needs to be provided to show why an assessment is not required.

Identification of all indicators of concern and assessment of these indicators must be conducted. In doing this assessment all sources need to be considered including emissions from haul roads, crushers, generators, processing operations (including leaching), mining operations and any other plant

operations on the site. The type of rock and soil also needs to be considered. For Level 1 and 2 assessments mobile sources (such as trucks and graders) also need to be included.

For large area-based sources of emissions such as mines and quarries the majority of emissions from the site arise from many ground level sources such as disturbance of soil due to earth moving equipment and vehicle emissions. It is appropriate that the criteria used to assess the potential impacts from these operations are directly related to the protection of the health of the surrounding population and sensitive land uses.

### 3.3 Assessment criteria

The assessment criteria are used to evaluate the impact of any residual emissions remaining after application of appropriate control practices, best practice or MEA, to ensure that emissions are managed in such a way that the beneficial uses of the air environment (as specified in SEPP (AQM)) are protected.

The assessment of emissions from area sources must consider local air quality (ie., existing air quality) in the vicinity of the mining or extractives operations. The assessment criteria are used to assess the total concentration of background plus emissions arising from activities on the site. Emissions from the mine or quarry must be managed to ensure that the cumulative impacts of all sources (including the mine or quarry) in the local area do not pose a risk to the health and amenity of local residents and that the beneficial uses specified in the SEPP (AQM) are protected.

Table 2 lists the assessment criteria applicable for the mining and extractive industries. These have been developed based on the protection of human health and for some indicators reflect the intervention levels in the SEPP (AQM).

**Table 2: Assessment criteria for mining and extractive industries<sup>2</sup>**

Indicator	Criteria	Averaging period
PM <sub>10</sub>	60 µg/m <sup>3</sup>	24-hour average
PM <sub>2.5</sub>	36 µg/m <sup>3</sup>	24-hour average
Respirable crystalline silica (as PM <sub>2.5</sub> )	3µg/m <sup>3</sup>	Annual average
Arsenic (total inorganic)	0.003 µg/m <sup>3</sup>	Annual average
Hydrogen cyanide	340 µg/m <sup>3</sup> 9 µg/m <sup>3</sup>	1-hour average Annual average
Nitrogen dioxide	0.14 ppm	1-hour average
Carbon monoxide	29 ppm	1-hour average
PAHs (as BaP)	0.3 ng/m <sup>3</sup>	Annual average
Asbestos	0.2 µg/m <sup>3</sup> or 0.05 PCM fibres/m <sup>3</sup>	Annual average
<sup>3</sup> Radionuclides	As low as reasonably achievable	Annual average

In areas where background concentrations of arsenic are unknown, a risk assessment maybe undertaken to assess the potential impacts of the mining operation. In these situations the risk arising from emissions from the activities on the site must not exceed a lifetime cancer risk of 1 in a million.

For indicators that do not have assessment criteria listed in Table 2 but may be present at some sites, eg heavy metals, the proponent should contact EPA for advice on appropriate assessment criteria to be used.

It is important that emissions from industries, including mining and extractives, do not contribute to a deterioration of air quality in urban centres and regional towns and townships. Although the assessment criteria have been established for mining and extractive industries there may be some situations where the assessment criteria cannot be met at the

nearest sensitive location to the operation, no additional management practices can be practically applied and the predicted impact from the proposed expansion or operation extends into urban areas or townships. These situations are likely to be rare.

In these situations assessment of the predicted emissions on existing air quality within the urban area or township may be required. Advice should be sought from EPA on the need for such an assessment. If required, the assessment should be undertaken at locations where the general population of the town is likely to be exposed (eg., town centre) rather than the nearest residence. Background (existing air quality) data must be included in the modelling. Where such an assessment is required the air quality standards contained in the Ambient Air Quality NEPM apply. For particles these standards are:

2 The assessment criteria for PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, and CO are the intervention levels from the SEPP (AQM). The criteria for respirable crystalline silica and hydrogen cyanide have been adopted from the California EPA Office for Environmental Health Hazard Assessment Reference Exposure Levels. The assessment criteria for arsenic and asbestos have been derived using the Cancer Potency Factors from the California EPA Office for Environmental Health Hazard Assessment. The criteria for PAHs (as BaP) has been adopted from the National Environment Protection (Air Toxics) Measure.

