MINERALOGY PTY. LTD.

Dust Management Plan

Iron Ore Mine and Downstream Processing, Cape Preston, Western Australia

Mineralogy Pty Ltd

November 2006

Dust Management Plan

Prepared for

Mineralogy Pty Ltd

Prepared by

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1.0 Introduction

1.1 Background

Mineralogy Pty Ltd (the proponent), proposes the development of an iron ore mine and downstream processing facilities at Cape Preston, 80km south west of Karratha.

In response to project environmental impact assessment requirements as determined by the Environmental Protection Authority (EPA), a Public Environmental Review (PER) was submitted to the Authority in December 2000 (HGM, 2000). The PER was supplemented with a Supplementary Environmental Review (SER) in February 2002 to address changes to the project design being sought by the proponent (HGM, 2002). Under the proposal assessed by the EPA pursuant to the PER and SER, and a subsequent successful application for a non-substantial change to the assessed project pursuant to Section 45(c) of the *Environmental Protection Act 1986,* the project would entail an annual mining rate of approximately 67.4 Mt and annual production of the following:

- Concentrate – approximately 19.6 Mt;
- Pellets – approximately 13.8 Mt; and
- Direct reduced/hot briquetted iron – approximately 4.7 Mt.

Through the Section 45(C) process seeking Ministerial approval for a non-substantial change to the assessed project, it was made clear that the stockpiling and export of concentrate was intended and in this regard, it should be noted that the Minister's approval of the proposed change was unconditional.

The Ministerial Statement for the project was issued in October 2003, subject to a number of Conditions and the Proponent's Commitments. Condition 10 was for the preparation of a Dust Management Plan for the construction phase of the project.

1.2 Relevant Legislation and Guidelines

State Government Legislation	**Application**
Environmental Protection Act, 1986	PER assessment and Ministerial approval process, and Section 45 (C) non substantial change
Iron Ore Processing (Mineralogy Pty Ltd) Agreement Act, 2002	Act under which the project is developed
Occupational Health, Safety and Welfare Act, 1984	Sets workplace limits for air quality
State Government Guidelines	
Land Development Sites and Impacts on Air Quality	Management of on-site air quality issues during construction
Ambient Air Quality Guidelines	Prescription of acceptable air pollutant concentrations

1.3 Purpose of this Document

The purpose of this document is to satisfy the conditions set down by the Minister for the Environment in Condition 10.4 of the Ministerial Statement No. 000635 (Minister for the Environment, 2003). Ministerial Condition 10.4 requires that:

Prior to commencement of construction of the DRI plant, the proponent shall prepare a Dust Management Plan which:

1. *incorporates baseline and ongoing monitoring;*
2. *details management measures to minimise dust during construction;*
3. *demonstrates best practice and details the methods to be used for all point and fugitive sources;*
4. *incorporates monitoring to determine the size and composition of particulates;*
5. *incorporates further investigations into reactive DRI dust and details measures to minimise impacts;*
6. *provides for continuous improvements in dust management; and*
7. *details complaint response procedures;*

1.4 Objectives of this Document

The objective of this Dust Management Plan is to manage dust emissions generated within the project area, so that the appropriate dust criteria are met during both the construction and operational stages of the project. This management plan should be read in conjunction with the project Environmental Management System and Construction Environmental Management Plan.

1.5 Responsibilities and Reporting

Overall responsibility for ensuring that site environmental management requirements are met during the construction phase of the project will rest with the proponent's Construction Manager. During the operational phase, this responsibility will rest with the Environmental Officer. In respect of this Dust Management Plan, this responsibility will include:

- ensuring that all construction and operational personnel, both the proponent's workforce and contract personnel, conform with requirements pursuant to the Management Plan;
- ensuring that all staff are fully inducted and aware of their environmental responsibilities and obligations; and
- ensuring that monitoring requirements are being met.

Contracting companies undertaking construction or operational roles will be required to appoint an environmental representative. The key responsibilities of this representative will be to:

- maintain routine contact with the proponent's Construction and / or Environmental Manager to ensure that environmental objectives of this plan are being met;
- provide monthly reports to the proponent's Construction and / or Environmental Manager on environmental issues and conduct regular audits; and
- ensure that all management aims and monitoring requirements of this Dust Management Plan are being met.

1.6 Consultation

Pursuant to Environmental Impact Assessment requirements under the *Environmental Protection Act (1986)*, comprehensive consultation with stakeholders and members of the community has been undertaken. The outcomes of these negotiations were used to develop the commitments provided by Mineralogy and presented in the Public and Supplementary Environmental Review documents (HGM 2000, 2002) and, ultimately, in the development of this environmental management plan.

