# Air Emissions Management Plan

**EMO-ENV-PLN-1203**

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
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<td>1</td>
<td>01/03/2011</td>
<td>New Document</td>
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<td>2</td>
<td>25/10/2015</td>
<td>Revised Plan</td>
<td>Jamie Coad</td>
<td>Jamie Coad</td>
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<td>3</td>
<td>28/9/2015</td>
<td>Revised Plan</td>
<td>Bella Bamford</td>
<td>Martin McLaughlin</td>
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<td>4</td>
<td>21/03/2016</td>
<td>Revised Plan</td>
<td>Bella Bamford</td>
<td>Martin McLaughlin</td>
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<td>5</td>
<td>17/02/2017</td>
<td>Revised Plan</td>
<td>Bella Bamford</td>
<td>Martin McLaughlin</td>
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# Air Emissions Management Plan

## TABLE OF CONTENTS

1. INTENT ........................................................................................................................................... 3  
   1.1 Purpose ........................................................................................................................................ 3  
   1.2 Context ......................................................................................................................................... 3  
   1.3 Applicability ............................................................................................................................... 3  
2. CURRENT STATUS ......................................................................................................................... 3  
   2.1 Current Operations ...................................................................................................................... 3  
   2.2 Sensitive Receptors .................................................................................................................... 4  
3. METEOROLOGY ............................................................................................................................. 4  
4. POTENTIAL IMPACTS ..................................................................................................................... 5  
   4.1 Particulates .................................................................................................................................. 5  
   4.2 Greenhouse Gases ....................................................................................................................... 6  
   4.3 Gaseous Emissions ...................................................................................................................... 6  
5. ENVIRONMENTAL OBJECTIVES ................................................................................................... 6  
6. PERFORMANCE INDICATORS / CRITERIA .................................................................................... 6  
7. MANAGEMENT & IMPLEMENTATION STRATEGY .......................................................................... 7  
8. STAKEHOLDER CONSULTATION .................................................................................................. 11  
9. TRAINING & AWARENESS ........................................................................................................... 11  
10. PERFORMANCE MONITORING .................................................................................................... 11  
11. CONTINGENCIES .......................................................................................................................... 12  
12. RELEVANT LEGISLATION & GUIDELINES .................................................................................. 12  
13. RELEVANT INTERNAL DOCUMENTS .......................................................................................... 12  
14. AUDITING & REPORTING ............................................................................................................ 13  
15. REVIEW & REVISION ................................................................................................................... 13  
16. DEFINITIONS ............................................................................................................................... 15  
17. REFERENCES ............................................................................................................................... 16
1. INTENT

1.1 Purpose

This Air Emissions Management Plan outlines the management of air emissions at Edna May Operations (EMO), including the minimisation of any environmental risks, hazards or impacts in relation to air emissions. Specifically, this document provides a framework to minimise, avoid or manage potential impacts from particulate and gaseous emissions and greenhouse gases generated from EMO.

1.2 Context

The Air Emissions Management Plan forms part of the overall Environmental Management System (EMS) for the operation. This Management Plan outlines the strategy and procedures to ensure that air emissions are monitored as per statutory requirements and managed to ensure that the environmental and community impact is minimised. Due to the proximity of EMO to the town of Westonia fugitive dust monitoring and management is the main focus.

1.3 Applicability

This Air Emissions Management Plan applies to all staff and contractors working at EMO. Occupational Health and Safety Management of air emissions are not covered in this Plan and will be managed separately under the Occupational Health and Safety Management System.

2. CURRENT STATUS

Edna May is an open cut gold mine located in the eastern part of the central Wheatbelt of Western Australia, 312 km by road from Perth and 10 km north of the Great Eastern Highway. Of the 767 ha which make up the mining leases of the Edna May Gold Project, over 50% of the area consists of cleared farmland. The farmland was cleared before the 1930’s and has been regularly cropped. The remaining land consists of previously disturbed mined areas and remnant vegetation.