3 The term 'radionuclide' includes naturally occurring radioactive isotopes. ALARA is determined by the Department of Human Services, Public Health Branch under the *Radiation Act* 2005 and Radiation Regulations 2007. Note that this Act applies where radioactive material (as defined in the Act) is possessed, transported, mined or processed. Contact the Radiation Safety Section, Environmental Health Unit on 1300 767 469 for advice.

- PM10 50 µg/m<sup>3</sup> 24-hour average
- PM2.5 25 µg/m<sup>3</sup> 24-hour average; 8 µg/m<sup>3</sup> annual average

The Ambient Air Quality NEPM also establishes a goal for PM<sub>10</sub> of no more than 5 allowable exceedances to be met by 2008. These exceedances allow for the impacts of prescribed burning, dust storms and bushfires on regional air quality and should not be interpreted as allowing individual industries to contribute to such exceedances. Such events must not be removed from background data files but clearly identified as arising from such events (see section 3.5).

### 3.4 Monitoring data required prior to conducting air quality assessment

To enable an assessment of air quality impacts through modelling an understanding of existing air quality (ie., background) in the area is required. The data requirements for each level of assessment are:

- **Level 1** – Real time continuous 24-hour PM<sub>10</sub> and PM<sub>2.5</sub> data for a 12-month period, analysis of crystalline silica (PM<sub>2.5</sub> fraction) and heavy metal content (PM<sub>10</sub>) (where applicable)
- **Level 2** – Continuous representative<sup>4</sup> 24-hour PM10 and PM<sub>2.5</sub> data for a 12-month period, representative analysis of crystalline silica (PM<sub>2.5</sub> fraction) and heavy metal content of PM<sub>10</sub>
- **Level 3** – no monitoring data is required prior to the assessment.

When data is being collected or developed for modelling purposes meteorological data is required to be collected at the same location for the same period where practicable.

For Level 1 assessments data from the area where the operation is proposed needs to be collected. This must be done prior to the air quality assessment commencing. In some circumstances data may be available from EPA. Contact EPA to check availability of appropriate data.

For Level 2 assessments data collected by EPA that is considered representative of the location where the mining or extractives operation is proposed can be used. In some circumstances representative data may not be available and some monitoring may be required. Contact EPA regarding availability of data.

Data for locations in Melbourne, Geelong and the Latrobe Valley can be obtained from EPA. Availability of appropriate data for other regional centres should be confirmed with EPA. If appropriate data is not available in these locations or for other areas where Level 1 or Level 2 operations are planned and appropriate data is not available 12 months of data

<sup>4</sup> Data collected at a similar location and considered by EPA to be representative of the location to which the proposal applies. Advice should be sought from EPA about the availability of such data.

needs to be collected or developed (eg., through modelling with approval from EPA) by the proponent prior to the assessment being undertaken. Use of alternative background data may be used if agreed by EPA. Contact EPA for advice.

### 3.5 Modelling to be undertaken

Results of any modelling are to be used for broad guidance as to the potential environmental impacts arising from any new or expanded development and to assist in the development of appropriate management strategies. The outputs from the model are highly dependent on the quality of the input data including emission estimates, meteorological data and background data. For mining and quarrying operations all of these inputs have a high level of uncertainty associated with them due to the nature of the activities being undertaken.

After application of practices to reduce emissions in accord with best practice or to the maximum extent achievable, modelling is undertaken to predict the impact of residual emissions – those remaining after the application of best practice or MEA. Any modelling conducted as part of the assessment of the air quality impacts from a new or expanded operation must be conducted using an EPA approved regulatory model following the requirements set out in Schedule C of SEPP (AQM) and the requirements set out in this PEM. If other modelling approaches are to be used then a modelling plan must be submitted to EPA for approval prior to the commencement of the modelling assessment.

The results of any modelling undertaken must be reported in three ways:

- Time series plots for the most affected sensitive receptors that clearly show the background data for the pollutant modelled, the contribution from the mining or extractive operation alone, the combined predicted concentrations over an entire year. This will indicate the frequency of predicted concentrations and any exceedances of the assessment criteria.
- Contour plots showing the geographic extent of maximum concentrations arising from the mining or extractive industry only. Contour plots should clearly show residential areas and other sensitive locations<sup>5</sup>.

<sup>5</sup> Sensitive locations include residences, schools, kindergartens, aged care facilities, hospitals, childcare centres and recreational areas. In assessing recreational areas the potential for exposure needs to be taken into account through a qualitative risk assessment process eg., whether activities are occurring on site when people are using the recreational area.

- A general discussion on the analysis of the modelling results including the degree of uncertainty in the results.