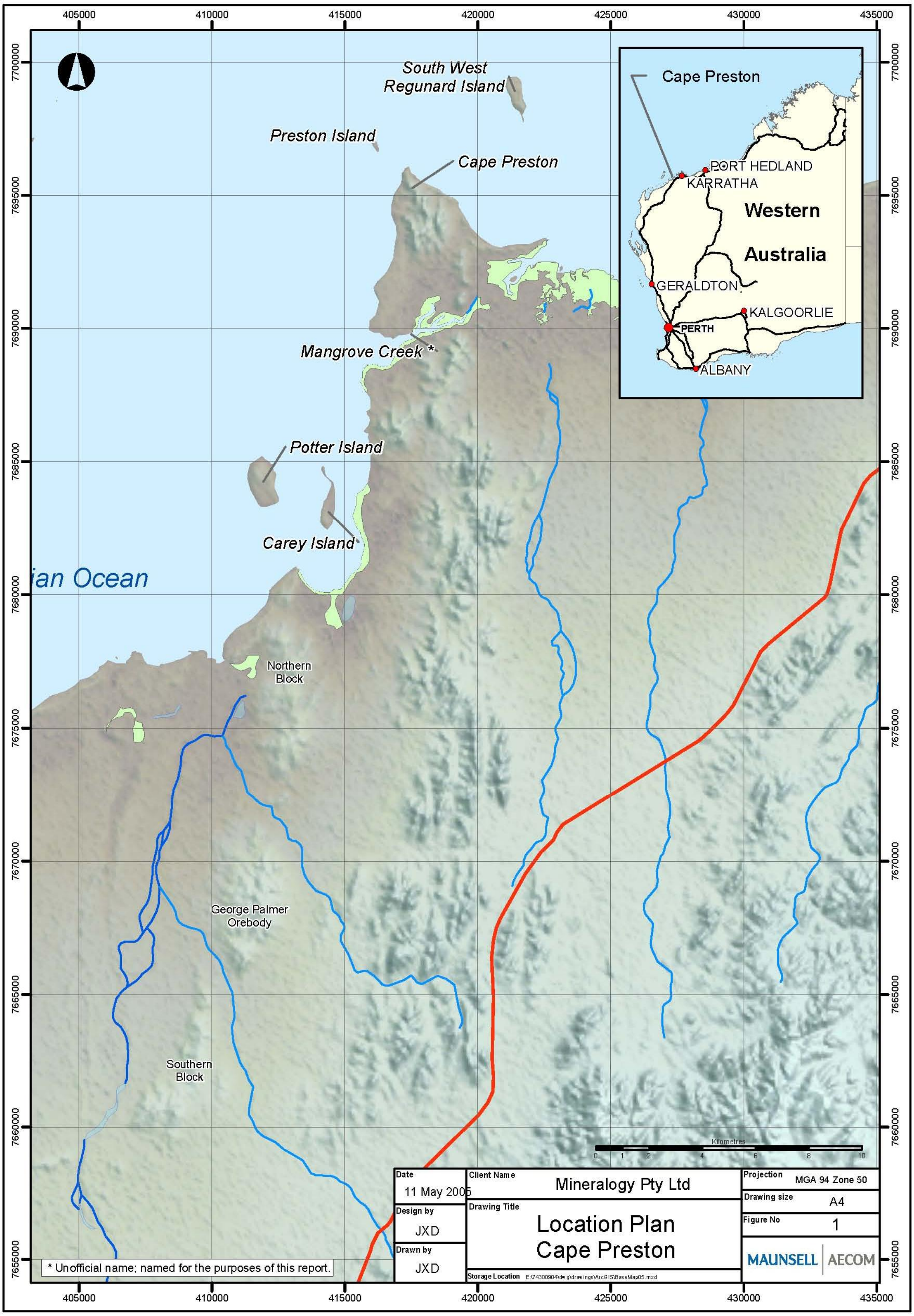
2.0 Project Description

2.1 Project Outline

The proponent plans to mine the George Palmer Orebody, which is located approximately 80km south west of Karratha and 25 km south of Cape Preston in the Pilbara region of Western Australia. A stockyard and laydown area will be constructed at Cape Preston. Preston Island is the intended location for the port facilities. Figure 1 depicts the location of the site in a regional context. The major components of the project are:

- open pit mine;
- desalination plant;
- HBI (Hot Briquetted Iron) plant;
- DRI (Direct Reduced Iron) plant;
- pellet plant;
- concentrator plant;
- tailings dam;
- waste dumps;
- system of conveyors and a service road to Cape Preston;
- product stockpile (HBI, DRI, pellets, concentrate) and adjacent general laydown areas at Cape Preston
- trestle to Preston Island;
- jetty to the load out / port facilities;
- port facilities; and
- accommodation for employees and construction staff.

Figure 1 – Regional Setting of Project Area



2.1.1 Climate

The climate of the Pilbara is classified as arid tropical with two distinct seasons: a hot summer extending from October to April and a mild winter from May to September. High evaporation rates are largely responsible for the arid climate with rates of evaporation often exceeding mean annual rainfall figures.

Rainfall in the Pilbara region is spatially and temporally variable, largely due to the random nature of tropical cyclones passing through the region and, to a lesser extent, localised thunderstorms. The majority of rainfall occurs between December and March as a result of tropical cyclones originating from the north. A lesser proportion of rainfall occurs between May and June from cold fronts moving across the south of the state in an easterly direction, which occasionally extend into the Pilbara. The northern and eastern areas of the Pilbara (Port Hedland/Marble Bar) receive most of their rain in the summer months and the southern and western areas (Onslow) experience winter rains (Ruprecht, 1996). Droughts, or long periods of low rainfall are common in the Pilbara and may be localised in one area. Rainfall occurrence, wind strength and wind direction have direct impacts on dust issues and hence, have been canvassed within this section.

Meteorological data sourced from the recording station located at Mardie Homestead (Met. Stn 005008), situated approximately 20km south of the George Palmer Ore Body, is provided in full in Appendix A and is summarised in Figure 2. Monthly wind roses calculated for 3hourly intervals between 6am and 6pm are also provided in Appendix A.