The current land uses within the Project Area are mining, processing, mineral exploration, farming and conservation. Westonia town site which includes local businesses, sporting facilities, residences and the mining camp is located approximately 0.8 km south of the southern end of the existing pit.

A map indicating current dust monitoring locations and the location of nearby residences can be seen in Appendix 1.

2.1 Current Operations

The pit, Run of Mill (ROM) and process plant are surrounded by native remnant vegetation, separating the mine site from the town. Agricultural land is located immediately to the north, east and west of the Integrated Waste Landform (IWL) and evaporation ponds, which are located to the north of the plant on cleared farmland.

EMO is licensed (L8422/2010/2) through the Department of Environment Regulation (DER) under the Environmental Protection Act 1986. The current licence was amended in March 2016 however the previous version issued in May 2013 contained an Improvement Reference which requested the development of a Dust Management Plan measuring PM$_{10}$. In response this management plan was amended in 2015 and an aerosol monitor which measures PM$_{10}$ was hired and commenced monitoring in September 2015 as a trial. In June 2016 the same model of monitor was purchased and in the next month the new monitor was setup and the rental returned.
Depositional (settled) dust monitoring has been completed onsite since 2011 and currently 9 sites are monitored including one for background.

2.2 **Sensitive Receptors**

Sensitive receptors surrounding the site include:

- Rural residential properties to the south-west (1 km) and north-west (2.4 km) of the plant, are potentially the most sensitive potential human receptors of dust generated from site; and
- Westonia town site (including a school, sport oval and residences) located approximately 0.8 km south of the southern end of the existing pit. This is buffered by vegetation.

Other sensitive receptors to air emissions include:

- Native vegetation surrounding the site (smothering of vegetation from dust); and
- Fauna present in native vegetation surrounding the site (dust can impact fauna habitats, further impacting on the occurrence and abundance of fauna species).

3. **METEOROLOGY**

The Avon Wheatbelt bioregion climate is semi-arid warm Mediterranean and is characterised by hot dry summers and wet winters. Climate is controlled primarily by 'southern oscillation of the anticyclonic belt' with relatively small influence of the ‘El Nino’ effect. The closest Bureau of Meteorology (BOM) weather station providing long-term data is located at Merredin (BOM station: 010092), approximately 42 km to the south-west.

The Merredin BOM station has a long term mean annual rainfall of 325.8 millimetres (mm), with the majority of this rain falling between May and August. Approximately 70% of annual rainfall falls during the 5-month growing period (May-September) and is of relatively low variability. Long-term statistics indicate that the monthly mean maximum temperatures range from 19° C in July to 37.4 ° C in January, and mean minimum temperatures range between 14.2 ° C in July to 30.9° C in January (BOM, 2013).

Figure 1 shows the mean monthly minimum and maximum temperature and mean monthly rainfall for Merredin. The important features of this figure are that rainfall occurs during the winter months and that summer temperatures can be very high. Annual rainfall is approximately 450mm in this easterly margin of the agricultural zone. These conditions are highly conducive to dust generation.

Monthly wind conditions for 9am and 3 pm in Merredin can be seen in Appendix 2. The data indicates that mornings during the summer months are dominated by easterly conditions with some strong north-easterly conditions that might be conducive to wind erosion. The winter afternoons appear to be dominated by westerly winds reflecting the progression of frontal conditions at that time of year.
Figure 1: Merredin climate data

4. POTENTIAL IMPACTS

4.1 Particulates

In 2015 - 2016 Evolution Mining reported to the National Pollutant Inventory (NPI) that Edna May emitted 1,108,142 kg of fugitive PM$_{10}$ and 17,070 kg of fugitive PM$_{2.5}$. There is no requirement under the NPI for the reporting of settled dust or total suspended particulates.

The main source of atmospheric pollution associated with the Project will be dust. Airborne particulates may be generated from a number of sources and activities, including:

- Land clearing and construction activities;
- Blasting, handling, and haulage / conveying of ore and overburden;
- Crushing and milling at the process plant; and
- Wind erosion of ore stockpiles, IWL (including tailings storage and waste landforms) and topsoil stockpiles.