Modelling is to be undertaken for a 12-month period under the worst-case scenario. Worst-case conditions are those for the periods when the maximum emissions are predicted to occur under normal operating conditions (for example when maximum earth moving activities are occurring or large areas of exposed land are expected on site) and/or where an expansion or development has maximum impact on sensitive receptors. The modelling is required to be undertaken for a number of scenarios including,

- construction activities during the development of the site, and
- operational phases of the mine or quarry.

In conducting the modelling the emissions factors from the National Pollutant Inventory (NPI) Handbook for Mining and Extractives should be used. Where a proponent can show actual site-specific emission factors from trials/assessments then these factors would be preferred over literature-based factors providing that EPA is satisfied that the methodology used to determine the factors is sound. Advice should be sought from EPA prior to conducting the modelling if site-specific factors are to be used. For indicators not included in the NPI Handbook, the latest USEPA AP42 emission factors should be used. Other emission factors that may be considered to be more applicable for a specific site can be used with prior approval from EPA.

PM<sub>10</sub> and PM<sub>2.5</sub> must be modelled as though they behave as a gas. Deposition for these size fractions is not included in the modelling. For TSP or deposited dust, dust deposition may be taken into account when deposition rates are known.

In conducting the modelling against the assessment criteria the impact of all sources of the indicator in the area must be included, as the assessment criteria have been established to account for cumulative impact of all sources.

This requires the inclusion of background data (this is discussed in more detail in the following sections). If the impacts of bushfires, prescribed burning or dust storms are identified in background files they should not be excluded but clearly identified in the reporting of the results of the modelling (eg shown in the time series plots separate to the contribution from the mining or extractive operations and the combined emissions).

The results of the modelling must be reported for sensitive locations including houses, schools, kindergartens, recreation areas and sporting ovals. Any proposed developments, such as new housing developments, and identified future land uses (including zoning requirements) must be taken into

account to ensure that developments planned closer to the sites than the current situation are considered in the assessment of potential impacts. The assessment at the selected locations must be done against the relevant assessment criteria listed in Table 2 of this PEM. Time-series plots showing the predicted concentrations for the pollutants being assessed for each day of the year should be presented for the sensitive locations that are predicted to be worst affected.

The assessment at the sensitive locations must be done against the relevant assessment criteria listed in Table 2 of this PEM. If the assessment criteria are exceeded then management practices on site should be reviewed to reduce emissions arising from the operations.

#### Level 1 assessments

The modelling for a Level 1 assessment requires 1 year of daily predictions for PM<sub>10</sub> and PM<sub>2.5</sub> under worst-case scenarios. Time varying background files (24-hour averages) must be included for large operations in these locations.

For crystalline silica, arsenic and other indicators that have long-term health effects annual average concentrations must be modelled with annual average background data included in the model.

For Indicators such as NO<sub>2</sub> and CO that have averaging times less than 24-hours, the 70<sup>th</sup> percentile of the 1-hour average data is to be included. If background is not included for these indicators then the justification of the reason why must be included in the assessment report. For example, in a rural area with low traffic volumes or other sources in the vicinity.

#### Level 2 assessments

As for Level 1 assessments, the modelling for a Level 2 assessment requires 1 year of daily predictions for PM<sub>10</sub> and PM<sub>2.5</sub> under worst-case scenarios. Representative time varying background files (24-hour averages) should be included for large operations in these locations. This data may be obtained from EPA.

If appropriate daily varying background data is not available, a screening assessment can be undertaken using 70<sup>th</sup> percentile of the 12 months of background data to determine the potential for the relevant assessment criteria to be exceeded. If the results of the assessment indicate that the assessment criteria are exceeded contact EPA about the requirements for further assessment or management options.

For crystalline silica, arsenic and other indicators that have long-term health effects annual average concentrations must be modelled where applicable with annual average background data included in the model. Inclusion of background data for CO and NO<sub>2</sub> is not required.

### Level 3 assessments

As for Level 1 and 2 assessments, the modelling for a Level 3 assessment requires 1 year of daily predictions for PM<sub>10</sub> and PM<sub>2.5</sub> under worst-case scenarios. Due to the low potential risk arising from these operations, no background data is required in the modelling.

For crystalline silica, arsenic and other indicators that have long-term health effects annual average concentrations must be modelled. The assessment at the nearest sensitive locations should be done against the relevant assessment criteria listed in Table 2 of this PEM. If the assessment criteria are exceeded then management practices on site should be reviewed to reduce the emissions arising from the operations.