Rainfall records have been collected at Mardie Homestead for 115 years and temperature for the past 46. Mean annual rainfall is 271.2mm from an average of 22 rain days, with the majority of rainfall experienced between January and June. Large temperature ranges typical of the Pilbara region occur at Mardie where mean monthly temperatures range from 27.7°C in July to 38.1°C in March (mean 33.9°C), whilst mean monthly minimum temperatures range from 11.7°C in July to 25.2°C in February (BOM 2005). Records indicate temperature ranges from a record July low of 2.9°C to a February high 50.5°C.

Wind roses using available data between 1957 and 2004 from Mardie Homestead (Appendix A) indicate that, in general, morning winds blow from the south west between October and February, shifting to the east between April to August. Afternoon winds are generally from the west between September and March, shifting to the north-west between April and August and becoming more northerly during June and July. Wind strengths are generally light during the morning throughout the year and in the afternoon between April and September, significantly increasing in intensity during the months of October to January.

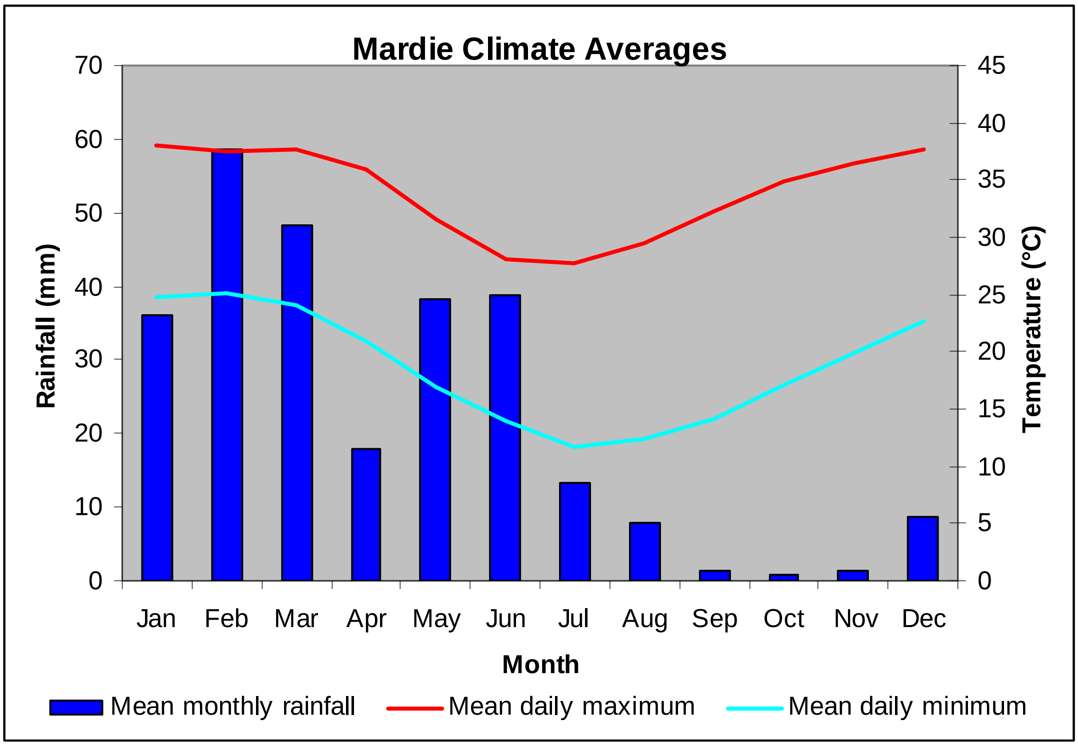


Figure 2 – Mean monthly rainfall and temperatures for Mardie Homestead (Station No. 005008)

2.2 Definitions

Dust is considered to be any particle suspended within the atmosphere. Particles can range in size from as small as a few nanometres to 100 microns (µm) and can become airborne through the action of wind turbulence, by mechanical disturbance of fine materials or through the release of particulate rich gaseous emissions. Most mine originated dust is chemically inert; however, there is the potential for more harmful and persistent particulate contamination to occur from mining ore containing or associated with certain products, such as asbestos, radioactive materials or heavy metals. Emissions from operating machinery not included as greenhouse gasses can also be classed as dust particulates.

Dust is measured using a variety of methods, the most common being Total Suspended Particulates (TSP), which nominally measures up to 50µm, and PM_{10} or $PM_{2.5}$ (particulate matter less than 10µm or 2.5µm in size, respectively). Deposited matter measures the mass of any particulate falling out of suspension expressed in mass per area per time and is the least commonly used in determining dust concentrations (Department of Environment 1998).

The following definitions are relevant to this management plan:

- **Land Development Site** – sites larger than 2000m^2 on which the clearing of vegetation and/or topsoil, re-contouring (bulk earthworks), trenching and/or road construction is undertaken to develop the land for any use.

- **Nuisance Dust** – describes dust particles that reduce environmental amenity without necessarily resulting in material environmental harm. This form of dust generally originates from mining processes (among others) and is often the form of dust that affects neighbouring land users.

- **Fugitive Dust** – refers to dust derived from a mixture of sources or a source not easily defined (non-point). It includes dust generated from vehicular traffic on unpaved roads, materials transport and handling and unvegetated soils and surfaces.