Potential impacts of dust can include:

- Smothering of vegetation;
- Secondary impacts from vegetation smothering on fauna dependent on these vegetation communities;
- Impacts on human health, depending on the size of the dust particle and its chemical composition; and
- Reduction of visual amenity.
4.2 Greenhouse Gases

The greenhouse effect is a natural phenomenon that warms the earth and enables it to support life (EPA, 2002). The six greenhouse gases specifically targeted by the The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) are carbon dioxide (CO₂), methane (CH₄), perfluorocarbons (CFₓ), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF₆), and nitrous oxide (N₂O) (Commonwealth Australia, 1988). For the Edna May Gold Project the major relevant greenhouse gas will be CO₂. The main energy using activities – those which dominate greenhouse gas emissions from the Edna May Project include:

- Operation of the processing plant; and
- Burning of fuels by vehicles, haul trucks and equipment during and operations.

EMO reports as a group member under Evolution Mining for the purposes of the National Greenhouse and Energy Reporting Act 2007 (NGER). In 2015 - 2016 EMO reported that 616,693 GJ of energy was consumed producing 26,878 t CO₂-e Scope 1 Emissions and 46,872 t CO₂-e Scope 2 Emissions.

4.3 Gaseous Emissions

Gaseous emissions are confined mainly to exhaust fumes from vehicles and machinery. Emissions from processing are considered negligible. Gaseous emissions have the potential to impact upon human health, and are covered under the OH&S management system.

Evolution Mining reports the Edna May emissions under the National Pollutant Inventory. In 2015 - 2016 there were 270,230 kg of fugitive NOx emissions, 145,083 kg of fugitive carbon monoxide emissions and 17,838 kg of volatile organic compounds (VOCs).

5. ENVIRONMENTAL OBJECTIVES

Environmental objectives for the management of air emissions at EMO are to:

- Ensure that air emissions (namely particulates) do not have an adverse impact on the ecological environment and the health, welfare and amenity of people and land uses;
- Ensure air emissions meet regulatory requirements; and

Adopt energy-efficient design and operational practices throughout the operation to reduce the generation of greenhouse gases.

6. PERFORMANCE INDICATORS / CRITERIA

The results of sampling are compared against the New South Wales (NSW) criteria for settled dust which are 2mg/m²/month as a primary standard where background dust is low and no more than 2mg/m²/month higher than background levels as a secondary standard where background dust is high. The NSW criteria were initially developed for coal dust, however, they are currently the only settled dust standards applied in Australia. EMO have been undertaking settled dust sampling since 2011.

There are no specific criteria that apply to this operation, however, should dust complaints arise or regulators intervene, for whatever reason, they will expect that dust levels experienced by the community will be restrained to comply with the criteria shown in Table 1.
Edna May Operations will monitor its environmental performance in relation to:

- Conformance with the air emissions management and implementation strategy (Table 2) (completion of actions specified within nominated timeframe);
- Compliance with regulatory requirements;
- Effectiveness and efficiency of management actions.

The means by which conformance with the management actions required under the emissions management strategy will be demonstrated is indicated under the column headed ‘evidence’ in Table 2.

7. MANAGEMENT & IMPLEMENTATION STRATEGY

Air emission management and implementation strategies at Edna May have been devised to comply with legislation and to reduce the risk of potential air emission impacts to human health and the environment. Responsible parties for the implementation of management actions and an indication of the timing for implementation are also provided in Table 2.