### 3.6 Risk assessment and risk management strategies

If the air quality modelling indicates that the assessment criteria may be exceeded then a risk assessment should be undertaken. The risk assessment process involves an assessment of the extent and the frequency of any exceedances of the assessment criteria at sensitive locations. This information will be available from the time series plots.

If exceedances are predicted, risk management strategies need to be developed that identify options that will reduce exposure of local communities to levels of indicators that may be of concern. These may include:

- identification of conditions (meteorological and operational) that may give rise to elevated levels of pollutants (this information can be obtained from either modelling or from experience with the operation of an existing site)
- options for reducing levels of exposure need to be identified. These may include for example movement of activities on the site under certain meteorological conditions, ceasing certain operations for limited periods of time if pollutant levels are reaching levels of concern, relocating residents for periods when the operations are expected to generate elevated levels of pollutants etc.

To monitor the effectiveness of these strategies, for sites in large urban areas or close to residential areas real-time monitoring of PM<sub>10</sub> and PM<sub>2.5</sub> should be undertaken at sensitive locations (such as residences) (Level 1 and 2 operations). This monitoring should be linked to a reactive management strategy that would allow changes to the operations on the site to be made if particle concentrations are reaching levels over a short timeframe that may impact on the achievability of the 24-hour health based values.

In situations where it has been identified that an operation will generate emissions of heavy metals and

is close to residences that are reliant on tank water as their main water supply, monitoring of heavy metals (eg antimony) should be conducted as a substrate of PM<sub>10</sub> where modelling predicts levels that may be greater than 50% of the assessment criteria (where applicable). In particular a management strategy needs to be in place to prevent impact on neighbouring rainwater tanks used for potable water supply. Emissions of heavy metals must be managed such that any impact on tank water in nearby residences does not lead to exceedances of the NHMRC drinking water guidelines for these substances ([www.nhmrc.gov.au/publications/synopses/eh19syn.htm](http://www.nhmrc.gov.au/publications/synopses/eh19syn.htm)).

The risk management options need to be built into the site Environmental Management Plan.

In situations where the assessment criteria are exceeded and additional management strategies are not an option or are not economically viable, a health risk assessment can be conducted and submitted as part of the assessment. In conducting the health risk assessment the following steps must be followed:

- review of the current information regarding the health effects associated with exposure to the indicator
- collection of information on the local population including identification of susceptible groups within the affected population (eg percentage of children with asthma or people aged over 65 years)
- potential for exposure of the local population to levels of the indicators (obtained from air quality modelling)
- calculation of the risk posed by this exposure

It is expected that a detailed quantitative health risk assessment will only be required in rare circumstances and is likely to be required under limited circumstances by large sites close to residential areas. A quantitative risk assessment should only be undertaken when all options for reducing emissions by changes in site management practices have been exhausted or are not economically viable. It should not be the first option taken.

Contact EPA for further guidance on conducting risk assessments.

## 4 OPERATIONAL CONTROL REQUIREMENTS

The responsibility lies with the generators of air emissions to identify and undertake appropriate air emissions control and management initiatives and demonstrate that the requirements for application of best practice and maximum extent achievable have been met and the beneficial uses of the air environment as specified in the SEPP (AQM) are

protected. These should be developed in consultation with EPA.

As part of the risk management strategy for level 1 and 2 operations real-time monitoring of PM<sub>10</sub> should be linked to a reactive management strategy that would allow changes to the operations on the site to be made if particle levels are reaching levels over a short timeframe (1-hour) that may impact on the achievability of the 24-hour health based values.

Deposited dust is an indicator of the effectiveness of site management practices and the potential for off-site nuisance. Deposited dust should be monitored at the site boundary for most operations. Monitoring is conducted with dust deposition gauges that should be located both upwind and downwind of the site to reflect the impact of the mining or quarry operations during the most predominant wind directions. Results of monitoring should not exceed 4g/m<sup>2</sup>/month (no more than 2g/m<sup>2</sup>/month above background) as a monthly average. If dust levels exceed this value then site management practices should be reviewed and dust controls implemented to reduce dust levels to within these guidelines. The criteria for deposited dust has been used in Victoria for many years to protect the amenity of populations near mines or quarries. The averaging period is set at a monthly average to enable an assessment of nuisance dust in a timely manner to ensure that people's amenity is not adversely impacted. If the criteria are exceeded management actions can be identified and implemented to reduce dust levels to avoid further nuisance being created. Further advice should be sought from DPI.