2.3 Implementation of Management Plan

Implementation of this management plan will begin with monitoring of dust and various meteorological measures to establish a data-set of baseline conditions. Dust management activities will continue through the construction phase and for the duration of the mining operation (Table 2.1). Dust level monitoring that is relevant to human and environmental health will continue throughout the life of the project. These activities will fall under the Environmental Management System and data showing deviations from target levels will trigger the applicable management response.

Table 2.1 Timeframe for Implementation of Management Plan

Action	Timeframe for Implementation	Duration
Baseline monitoring	12 months prior to commencement of construction of the DRI plant.	12 months
Meteorological monitoring	12 months prior to completion of construction of the DRI or Power plant (whichever is sooner).	12 months
Dust Management Programme	Commencement of construction	Life of mine
Review of Management Plan	As required by the project EMS	Life of mine
Dust monitoring	Commencement of construction	Life of mine

3.0 Dust Management Procedures

3.1 Best Management Practices

The proponent will ensure that all realistic, best practice measures to prevent or minimise the generation of dust from all activities will be implemented for the duration of construction and operation activities, and the effectiveness of the Dust Management Programme will be reviewed.

This Dust Management Plan will follow current best management practices. This approach requires appropriate preliminary planning, implementation of current engineering designs for dust management and ongoing monitoring and reporting (Department of Environment 1998). At this pre-construction stage, predicted impacts have been systematically identified and preliminary management and reporting activities have been suggested.

Preliminary dust modelling was conducted for the Public Environmental Review document (HCM 2000) using ISCPRIME, a United States EPA modelling approach. This exercise concluded that maximum PM_{10} levels will be within 500m of the plant site and the concentrations will be below National Environmental Protection Measure (NEPM 1998) ambient standard beyond the lease boundary.

The following sections detail predicted impacts and preliminary management activities. Refinement of best practice approaches will continue during the design, construction and operation periods. The overall approach to dust management including monitoring, review, reporting and coordinating feedback will be incorporated into, and administered as part of, the Environmental Management System.

3.2 Predicted Impacts

3.2.1 Sources of Dust

During the construction phase of a mining and mineral processing project dust is generated as a result of the disturbance of soil and rock and the handling of bulk construction materials such as crushed hard rock aggregate. The layer of vegetation and stable soil, which would normally form a seal against wind dispersion, is removed. Consequent environmental effects are usually localised and depend on the size of the dust particles and the strength of distributing factors and usually decrease rapidly with separation from the source. Under adverse weather conditions, however, dust can travel considerable distances, potentially resulting in its deposition in otherwise remote locations. Other than small amounts of combustion products from construction machinery, there is unlikely to be any significant emission of other pollutants during the construction phase of the project (SKM 2000).

During ongoing operations, dust is likely to be generated from excavation and ore handling activities, primary and secondary crushing, other ore processing, ore transport and storage at the stockyard. Throughout the project, vehicle movement can generate dust on unsealed roads. There is the potential for fugitive dust to be generated by wind movement over stockyards and the conveyor. As well, any ore handling has the potential to generate fugitive dust from increased materials movement. The National Pollution Inventory suggests that the majority of total suspended particulate in metalliforous mining comes from dry grinding and materials drying (NPI 2001).

In summary, dust generation is likely to come from activities such as:

- vegetation clearing;
- light / heavy vehicle movements;
- haul roads, track and access construction;

- drilling and blasting;
- earth moving;
- Mining operations (e.g., pit excavation, waste removal);
- Ore handling;
- Crushing and ore beneficiation (e.g., DRI);
- Ore transport; and
- Stockpiling.

3.2.2 Dust Impacts

Dust poses a human health concern. The greatest human health risk comes from fine particles which can enter into the respiratory tract and possibly cause respiratory problems. Dust may also irritate the eyes and mucus membranes. Some mining dust can also contain toxic particles such as asbestos which has an elevated human health concern.

Since particle size and type are appropriate for distinguishing between human health effects, dust generated from mining activities is often categorised based on these characteristics. The following types of dust are likely to be generated in the project area:

- **DRI Dust** – is very reactive, particularly with moisture, is exothermic and produces hydrogen gas (EPA, 2002). Stabilisation of DRI via hot briquetting or via passivation can reduce the reactivity, however, DRI dust can pose a hazard in process areas and during materials handling.

- **PM_{10}** – a criteria air pollutant consisting of small particles with an aerodynamic diameter less than or equal to a nominal 10 microns (about 1/7 the diameter of a single human hair). Their small size allows them to make their way to the air sacs deep within the lungs where they may be deposited and result in adverse health effects. PM_{10} also causes reduced visibility.

- **$PM_{2.5}$** – includes tiny particles with an aerodynamic diameter less than or equal to a nominal 2.5 microns. This fraction of particulate matter penetrates most deeply into the lungs.

Dust can also affect the environment by impacting flora and fauna health and by reducing visual amenities. In the immediate vicinity of the source, dust can stress vegetation through blocking stomata and reducing light availability. Overall, the potential impacts of dust in the project area include:

- reduced visual amenity;
- smothering of surrounding vegetation;
- adverse impact and disturbance to fauna;
- risk to human health; and
- nuisance.

The social impact of dust is expected to be low given that the nearest population centre is some 80 km to the north-east, although it may have some nuisance effect on recreational traffic utilising the informal coastal access tracks that traverse the project area. However, the greatest potential for impact will be within the immediate environs of construction and operation activities, including the on-site accommodation camp, and on the surrounding vegetation. Accordingly, dust suppression measures will be necessary to mitigate any consequent adverse effects of generated dust.