In the event that the outcomes targeted by the key management actions are not achieved, existing management controls will be reviewed to identify whether the inadequate outcomes are the result of a failure to implement the actions, or whether the management controls are themselves ineffective.
## Table 2: Air Emissions Management & Implementation Strategy

<table>
<thead>
<tr>
<th>MANAGEMENT ACTION</th>
<th>TIMING</th>
<th>RESPONSIBILITY</th>
<th>EVIDENCE</th>
</tr>
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<tbody>
<tr>
<td><strong>Stakeholder Consultation</strong></td>
<td></td>
<td></td>
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<tr>
<td>AEIS 1</td>
<td>Ongoing</td>
<td>General Manager / People and Culture and Community Manager</td>
<td>Information Letters Stakeholder Consultation Register</td>
</tr>
<tr>
<td>Correspond with closest residents when significant changes to mine site activities are planned.</td>
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<tr>
<td>AEIS 2</td>
<td>Ongoing</td>
<td>People and Culture and Community Manager</td>
<td>Complaints Register Incident Reporting (QHSE)</td>
</tr>
<tr>
<td>24 hour complaints procedure. This may assist in determining where further corrective actions are required.</td>
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<tr>
<td>AEIS 3</td>
<td>Ongoing</td>
<td>People and Culture and Community Manager</td>
<td>Complaints Register Incident Reporting (QHSE)</td>
</tr>
<tr>
<td>When an air emissions complaint is received it will be acknowledged and responded to within 48 hours. If the investigation indicates that corrective actions are required they will be implemented as soon as reasonably practicable.</td>
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<tr>
<td><strong>Particulates</strong></td>
<td></td>
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<tr>
<td>AEIS 4</td>
<td>Ongoing</td>
<td>Mining Shift Supervisor</td>
<td>Water carts in use.</td>
</tr>
<tr>
<td>Dust suppression in high traffic areas including haul roads, access roads, IWL, around the plant and offices and other disturbed areas, with water carts. Dust suppression using water carts will also be undertaken where visible dust indicates significant dust lift off and otherwise as required.</td>
<td></td>
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<tr>
<td>AEIS 5</td>
<td>Ongoing</td>
<td>All personnel</td>
<td>Road signs Incident reporting (QHSE)</td>
</tr>
<tr>
<td>Speed limits</td>
<td></td>
<td></td>
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<tr>
<td>AEIS 6</td>
<td>Ongoing</td>
<td>Processing Manager</td>
<td>Effective operation of the dust management system</td>
</tr>
<tr>
<td>Dust generated by the processing plant will be controlled by water sprays.</td>
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<tr>
<td>AEIS 7</td>
<td>Ongoing</td>
<td>Process Shift Supervisors</td>
<td>Tailings logs Inspection sheets TSF Annual Audit Report</td>
</tr>
<tr>
<td>Ensure tailings are deposited in accordance with the Operations Manual for Tailings Storage to minimise dust.</td>
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<td></td>
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<tr>
<td>AEIS 8</td>
<td>During Blasts</td>
<td>Mining Manager</td>
<td>Blasting logs</td>
</tr>
<tr>
<td>To mitigate dust from blasting, blasting will not be carried out on excessively windy days, and when the wind direction is likely to carry dust over the town of Westonia (i.e. from the north).</td>
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<td>AEIS 9</td>
<td>Ongoing</td>
<td>General Manager / Mining Manager / Environmental Advisors</td>
<td>Mine Closure Plan. Summarised in the AER.</td>
</tr>
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<td>Progressive rehabilitation of exposed / disturbed areas.</td>
<td></td>
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<td></td>
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<tr>
<td><strong>Greenhouse Gas and Gaseous Emissions</strong></td>
<td></td>
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<tr>
<td>AEIS 10</td>
<td>Ongoing</td>
<td>Project Manager</td>
<td>Final design plans.</td>
</tr>
<tr>
<td>Design features that have been incorporated in the Project to reduce energy consumption, and hence greenhouse emissions include:</td>
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<tr>
<td>• High efficiency impellors on tailings pumps; and</td>
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</table>
### Variable speed drives on various motors in the process plant.

**AEIS 11**
Vehicle, plant and generator exhaust emissions are minimised through regular servicing and maintenance. All machines are scheduled for regular service and maintenance programs, and emissions adhere to all relevant standards and regulations.  
Ongoing
Maintenance Superintendent
Pronto work orders PM program

### Energy efficient lighting, air conditioning and computers progressively deployed throughout the administration and accommodation areas.