In situations where it has been identified that an operation will generate emissions of heavy metals and is close to residences that are reliant on tank water as their main water supply a management strategy needs to be in place to prevent impact on neighbouring rainwater tanks used for potable water supply. Emissions of heavy metals must be managed such that any impact on tank water in nearby residences does not lead to exceedances of the NHMRC drinking water guidelines for these substances.

## 5 GREENHOUSE AND ENERGY REQUIREMENTS

The SEPP (AQM) requires consideration of greenhouse and energy issues especially when proposals are associated with a Works Approval application to EPA. A Protocol for Environmental Management (Greenhouse and Energy) has been developed with a supporting tool kit to assist industries in conducting their assessments. The PEM and associated toolkit are available on the EPA website ([www.epa.vic.gov.au](http://www.epa.vic.gov.au)) and should be followed to conduct an assessment of greenhouse and energy issues for all developments.

## 6 MONITORING OF PARTICLES FOR THE MINING AND EXTRACTIVE INDUSTRIES

Monitoring is conducted for several purposes. These range from collecting information on existing air quality prior to commencing assessment and operation, ensuring that off-site emissions meet the assessment criteria to monitoring linked to reactive management strategies to ensure that action can be taken in a timely manner to ensure that activities on site are managed so that adverse off-site impacts do not arise. The type of monitoring equipment required is dependent on the intent of the monitoring. The sites for monitoring should be selected in consultation with EPA.

### 6.1 Monitoring conducted prior to preparation of an air quality assessment

Where EPA does not have monitoring data applicable for an area where a new development or expansion of an existing development is planned, collection of data on existing air quality in the area of the proposed or expanded development is required for premises requiring Level 1 assessment. Proponents will be required to collect this data prior to the preparation of the air quality assessment unless existing data is available from EPA. Such monitoring requires the use of monitoring equipment for PM<sub>2.5</sub> and PM<sub>10</sub> that complies with the Australian Standards for monitoring these particles.

Monitoring should be conducted on a daily basis for a 12-month period prior to the commencement of the air quality assessment report. Some gravimetric sampling should also be conducted to allow for analysis of the particles for components such as respirable crystalline silica and heavy metals where it has been identified that emissions of these indicators are likely to occur. The filters used for this purpose must be consistent with the analysis technique used for assessing the content of the relevant indicators. Sampling for crystalline silica and arsenic must be conducted for a period of up to 1 week once a month for an entire year to allow calculation of an annual average (total 12 samples per year). The sampling frequency and duration will be dependent on the levels of particles generated and the percentage of the indicator of concern within the PM<sub>10</sub> or PM<sub>2.5</sub> mass. In some circumstances more frequent sampling for shorter periods may be required due to high particle levels. Advice should be sought from EPA on the required sampling frequency and duration. Analysis for arsenic or respirable crystalline silica must undertaken by laboratories NATA accredited for that analysis.

For developments requiring a Level 2 assessment representative data should be available for most cases from EPA. Where representative data is not available monitoring may be required. Advice should be sought from EPA.

For Level 3 assessments no data is required on existing air quality prior to the assessment being undertaken.

## 6.2 Monitoring conducted for approved developments

As modelling can only provide general guidance about the potential impacts for large premises that require a Level 1 assessment, monitoring should be conducted so that an evaluation of the local air quality (including the contribution from the mine or quarry site) against the assessment criteria can be undertaken. This type of monitoring is conducted to confirm the modelling predictions and would only be conducted for a limited period of time (eg., 12 - 24 months). The need for such monitoring to be ongoing would be reviewed by DPI in consultation with EPA and taking into account the advice of the site Environment Review Committee (or similar consultative body) after 12 months.

This compliance monitoring requires the use of monitoring equipment for PM<sub>2.5</sub> and PM<sub>10</sub> that complies with the Australian Standards for monitoring these particles. Monitoring should be conducted on a daily basis (24-hour periods) or in real-time. Some gravimetric sampling should also be conducted to allow for analysis of the particles for components such as respirable crystalline silica and heavy metals. The filters used for this purpose must be consistent with the analysis technique. Sampling for crystalline silica and arsenic must be conducted for a period of up to 1 week each month for an entire year to allow calculation of an annual average (total 12 samples per year). The sampling duration will be dependent on the levels of particles generated and the percentage of the indicator of concern within the PM<sub>10</sub> or PM<sub>2.5</sub> mass. Advice should be sought from EPA on the required sampling duration. Analysis must be undertaken by laboratories NATA accredited for that analysis.