Dust generated by the project will be additive to the existing site dust conditions. Within the Pilbara region, the inherently dry and friable nature of the *in situ* soils presents further opportunities for dust generation. Furthermore, strong winds generated from extreme weather events will increase dust generation and spread.

3.3 Management of Predicted Impacts

At this time, project design is still underway. During the design process, dust minimisation, suppression and containment will be priorities and in this regard, the proponent commits to:

- implementing all reasonable and practicable measures to ensure the prevention or minimisation of dust from all project construction related activities;
- complying with limits set by the National Environment Protection (Ambient Air Quality) Measure (NEPC, 1998); and
- ensuring that nuisance dust levels and potential health hazards are not experienced by neighbouring land users

Although dust generated during both construction and operational phases of the project could potentially have an impact on human and environmental health, each phase involves different primary dust-generating activities. Consequently, dust management for each phase of the project differ.

3.3.1 Construction Phase Dust Management

To achieve 'best practice' dust management procedures, the following will be implemented:

- Adoption of a policy to ensure that vegetation is cleared only when and where necessary. Where clearing is required, the following procedures will apply:

    - where practicable vegetation will be salvaged from the site to be cleared (taking care to limit the amount of soil disturbance) and retained;
    - topsoil will be removed to the maximum depth practicable and consistent with best operational practice;
    - if the quantity of salvageable topsoil is insufficient for rehabilitation requirements, alternate cover such as detrital/gravel material will be used in site rehabilitation;
    - where practicable, topsoil will be directly transferred to exposed surfaces requiring rehabilitation and covered with salvaged vegetative material;
    - where direct transfer of topsoil is not possible, it will be stock piled and stabilised with previously salvaged vegetation; and
    - topsoil stockpiles will be further stabilised by encouraging native vegetation to establish and, if necessary, appropriate stabilising emulsion will be applied to supplement these measures.

- As practicable and consistent with operational requirements, disturbed areas will be progressively stabilised and rehabilitated, to reduce the potential for windborne dust generation.

- Truck mounted sprays will water unsealed, regularly trafficked areas such as access tracks, work areas and haul roads, as conditions require. Seawater will not be used for dust suppression purposes at any time. Mineralogy will ensure that all water used for dust suppression is of sufficient quality so as not to impact native vegetation.

- If additional dust control measures are required and dust suppressant products are deemed necessary, Mineralogy will ensure as practicable that only environmentally benign products will be used and that any products used will not affect the viability of the topsoil.

- Routine housekeeping practices will be employed to ensure that spillages and other materials that could contribute to dust generation do not accumulate within the project site.

- Routine maintenance of machinery will be carried out to ensure efficient operation (to minimise exhaust particulate emissions).

- All personnel (including contractors) will be informed of their responsibilities and the importance of minimising ambient dust levels during site inductions.

Any complaints received will be registered and will trigger a review of the relevant dust management procedure/s by the site Environmental Officer as a basis for development and implementation of appropriate modified practices.

Table 3.1 Summary of Construction Dust Management Requirements

Dust Generating Source	Task/Requirement	Timing	Responsibility	Related Plans/Procedures
Vegetation clearing	A 'clearing' policy will be adopted to ensure that vegetation is cleared only when and where necessary. In instances where the clearing of extensive areas is unavoidable, additional dust suppression techniques will be employed to ensure stabilisation of the cleared surfaces. As practicable and consistent with operational requirements, disturbed areas will be progressively rehabilitated, to reduce the potential for windborne dust generation.	Construction phase	Construction Manager Environmental Officer.	Construction Environmental Management Plan Staff Induction Training
Vehicle movement	Unsealed, regularly trafficked areas such as access tracks, work areas and haul roads will be watered by truck mounted sprays as conditions require. Sea water will not be used for dust suppression purposes at any time.	Project duration	Construction Manager Environmental Officer	Dust control procedure Haul roads and access track drawings Staff Inductions / Training
Haul roads, materials handling	Areas involving materials handling will be sprayed with water as conditions require.	Project duration	Construction Manager Environmental Officer.	Dust control procedures Staff Inductions / Training
Housekeeping	Routine maintenance of equipment and general housekeeping	Project duration	Construction Manager Environmental Officer	Environmental Management Plan Staff inductions / Training

3.3.2 Operations Phase Dust Management

Many dust management practices will continue into the operational phase. For example, management of dust generated from vehicle movement will continue throughout the life of the project. With new activities such as mining, ore processing and ore export, additional dust management will be required.

Ore processing and handling activities are expected to generate both point-source and fugitive dust. In the plant facilities, where crushing and DRI production will occur, an internal dust collection system will be incorporated into plant design. Clean air will be discharged from the top of the scrubbers to the atmosphere while water with entrained dust will discharge from the scrubber to the scrubber slurry sump. Effluents from these dust collection sumps will be discharged into the clarifier.

DRI dust can have additional health implications. It is exothermic and produces hydrogen gas (EPA, 2002). Stabilisation of DRI via hot briquetting or via passivation can reduce the reactivity, however, DRI dust can pose a hazard in process areas and during materials handling. To manage these potentially hazardous effects, the dedusting system in the DRI plant will minimise fugitive dust generation. As well, operators with potential dust exposure will wear approved dust respirators and protective clothing. Further investigation into the impact of DRI dust, particularly on mangrove populations, will be prepared prior to commissioning of the third DRI module.