**AEIS 12**

Ongoing
All Personnel
Summarised in the AER.

### Training & Awareness

- **AEIS 13**
  Educate Edna May employees and contractors on driving to conditions and speed limits through inductions and awareness activities.  
  Ongoing
  Environmental Advisors / Area Supervisors
  Induction presentation Monthly awareness presentations Toolbox meetings

- **AEIS 14**
  Employee and contractor awareness for potential elevated dust emissions is conducted through inductions.  
  Ongoing
  HSE Superintendent
  Induction presentation

- **AEIS 15**
  Emission management onsite is the responsibility of all EMO personnel and contractors. Each department is responsible for emission management and emission reduction strategies in their specific work area (where applicable).  
  Ongoing
  Department Managers
  Quarterly area inspections Audits records.

### Monitoring & Contingencies

- **AEIS 16**
  Periodic visual observations and inspections will be held to assess the condition of the vegetation along the mine site roads, surrounding the IWL and plant.  
  Monthly
  Environmental Advisors
  Photo Monitoring

- **AEIS 17**
  Photographic monitoring is undertaken to observe any impacts attributed to dust:
  - Monthly photographic monitoring of vegetation health every 50 m along the southern boundary of the IWL;
  - Quarterly photographic monitoring of remnant vegetation strip to the west of the IWL haul road; and
  - Quarterly photographic monitoring of remnant vegetation along the Corsini haul road;  
  Monthly and / or Quarterly
  Environmental Advisors
  Photo Monitoring

- **AEIS 18**
  Monitor traffic on roads to ensure speed limits are met.  
  Operations
  EMO Managers
  HSE Superintendent
  Toolbox meetings HSE minutes Incident reporting (QHSE)

- **AEIS 19**
  Regular review of complaints register and incident reports are undertaken. If complaints from residents are received or adverse impacts to flora and fauna are observed (due to dust emissions) an incident report will be prepared and submitted to the HSE Department within 24 hrs. The incident report will identify contingency actions to be implemented and the date for completion of contingency actions.  
  Operations
  HR& C Manager
  HSE Superintendent
  Incident reporting (QHSE) Complaints register Summarised in the AER.
| AEIS 20  | The EMO incident management system records all environmental incidents, environmental complaints and tracks and manages corrective actions resulting from environmental incidents; addresses community complaints; and records audit outcomes. | Ongoing | All personnel | Incident reporting (QHSE) Complaints register Summarised in the AER. Audit Records |
| AEIS 21  | Settled dust samplers will be deployed throughout the year at locations DM1, DM2, DM3, DM6, DM7, DM9, DM10, DM11 and DM13. | Ongoing | Environmental Advisors | Certificate of Analysis MonitorPro database |
| AEIS 22  | Quarterly environmental audits of site will be organised and completed by the Evolution Mining Group | Quarterly | Group Manager – Environment & Sustainability | Audit Records (QHSE) Summarised in the AER. |
| AEIS 23  | PM10 monitoring will be completed in areas identified as a high priority | Ongoing | Environmental Advisors | MonitorPro database |

**Auditing & Reporting**

| AEIS 24  | When emission triggers for reporting under the National Pollution Inventory (NPI) and the National Greenhouse and Energy Reporting (NGERS) are exceeded, dust, plant, blast and exhaust emissions are calculated, reported and submitted annually. | Annually | Environmental Advisors | NPI and NGERS reports |
| AEIS 25  | This management plan, its outcomes and the implementation of management actions detailed in this plan will be audited and revised when required. | Ongoing | Environmental Advisors | Summarised in the AER |
| AEIS 26  | Breaches of license or tenement conditions will be reported to the relevant authority (DER or DMP) within 48 hrs. and summarised through the Annual Audit Compliance report (AACR), as part of License L8422/2010/2. External reporting of incidents is the responsibility of the General Manager with assistance from the Environmental Department. | As Required | General Manager / Environmental Advisors | Incident reporting (QHSE) Summarised in AER Submitted AACR |