For Level 2 operations, once operations have commenced 1-in-6 day sampling of PM<sub>10</sub> should be undertaken for a limited period to confirm the results of the modelling. The period of time required should be confirmed in consultation with EPA during the development of the site environmental management plan. The sampling should be undertaken at the time of year when the modelling predicts that the greatest contribution from the mining or quarry operations is likely to occur.

Sampling should be undertaken at sensitive locations such as residences where the modelling has predicted potentially high levels of particles and at least one site should be chosen downwind of the site to reflect the impact of the mining or quarry operations during the most predominant wind directions.

For developments that require a Level 3 assessment no compliance monitoring for PM<sub>10</sub>, PM<sub>2.5</sub>, respirable crystalline silica or heavy metals is required.

## 6.3 Monitoring for reactive management purposes

To ensure that the emissions from the site do not adversely impact sensitive locations, monitoring must be undertaken that allows for real-time reactive management practices to be implemented. This type of monitoring should be implemented for developments that have required a Level 1 or Level 2 assessment. This monitoring would be incorporated as part of the site environmental management plan. The need for ongoing monitoring would be reviewed at the end of each 12-month period and the site environmental management plan amended if required.

This type of monitoring allows site managers to identify when a problem has arisen on the site that may lead to an exceedance of the 24-hour air quality criteria. It allows management practices on site to be implemented to reduce the level of dust being generated. This may involve increased use of water sprays, use of chemical suppressants, or under unfavourable meteorological conditions the relocation of active works away from sensitive locations or ceasing works for a few hours until more favourable conditions are experienced. Hourly trigger levels will be provided by EPA that will allow site managers to identify when a problem may be arising on site.

The type of equipment used for this monitoring is not the same as that used for compliance purposes. There is a range of equipment available that is portable and relatively inexpensive that would be suitable for this type of monitoring. An indicative but not exhaustive list of the types of equipment available, indicative cost and suppliers is available on EPA's website and will be regularly updated. The availability of equipment and costs will change with time and suppliers should be contacted to identify the current range of equipment and costs.

Contact EPA for advice on appropriate monitoring equipment for this purpose and for the trigger levels that could be used to identify when levels are reaching levels that may require additional management practices.

## 7 FURTHER ADVICE OF AIR QUALITY ASSESSMENTS

Advice from EPA should be requested through the EPA Client Manager for the region. The EPA Client Manager will coordinate advice across EPA and will be the point of contact throughout the assessment process.

**Table 3: Summary of PEM requirements for mining and extractive industries**

	<b>Close to residential areas or large urban areas Level 1</b>	<b>Rural locations with residences in close proximity Level 2</b>	<b>Rural locations with no residences nearby Level 3</b>
Indicators to be assessed	<p>PM<sub>10</sub>, PM<sub>2.5</sub>, respirable, crystalline silica, nuisance dust (dust deposition).</p> <p>In gold mining areas also assess arsenic.</p> <p>Emissions from combustion processes to be included in modelling.</p> <p>Check with EPA Client Manager about other indicators that should be considered on a case-by-case basis.</p>	<p>PM<sub>10</sub>, PM<sub>2.5</sub>, respirable, crystalline silica, nuisance dust (dust deposition).</p> <p>In gold mining areas also assess arsenic.</p> <p>Emissions from combustion processes to be included in modelling.</p> <p>Check with EPA Client Manager about other indicators that should be considered on a case-by-case basis.</p>	<p>PM<sub>10</sub>, PM<sub>2.5</sub>, respirable, crystalline silica, nuisance dust (dust deposition).</p> <p>In gold mining areas also assess arsenic.</p> <p>Emissions from combustion processes to be included in modelling.</p> <p>Check with EPA Client Manager about other indicators that should be considered on a case-by-case basis.</p>
Monitoring data required for assessment	<p>12 months of 24 hour data to be available prior to assessment</p> <p>For Melbourne, Geelong and Latrobe Valley EPA to provide data</p> <p>For other areas 12 month of data to be collected by proponent</p> <p>Check with EPA client manager about availability of data</p>	<p>12 months of 24 hour representative data to be available prior to assessment</p> <p>Check with EPA client manager about availability of data</p> <p>In some circumstances the proponent may be required to collect data prior to the assessment.</p>	<p>No data required</p>