DRI dust also has the potential to stain vehicles and ships. Boodarie Iron, which produces DRI in Western Australia, has commissioned research into DRI effects on paint. Testing revealed that the staining is generally superficial and regular washing and vehicle maintenance were found to be effective ways to manage any potential effects (Boodarie Iron 2002). Vehicle washing will be conducted in concert with regular vehicle maintenance.

Dust suppression techniques for ore handling and transportation will primarily be through maintenance of the appropriate water content. Water spraying for dust suppression is a common management technique. This is a recommended dust management technique by the Minerals Industry Safety Handbook (New South Wales Department of Mineral Resources 2002) and by dust management best practices (Department of Environment 1998). Investigations into dust suppression techniques in Port Hedlands found that lump ore moisture content of 4% and 6% for fines would not generate dust (SKM 2002). As a general rule, keeping the ore wet is estimated to reduce the dust emission rate by 50% (National Pollution Inventory 2001).

Maintenance of water content will be especially important in the stockyard area where materials can rapidly lose moisture content. Other iron ore stockyard facilities in Western Australia have suppressed dust through fixed water cannon based spray systems applying 1mm of water at 50-60 min intervals during daylight hours for eight months of the year. The Cape Preston stockyard facility will incorporate a similar water spraying system.

The open conveyor is another source of fugitive dust. To suppress dust, transported materials will be wetted. As well, the conveyor will include coverings and skirting at transfer points. Conveyor wash-down stations will remove any potential materials that could contribute to dust.

To achieve the objective of ‘best practice’ dust management during the operational phase, the following will be implemented:

- Any blasting required to facilitate construction will be conducted only under favourable wind and weather conditions, and the blasting site will be dampened with water sprays.

- Within areas involving materials processing, dust management will be achieved through a combination of enclosure, extraction and suppression through water application based on maintaining appropriate material moisture levels.
- The plants will be designed with internal dedusting systems. DRI dust exposure will be minimised by the use of approved dust respirators and protective clothing for operators exposed to dust hazards.
- Conveyor protection will be provided at ore transfer points and conveyor spray/scrap stations will minimise dust generation.
- Routine housekeeping practices will be employed to ensure that spillages and other materials that could contribute to dust generation do not accumulate within the project site.
- Routine maintenance of machinery will be carried out to ensure efficient operation (to minimise exhaust particulate emissions) and to wash vehicles to remove DRI dust.

Table 3.2 Summary of Operational Phase Management Activities

Dust Generating Source	Task/Requirement	Timing	Responsibility	Related Plans/Procedures
Vehicle movement	Unsealed, regularly trafficked areas such as access tracks, work areas and haul roads will be watered by truck mounted sprays as conditions require. Sea water will not be used for dust suppression purposes at any time.	Project duration	Construction Manager Environmental Officer	Dust control procedure Haul roads and access track drawings Staff Inductions / Training
Vehicles	Routine maintenance of machinery will be carried out to ensure efficient operation (to minimise exhaust particulate emissions) and to wash DRI dust.	Project duration	Construction Manager	Pre-start inspections checklist Maintenance Register
Mining operations	Any blasting required to facilitate construction will be conducted only under favourable wind and weather conditions, and the blasting site will be dampened with water sprays.	Project duration	Construction Manager	Dust control procedures Blasting and drilling procedures Staff Inductions / Training
Crushing & Pellet process	Maintain appropriate material moisture level to suppress dust. All dust creating areas will be covered with hoods or castings and connected to the room dedusting system. Wet scrubbers will be installed for dedusting plant areas. Effluent from the dust collection sumps will be discharged to the clarifier.	Operation Phase	Environmental Officer	Dust control practices Plant design drawings.
DRI process	A dedusting system will be incorporated into the process plant. Approved dust respirators and skin protection will be worn by operators exposed to dust hazards.	Operation Phase	Environmental Officer	Dust control practices Plant design drawings
Ore handling, ore transport	Maintain appropriate material moisture level to suppress dust	Operation Phase	Environmental Officer	Dust control procedures

Dust Generating Source	Task/Requirement	Timing	Responsibility	Related Plans/Procedures
Ore Transport	Conveyor protection at ore transfer points and regular belt cleaning at conveyor cleaning stations.	Operation Phase	Environmental Officer	Dust control practices Conveyor design drawings.
Stockpile	Maintain ore moisture levels for dust suppression	Operation Phase	Environmental Officer	Dust control practices
Housekeeping	Routine maintenance of equipment and general housekeeping	Project duration	Construction Manager Environmental Officer	Environmental Management Plan Staff inductions / Training

3.4 Performance Indicators

National standards for ambient air quality have been developed by the National Environmental Protection Council (NEPC 1998, 2003). These maximum concentration levels have been developed for the protection of human health (Table 3.3). The standard for PM_{10} concentrations has been established. The maximum concentration for up to five days per year allows for natural dust producing phenomenon such as forest fires and storm events.

The national air quality standards do not apply to vegetation smothering. Vegetation monitoring will make visual and quantitative assessments of dust deposition levels and quantitative measurements of vegetation health. Visual inspections will give early warning of excessive dust levels which will trigger appropriate management activities (depending on the sources contributing to the dust generation).

Further visual inspections throughout the project site will inspect:

- the absence of fugitive dust originating from cleared areas and construction sites; and
- the level of impact on vegetation adjacent to cleared areas, haul roads, access tracks and construction sites.