**Review & Revision**

| AEIS 27  | The General Manager will review this Air Emission Management Plan, allocate resources to implement it, ensure appropriate action is being taken on non-compliances, and offer support to environmental staff through directives to site personnel. | Ongoing | General Manager | Revision Record Completed Actions (QHSE) |
| AEIS 28  | This Air Emissions Management Plan will be internally reviewed at least every 2 years. Reviews will also be conducted at key stages of the Project based on planning requirements; review of incidents, audits and corrective actions; legal requirements; and analysis of monitoring results. The reviews will incorporate feedback from relevant Edna May staff and DER / DoW / DMP staff. | As a minimum every 2 yrs or when required | Environmental Advisors | Revision record |
8. STAKEHOLDER CONSULTATION

Edna May has developed a Complaints Register to record complaints from stakeholders, and record actions taken to address these complaints by site personnel. All complaints are recorded in a site Complaints Register and an Incident Report raised. The Incident Report for the Complaint is recorded in QHSE. Evolution Mining aims to maintain a healthy relationship with neighbouring stakeholders by promoting open and honest communications regarding any hazards that may impact upon the operations neighbours.

Following reports of an air emissions complaint an acknowledgement will be made within 48 hours. Investigation of potential dust sources will proceed immediately following receipt of the complaint and any excessive dust emissions will be controlled. If operations are found to be the source of excessive dust then this will be acknowledged to the person making the complaint along with indication of how the dust source is to be controlled.

9. TRAINING & AWARENESS

Sources and impacts of dust as well as management practices and requirements are outlined during contractor and employee inductions to ensure all Edna May personnel understand and implement mitigation and management requirements regarding emissions. All EMO employees and contractors are responsible for minimising and managing dust during operations and especially in their work areas.

Additional area specific training and awareness presentations will be completed where required.

10. PERFORMANCE MONITORING

Monitoring of impacts from air emissions is performed through:

- Depositional (settled) dust monitoring;
- PM$_{10}$ monitoring;
- Regular visual observations of vegetation health along roadways, surrounding the IWL and surrounding the plant;
- Monthly photo monitoring of the remnant vegetation along the southern boundary of the IWL;
- Quarterly photo monitoring of remnant vegetation;
  - east of the IWL;
  - along the Corsini haul road; and
  - along the site access road;
- Monitoring traffic speeds;
- Regular review of complaints register and incident reports;
- Quarterly environmental assurance and implementation audits;
- Annual *Eremophila resinosa* survey (plant number and health); and
- Quarterly area inspections.

Air emissions are also reported in the National Pollution Inventory (NPI) and for the National Greenhouse and Energy Reporting (NGER).
11. CONTINGENCIES

If unauthorised or unexpected adverse impacts attributable to air emissions are detected an incident report will be prepared and submitted to the EMO Management Team within 24 hrs. The incident report will identify contingency actions to be implemented and the date for completion of contingency actions.

12. RELEVANT LEGISLATION & GUIDELINES

The following legislation, regulations and guidelines are applicable to this management plan:

- Biodiversity Conservation Act 2016;
- Clean Energy Act 2011;
- EPA Guidance Statement No. 12 Mining Greenhouse Gas Emissions;
- Environmental Protection Act 1986 and Regulations 1987;
- EPA Guidance Statement No 18 Prevention of Air Quality Impacts from Land Development Sites, 2000;
- National Environmental Protection (Ambient Air Quality) Measure (NEPC, 2003);
- Environmental Protection (NEPM - NPI) Regulations 1998;
- Environmental Protection (Unauthorised Discharges) Regulations 2004;
- National Greenhouse and Energy Reporting Act 2007;
- Mining Act 1978;
- Mines Safety and Inspection Act 1994; and
- Mines Safety and Inspection Regulations 1995;

13. RELEVANT INTERNAL DOCUMENTS

The following relevant internal documents can be located on QHSE;