	<b>Close to residential areas or large urban areas Level 1</b>	<b>Rural locations with residences in close proximity Level 2</b>	<b>Rural locations with no residences nearby Level 3</b>
Modelling to be undertaken for EES processes or Works Approval applications	<ul style="list-style-type: none"> <li>1 year of daily predictions for PM<sub>10</sub> and PM<sub>2.5</sub> under worst-case scenario. For respirable crystalline silica, arsenic and other indicators that have long-term health effects annual average concentrations must be modelled.</li> <li>Modelling must be done at sensitive locations including houses, schools, recreation parks and sporting ovals, kindergartens. Any proposed developments must be assessed.</li> <li>Assessment to be conducted against assessment criteria included in Section 3 of this PEM</li> <li>Background data to be included - 24hour daily varying background for PM<sub>10</sub> and PM<sub>2.5</sub>. Annual average background data to be included for indicators for which annual average concentrations are being modelled.</li> </ul>	<ul style="list-style-type: none"> <li>1 year of daily predictions for PM<sub>10</sub> and PM<sub>2.5</sub> under worst-case scenario. For respirable crystalline silica, arsenic and other indicators that have long-term health effects annual average concentrations must be modelled.</li> <li>Modelling must be done at sensitive locations including houses, schools, recreation parks and sporting ovals, kindergartens. Any proposed developments must be assessed.</li> <li>Assessment to be conducted against assessment criteria included in Section 3 of this PEM</li> <li>Background data to be included - representative 24hour daily varying background for PM<sub>10</sub> and PM<sub>2.5</sub>. If not available then 70<sup>th</sup> percentile data can be used. Check with EPA client manager about appropriate data. Annual average background data to be included for indicators for which annual average concentrations are being modelled.</li> </ul>	<ul style="list-style-type: none"> <li>1 year of daily predictions for PM<sub>10</sub> and PM<sub>2.5</sub> under worst-case scenarios. For respirable crystalline silica, arsenic and other indicators that have long-term health effects annual average concentrations must be modelled.</li> <li>No background data required.</li> <li>Assessment to be conducted against assessment criteria included in Section 3 of this PEM.</li> </ul>
Dust control practices to be applied	<p>All emissions must be controlled by application of best practice.</p> <p>For Class 3 indicators such as respirable crystalline silica and arsenic, emissions must be controlled to the maximum extent achievable.</p>	<p>All emissions must be controlled by application of best practice.</p> <p>For Class 3 indicators such as respirable crystalline silica and arsenic, emissions must be controlled to the maximum extent achievable.</p>	<p>All emissions must be controlled by application of best practice.</p> <p>For Class 3 indicators such as respirable crystalline silica and arsenic, emissions must be controlled to the maximum extent achievable.</p>

	<b>Close to residential areas or large urban areas Level 1</b>	<b>Rural locations with residences in close proximity Level 2</b>	<b>Rural locations with no residences nearby Level 3</b>
Operational practices	Real-time continuous monitoring of PM <sub>10</sub> and PM <sub>2.5</sub> and nearest sensitive locations linked to a reactive management strategy.  12 months of 1 in 6 day sampling for respirable crystalline silica to confirm results of modelling.	Real-time continuous monitoring of PM <sub>10</sub> and PM <sub>2.5</sub> and nearest sensitive locations linked to a reactive management strategy.  12 months of 1 in 6 day sampling for respirable crystalline silica to confirm results of modelling.	None required for off-site impacts. Occupational health and safety requirements to be met.
Consideration of greenhouse and energy issues	Proponents must demonstrate that consideration has been given to greenhouse and energy efficiency issues in their proposal. Refer to the PEM for Greenhouse and Energy Efficiency and the associated toolkit for further information.	Proponents must demonstrate that consideration has been given to greenhouse and energy efficiency issues in their proposal. Refer to the PEM for Greenhouse and Energy Efficiency and the associated toolkit for further information.	Proponents must demonstrate that consideration has been given to greenhouse and energy efficiency issues in their proposal. Refer to the PEM for Greenhouse and Energy Efficiency and the associated toolkit for further information.