Dust level complaints will also serve as an early warning sign of dust levels. This process will be especially important for preventing the negative impacts of dust on visual amenities. Tracking of performance of this management plan based on the complaints will be based on reducing the number of complaints received and registered (coupled with decreases in measured dust levels) and increasing the level of achieved complaint satisfaction.

Table 3.3 Ambient Air Quality Criteria

Pollutant	Averaging Period	Maximum Concentration	Goal within 10 years maximum allowable exceedance
Particles as PM_{10}	1 day	50µg/m^3	5 days
Particles as $PM_{2.5}$	1 day	25µg/m^3	Not yet established
	1 year	8µg/m^3	Not yet established

Using these performance indicators, the proponent will undergo continuous review of its dust management procedures and will adjust target levels as improved resources, capability or technical understanding is achieved.

4.0 Dust Monitoring Programme

Monitoring will provide for assessment of all activities undertaken during construction and operation. Baseline monitoring of suspended (airborne) particulates is required from the outset of the construction phase. This will provide a basis for evaluating the effectiveness of dust management programmes. Other monitoring activities will provide an indication of dust impacts on human health, visual amenities, and vegetation health.

Under Ground 7 of Appeal Number 117 of 2002 (Objection to the Report and Recommendations of the EPA, Bulletin 1056), the Minister for the Environment accepted the proponent's position regarding the requirement for establishment of a meteorological station. Accordingly, meteorological monitoring will be conducted over the 12 months preceding the completion of construction of the DRI plant or power station (whichever occurs first).

4.1 Dust Monitoring

Ambient air data will be collected for a period of 12 months prior to commencement of construction of the DRI plant, in accordance with Ministerial Condition 10-4. Regular dust monitoring will also occur during the construction and operation phases of the project.

Monitoring stations will be located based on meteorological monitoring data, in order to ensure that both project related dust impacts and ambient dust levels are being recorded at all times, regardless of wind direction. Monitoring equipment and sampling methods will conform to Australian Standards (Table 4.2) and will be determined prior to commencement of the dust monitoring programme.

4.1.1 Construction Phase Dust Monitoring

Dust monitoring during the construction phase will be through baseline monitoring and dust monitoring for human health. Baseline monitoring will also be carried out during the construction phase which will monitor ambient air conditions upwind from the mine site. This monitoring will indicate the level at which construction activities have elevated dust levels above naturally occurring dustiness. The meteorological monitoring will provide wind and temperature information that can assist in dust management and identification of dust sources. High wind levels (such as 30m/s) will indicate poor conditions for blasting or plant operation.

Construction dust monitoring stations will be placed adjacent to active construction sites, and they will be moved periodically with the phase of construction in order to lie between the construction site and the camp areas. They will be located in the dominant down-wind location (south-west from the construction area, as indicated in Mardie Homestead wind data, Appendix A). These dust monitors will collect data in real-time and provide accurate quantifications of dust levels over an averaging period. Breach of the NEPC levels for PM_{10} will trigger an investigation of the dust source and improvements in dust management and suppression.

Continuous particle monitors, either Tapered Element Oscillating Microbalances (TEOM) or Beta Attenuation Mass Monitors (BAM), can be used as permanent monitors. Alternative instruments such as Dustrak or Osiris are more portable instruments that may be better suited for the construction dust monitors.

The Proponent's Construction Manager will maintain a complaints register, and any complaints received will be investigated and the dust suppression methods employed will be reviewed. Suitable remedial action will be undertaken as necessary. The proponent will seek to participate in the Coastal Communities Environmental Forum (based in Karratha) as it will provide the opportunity for public liaison on any dust-related issues associated with the project with the potential to affect the towns of Karratha and Dampier.

This above paragraph is unnecessary, given the project distance from these population centres. Remove.

Although the Construction Manager will be responsible for performing spot checks on a regular basis, the entire construction workforce will be made aware of issues relating to dust during site health, safety and environment inductions and will be required to report any excessive atmospheric particulates resulting from their work.

4.1.2 Operations Phase Dust Monitoring

Dust monitoring during the operation phase will establish permanent continuous particle monitors (TEOM or BAM). These monitoring stations will provide accurate and current information on dust levels for human health. They are proposed to be located adjacent to the major dust producing areas: the mine site and the stockyard area. The monitors will be located downwind from the dominant wind direction based on collected meteorological data on-site and long-term wind data from Mardie Homestead (Appendix A). NEPC standards will be used for PM_{10} levels. In the event that monitoring indicates that dust levels attributable to the project reach 90% of the acceptable limit, dust suppression measures will be immediately reviewed and more stringent measures will be developed and implemented in consultation with the relevant regulatory agencies.

Korean Steel Pty Ltd. has proposed an expansion of the Cape Preston stockyard (EPA 2006). Therefore, dust generated from the stockyard will be from other projects in addition to this project. The proponent will negotiate with Korean Steel Pty Ltd. in order to determine the management and monitoring of cumulative dust generation.

Dust monitoring for impacts on flora and fauna will be largely through vegetation monitoring and visual inspections. Visual inspections will focus on potential dust impacts on marine areas and visual amenity. Indications of high dust levels for vegetation or visual amenity will trigger investigations into dust sources and improved management activities.

Vegetation monitoring sites will be established and complemented by deposition gauges. These monitoring stations will collect data on dust levels on vegetation. In accordance with the Vegetation Monitoring Plan (Maunsell 2005), sampling will be carried out under the BACI Sampling Design (Green, 1979). If possible, two sampling events will take place over a twelve month period to establish baseline data for both wet and dry season conditions, prior to the commencement of operations. Monitoring sites will be located adjacent to dust monitoring stations, while control sites will be established in locations removed from expected project related dust impacts.