- Environmental Management System Manual (EMO-ENV-MAN-1201)
- Noise Management Plan (EMO-ENV-PLN-1204);
- Crusher and Coarse Ore Stockpile Dust Management Plan (EMO-ENV-PLN-1702);
- Clearing and Ground Disturbance Procedure (EMO-ENV-WP-1201);
- Blast Monitoring Procedure (EMO-ENV-WP-1210);
- Data Management Procedure (EMO-ENV-WP-1213);
- Depositional Dust Monitoring Procedure (EMO-ENV-WP-1214);
- Photo Point Monitoring Procedure (EMO-ENV-WP-1221);
- Topsoil Stripping Procedure (EMO-ENV-WP-1222);
- PM10 Dust Monitor Maintenance and Data Collection Procedure (EMO-ENV-WP-1224); and
- Water Truck Operation Procedure (EMO-MIN-WP-1406).
Other relevant documents include:

- DER Site Operating Licence L8422/2010/2
- DER WWTP Licence L8811/2014/1
- Westonia Gold Mine Threatened Flora Management Plan, 2007 (Outback Ecology, 2007);
- Edna May Gold Mining Proposal May, 2009;
- EMO Edna May Gold Project Works Approval, March 2009, Works Approval Number 4546/2009/1;
- EMO Mine Closure Plan (2016) and
- EMO Compliance Register.

14. AUDITING & REPORTING

This EMP and its outcomes, commitments and the implementation of the management actions will be audited and revised where required. The key management actions identified in Table 2 will be the basis for this audit.

The results of inspections, audits and incident reports or complaints received relating to air emissions will be included in the AER submitted to the statutory authorities. This will be additional to any event-based reporting.

The EMO internal reporting system (QHSE) will record any non-compliance or licence or tenement conditions relating to air emissions and their management. The non-compliances will be recorded and will not be closed out until corrective measures are in place. These will also be summarised in the AER.

Breaches of licenses, permits or tenement conditions which result in an adverse effect on the environment will be reported to DER or DMP within 24 hours and summarised in the AER. The timelines and responsibilities associated with reporting are detailed in Table 2. External reporting of incidents is the responsibility of the General Manager with assistance from the Environmental Department.

Compliance assurance audits will be undertaken by Group on a quarterly basis and may include this Management Plan. All audit reports and subsequently allocated corrective actions are available on QHSE.

15. REVIEW & REVISION

This EMP is intended to be adaptive and is subject to change as new information becomes available. It incorporates the formal requirements of the DER Operating Licence as well as Tenement Conditions.

This EMP will be reviewed by the Environmental Department as a minimum every 2 years or in the following circumstances,

- Procedures are required to be modified; or
- The Project scope has changed significantly.

Review of this EMP will seek to address the following questions:
• Is the background information about the Project current?
• Are there cross references to other documents (including procedures) that should be added?
• Has any further consultation of a material nature been undertaken?
• Has the scope of the plan changed in a material way?
• Is there any new or revised legislation or policy that should be considered?
• Are any of the management actions fully complete such that they can be removed?
• Should any new management actions be added, either as a result of incident reports, inspection results, project changes or other developments?
• Are the performance indicators effective in assessing performance?
• Are there better alternative indicators?
• Has monitoring highlighted any gaps in the program, and should the existing monitoring program be modified?
• Is the allocation of responsibilities for each management action appropriate? Is the review period for this plan appropriate?

If the assessment identifies the need for changes to the management plan, such changes will be implemented and the plan reissued.
16. DEFINITIONS