## APPENDICES

### Appendix 1: Mining and Extractive Industry Regulation

#### Department of Primary Industries

Minerals and Petroleum Regulation Branch within DPI is responsible for the regulation of the extractive and mining industries in Victoria under the *Extractive Industries Development Act 1995* ('EID Act') and *Mineral Resources (Sustainable Development) Act 1990* ('MRSD Act') respectively. Mining differs from extractive industry in that a Mining Licence must be obtained under the MRD Act before a proponent can proceed to obtain other approvals. Both mining and extractive industry proponents must obtain a Work Authority under the relevant act prior to commencing work. A Work Authority can only be granted once the Department is satisfied that the proponent/licensee has :

- a satisfactory work plan;
- entered into a rehabilitation bond;
- obtained a planning permit or completed a satisfactory EES
- obtained all necessary infrastructure as well as landowner consents in accordance with Section 19 of the Extractive Industries Development Act 1995 and Section 42 of the Mineral Resources Development Act 1990.

DPI's role also includes assessing applications for mining titles and Work Authorities, auditing sites, investigating complaints and incidents, ensuring rehabilitation bonds cover the actual rehabilitation liability and undertaking appropriate enforcement action.

#### Environment Protection Authority (EPA) Victoria

The *Environment Protection Act 1970* establishes the Environment Protection Authority (EPA), defines EPA's powers, duties and functions, and provides a number of instruments which are used to minimise wastes, pollution, and environmental risks. These instruments include State Environment Protection Policy (SEPP), Waste Management Policy (WMP), works approvals, licences, pollution abatement notices (PANs), noise control notices, environment improvement plans and industry waste reduction agreements.

SEPPs are declared by the Governor in Council under section 16(1) of the *Environment Protection Act 1970*. A SEPP may, for a specified segment of the environment:

- identify the beneficial uses of the environment that are to be protected

- describe the environmental indicators to be employed to measure and define the environmental quality
- state environmental quality objectives to protect beneficial uses (where practicable)
- describe a program by which the stated environmental quality objectives are to be attained.

SEPPs provide a context for environmental decision making and a clear set of publicly agreed environmental objectives that all sections of the community work together to achieve. Within this framework, EPA has the primary role for pollution prevention and control, whilst other government departments and agencies have other responsibilities to ensure SEPP objectives are attained.

SEPPs are now developed in accordance with the principles of the Intergovernmental Agreement on the Environment. This Agreement was signed by all three spheres of Australian government ie. National, State and local in 1992.

The Agreement contains principles for guiding the development and implementation of environmental policy and programs by all levels of government including:

- *the Precautionary Principle;*
- *Intergenerational Equity;*
- *Conservation of Biological Diversity and Ecological Integrity;*
- *Improved Valuation, Pricing and Incentive Mechanisms.*

Under the provisions of the Environment Protection Act "scheduled" discharges to the environment require EPA works approval and licensing unless an exemption applies. The industries so scheduled are outlined in the *Environment Protection (Scheduled Premises and Exemptions) Regulations 1996*.

Mining is exempt from the need for works approval and licensing provided the discharge or deposit of mining waste is solely to land and in accordance with the *Mineral Resources (Sustainable Development) Act* or the *Extractive Industries Development Act*.

EPA (Victoria) role is to ensure that the off-site emissions arising from mining and extractive industries do not adversely impact on the beneficial uses of the environment identified in SEPPs. For air quality these are listed in Section 3 of this Protocol for Environmental Management.

#### Department of Human Services

The mission statement for the Department of Human Services Public Health Branch is that:

'Public Health, in partnership with communities, government and other organisations, focuses on the health of all Victorians by:

- *Promoting health and wellbeing for all*
- *Preventing and minimising the effects of disease, illness and injury*
- *Addressing inequalities and the underlying causes of ill health*
- *Responding to public health threats and community concerns, and*
- *Promoting informed decision-making through a solid foundation of research, policy and legislation.'*

The Environmental Health Unit (EHU) is located within the Public Health Branch. EHU looks at aspects of human health that can be protected and enhanced by changing physical, chemical, biological, radiological and social factors in the environment. This is done via statutory and advisory functions.

In relation to major projects in Victoria, including mining and extractive activities, EHU has a role in:

- Environment Effects Statement planning processes
- review of draft Workplans (referred by Department of Primary Industries)
- assessment of EPA Works Approval applications
- development of air quality standards that are protective of human health
- regulating radiation safety in Victoria via the *Radiation Act 2005* and the *Radiation Regulations 2007*.

The *Health Act 1958* also contains Nuisance Provisions, giving local government powers to issue abatement notices on operations causing a nuisance in their municipality.

For further advice contact the Environmental Health Unit on 1300 768 874 or the Radiation Safety Section on 1300 767 469 or refer to

[www.health.vic.gov.au/environment/radiation](http://www.health.vic.gov.au/environment/radiation).