Dust deposition gauges will be used for vegetation monitoring sites. These instruments rely on passive deposition and quantify dust deposition rate (usually in g/m^2/month). These measures will verify visual inspections, as high dust levels will be indicated as $4g/m^2$ per month. Dust sources cannot be identified by the gauges, but they will indicate cumulative environmental and anthropogenic-caused dust levels that may impact environmental health.

Although the Environmental Officer will be responsible for performing spot checks on a regular basis, the entire workforce will be made aware of issues relating to dust during site health, safety and environment inductions and will be required to report any excessive atmospheric particulates resulting from their work.

Table 4.1 Summary of Dust Monitoring Programme

Monitoring Action	Monitoring Equipment	Monitoring Locations	Performance Indicator	Frequency	Responsibility
Baseline ambient air monitoring	Continuous particle monitor (TEOM or BAM)	Upwind of mine, approximately north-west of mine site.[1]	National Environmental Protection Council (NEPC) standards for TSP, PM_{10} and determined standards for $PM_{2.5}$	12 months prior to commencement of construction of the DRI plant	Environmental Manager
Meteorological monitoring	Acoustic anemometer	At mine site.	Wind speeds of 30m/s or greater.	Continuous, beginning 12 months prior to completion of construction of the DRI plant or Power plant (whichever is sooner)	Environmental Manager
Construction Dust Monitoring	Portable Continuous Particle Monitors (Dustrak or Osiris)	Down-wind and adjacent to major construction sites. An additional monitoring site between mine construction site and construction camp.[1]	National Environmental Protection Council (NEPC) standards PM_{10} and TSP.	Continuous throughout construction period	Environmental Officer
Operation Dust Monitoring	Continuous Particle Monitors (TEOM or BAM)	(1) east of stockyard facility (2) 50m east of processing plants[1]	National Environmental Protection Council (NEPC) standards for PM_{10} and TSP.	Continuous throughout life of project	Environmental Officer
Visual monitoring	N/A	Throughout mine site, but with a focus on beach areas, stockyard, processing plant, camp, and adjacent vegetation.	Traffic movements Number of complaints received Build-up of dust on vegetation and structures	Weekly dust inspection checklist	Environmental Officer

[1] Specific location will be determined upon discussions with relevant authorities and pursuant to AS 2922.

Monitoring Action	Monitoring Equipment	Monitoring Locations	Performance Indicator	Frequency	Responsibility
Vehicle exhaust emissions		N/A	Vehicle Maintenance Register Pre-start Inspection checklist	Exhaust spot checks	Environmental Officer
Vegetation monitoring	Dust deposit gauges	Adjacent to vegetation monitoring plots[1].	$4 g/m^2$/month as an indication of high and unacceptable dust levels. Qualitative assessment of high dust levels. Vegetation health	In conjunction with vegetation monitoring programme (Vegetation Monitoring Plan)	Environmental Manager

4.1.3 Dust Monitoring Standards

Various Australian Standards have been developed in relation to dust monitoring (Table 4.2). The proponent will conduct all monitoring in accordance with these standards.

Table 4.2 Australian Standards for Particulate Monitoring

Pollutant	Method Title	Method Number
All	Ambient Air – Guide for the Siting of Sampler Units	**AS 2922**
All	Workplace Atmospheres – Methods for Sampling Respirable Dust	**AS 2985**
All	Workplace Atmospheres – Methods for Sampling Inspirable Dust	**AS 3640**
Total Suspended Particles (TSP)	Determination of Total Suspended Particles	**AS/NZS 3580.9.3:2003**
Particles as PM_{10}	Determination of Suspended Particulate Matter - PM_{10} High Volume Sampler with Size-Selective Inlet - Gravimetric Method	**AS 3580.9.6:2003**
	Determination of Suspended Particulate Matter – PM_{10} Dichotomous Sampler – Gravimetric Method	**AS 3580.9.7:1990**
	Determination of Suspended Particulate Matter - PM_{10} Continuous Direct Mass Method Using a Tapered Element Oscillating Microbalance (TEOM) Analyser	**AS 3580.9.8:2001**
Particles as $PM_{2.5}$	Tapered Element Oscillating Microbalance (TEOM)	**AS/NZS 3580.9.10:2006**

4.2 Training

All employees and subcontractors will be required to undergo a site specific induction, outlining environmental controls to be implemented during construction. The induction will provide necessary awareness of dust management and the procedures and work practices to minimise and report dust generation.

Regular toolbox meetings will also be held to reinforce a positive attitude towards dust management and to highlight any issues that arise during the course of construction. A record of all training will be maintained.

4.3 Reporting

Air quality data will be recorded on a continual basis, with the results published in monthly internal reports. All data collected for the Dust Monitoring Plan will be collated and summarised in the Annual Environmental Review, which will be submitted to the Environmental Protection Authority. Records will be maintained in accordance with the Project Environmental Management System. The regulatory bodies will be immediately notified of any exceedance of established dust-related ambient air quality criteria and of the response to such exceedance. All employees and contractors will be required to report any generation of significant dust plumes to the Site Environmental Officer (or equivalent) via their supervisor.

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Appendix A – Bureau of Meteorology Climate Data for Mardie Homestead Weather Station 005008