<table>
<thead>
<tr>
<th>Dust Type</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Carbon Dioxide (CO₂)</td>
<td>CO₂ is a colourless odourless gas at normal temperature and pressure that represents some 0.039% of the atmosphere. It is one of the products of complete combustion of hydrocarbons such as diesel (Oxford Dictionary of English, 2005). Carbon dioxide is radiatively active, meaning that it adsorbs some low wavelength infrared frequencies. For this reason it is considered a greenhouse gas.</td>
</tr>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>Carbon monoxide is a colourless odourless gas that is a product of partial combustion. Carbon monoxide fixes to blood haemoglobin in preference to oxygen where it remains for considerably longer periods. Sufficient exposure to carbon monoxide can result in an impact of blood oxygen saturation leading initially to dizziness, nausea and headaches. Continued exposure will drive down blood oxygen levels leading to coronary stress and ultimately asphyxiation. Relatively low impacts are reversible by removing the exposed person to a well-ventilated area, however typical exhaust concentrations are sufficient to lead to death if exposure is longer than a few minutes. The Ambient Air Quality NEPM standard for carbon monoxide is 9.0 ppm over 8 hours (NEPC, 1994).</td>
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<tr>
<td>Nitrogen Dioxide (NO₂)</td>
<td>At typical atmospheric concentrations NO₂ is colourless and odourless; however in concentrated form it is a reddish brown gas that has an acrid odour. It is highly acidic and even at low concentrations may cause respiratory tract irritation and prompt asthma and other airways diseases amongst those who are susceptible. The Ambient Air Quality NEPM standards for nitrogen dioxide are 120 ppb over 1 hour and 30 ppb as an annual average concentration (NEPC, 1994).</td>
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<tr>
<td>Oxides of Nitrogen (NOx)</td>
<td>NOx is the collective term for oxides of nitrogen and comprises two compounds (Nitrogen Dioxide and Nitric Oxide) NOx is formed by thermal fixing of atmospheric nitrogen with atmospheric oxygen during high temperature processes such as combustion. Typically most primary NOx is nitric oxide (NO), which is a colourless odourless gas. However, a small proportion (usually in the region of 10%) is nitrogen dioxide (NO₂). In addition, nitric oxide will react with low altitude atmospheric ozone to form NO₂. A third oxide of nitrogen – nitrous oxide (N₂O) may form in small quantities under oxygen limited conditions. N₂O is a greenhouse gas, which has gained some interest in the last 30 years, however the term oxides of nitrogen was defined in the 1940s and does not include this compound.</td>
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<tr>
<td>PM₁₀</td>
<td>Dust with an aerodynamic particle size of 10 µm or less. Whilst mechanical sources of dust contribute to this size range, sources of combustion and secondary aerosols also become important. A number of studies have found a correlation between increasing PM₁₀ concentrations and increases in morbidity and mortality. PM₁₀ does not usually settle out of the atmosphere without further reaction, nucleation or precipitation. PM₁₀ is the subject of a NEPM that sets a limit on daily average concentrations of &lt;50 µg/m³, which is not to be exceeded more than five days a year (NEPC 1994).</td>
</tr>
<tr>
<td>Total suspended particulates (TSP)</td>
<td>All particles entrained / suspended in the atmosphere which includes the fine, respirable particles (PM₁₀ and PM₂.5) 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 50 micrometres or less. Typically represents all dust that enters the atmosphere, but not necessarily the lungs. This dust is mainly generated by mechanical action, but may also arise from wind erosion of cleared surfaces at wind speeds in the region of 8 m/s and from combustion sources.</td>
</tr>
<tr>
<td>Settled Dust</td>
<td>Settled dust is the coarse fraction that typically arises due to mechanical disturbance of the surface (e.g. truck wheels). Dust of this particle size typically settles out completely within 400m of the source, with the majority of it settling out within 50m (NSW Minerals Council, 2011). If the elemental composition of the settled dust is benign, then the potentially significant impacts of this type of dust are confined to smothering of vegetation and fauna habitats and nuisance soiling.</td>
</tr>
</tbody>
</table>
17. REFERENCES


NEPC (1994). National Environment Protection (Ambient Air Quality) Measure, Commonwealth of Australia, Canberra, ACT, Australia
Appendix 1
Edna May Operations

Residence

Legend
- Deposional Dust Monitoring
- PM10 Monitoring Point

Air Quality Monitoring

Edna May Operations

0 200 400 800 1,200 1,600 Meters

Evolution

Edna May
Appendix 2
## Monthly Wind Roses for Merredin (BoM, 2017)

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