McArthur River Mining Pty Ltd

Technical Manual

For Environmental Monitoring

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14. Dust

Due to the fine-grained nature of the ore body and in particular the concentrate, the generation of dust is one of the environmental issues at MRM. Aided by its fine grade nature, any dust generated on site has the potential to spread and contaminate adjacent areas. The potential for dust related contamination at Bing Bong Port is increased through the coastal location and regularly windy conditions. Contaminated dust has the potential to impact on the surrounding environment by smothering vegetation and accumulating metals in adjacent soil, sediment and aquatic systems.

MRM's dust monitoring program is aimed at measuring the effectiveness of dust suppression strategies around the mine site and Bing Bong port through numerous, strategically positioned depositional dust gauges (Figure 14.2 and Figure 14.3). The gauges are mounted on stands, approximately two meters high and remain in place for the recommended 30 ± 2 days, after which they are replaced and analysed. Data evaluation is undertaken by comparison with historical, geographically relevant trends and correlation with soil sampling data.

14.1. Locations

Depositional dust gauges are located around MRM and Bing Bong Port, as below, for further detail on sampling locations refer to Section 24.

Sample site locations and site code are listed below:

Bing Bong

- BBD1
- BBD2
- BBD3
- BBD4
- BBD5
- BBD6

Mine Site

- D6
- D8
- D12
- D13
- D15
- D22
- D23
- D24

- D25
- D26
- D27
- D28
- D29
- D30
- D31
-

14.2. Frequency

Depositional dust monitoring procedures adhere to. These gauges remain in place for the recommended 30 ± 2 days after which they are replaced and sent for analysis (as per AS3580.10.1:2003).

14.3. Analyses

Depositional dust samples undergo laboratory analysis on a monthly basis by the Analytical Laboratory, Mount Isa Mines (to be analysed within 30 days of collection as per AS3580.10.1:2003).

Monthly Parameters:

- Total Insoluble Matter (TIM); and
- Total Pb, Zn.

Sample submission forms, containing the parameters listed are available in Pasidium (GEN-ENV-FRM-6040-0006 Dust Sample Submission).

14.4. Equipment

Bottle Requirements:

- 1 4 litre amber dust gauge per site (treated with copper sulphate solution) Per sample;
- 1 Spray bottle of deionised water;
- 1 Plastic tub for sample containment (each tub holds 6 sample bottles);
- 2 Spare 15 cm diameter glass funnel;
- 1 Packet spare O'rings (Tamrock BS222 D90 or similar);
- 1 Pen/permanent marker;
- 1 GPS containing site locations;
- 1 Data sheet (for start and finish dates); and

- 1 Satellite phone.

Figure 14.1 Active Dust Monitor

Figure 14.2 Dust Monitoring Locations at the McArthur River Mine Site

Figure 14.3 Dust Monitoring Locations at the Bing Bong Port Facility

14.5. Methodology

When approaching sample sites in a vehicle take care to minimise dust mobilisation to prevent influencing sample analysis results.

The dust gauge stands are 2.0 ± 0.2 meters in height (as per AS3580.10.1-1991) with a platform which holds the bottle and funnel (as shown in Figure 14.1).

For ease of identification in this document the dust bottle that has been in place for the sample period will be referred to as the 'old' bottle with the dust bottle replacing it referred to as the 'new' dust bottle.

- Remove the wooden chock that holds the dust bottle stable and remove the 'old' dust bottle from the holder, extreme care must be taken to ensure the glass bottle and/or glass funnel are not dropped or damaged for safety and sample analysis reasons.
- If required, use a step ladder to safely access the dust bottle in the holder.

- Extreme care must be taken during the wet season as the bottles are likely to be full of water and subsequently present manual handling difficulties, especially when in the holders.
- Remove the 'new' sample bottle from the storage tub. Unscrew the cap from the 'new' amber dust bottle and place where it will not be affected by contamination.
- Carefully spray around the opening of the funnel to wash any adhering dust into the bottles and allow all the water to drain into the bottle.
- Remove the funnel from the 'old' dust bottle; care must be taken as the O-ring may make it difficult to remove. Re-set the O-ring close to the neck of the funnel and place it into the 'new' dust bottle. Set the 'new' dust bottle in the holder with the label facing away from the direction of the sun to minimise fading.
- Secure the cap (the cap that was taken off the 'new' dust bottle) on the 'old' dust bottle.
- Store the 'old' dust bottle in the storage tub with sufficient padding to prevent damaging the bottles in transit as they cannot be re-sampled.

Samples must then be dispatched as per Section 14.6. Samples are to be dispatched as soon as possible after sampling; however there is no specified holding time on dust samples.

14.6. Sample Dispatch

Samples are to be stored and sent in the storage tubs with sufficient padding to ensure the bottles are not damaged during transit. Samples are to be dispatched on NQX Freight System trucks destined for Mount Isa as soon as possible to ensure analysis is completed within 30 days of sample collection (as per AS3580.10.1-1991).

Dust samples are analysed by Mt Isa Mines Analytical laboratory on a monthly basis. ADM-ENV-FRM-6040-0006 Dust Sample Submission Form is to be completed prior to dispatch. Ensure all site locations are listed in the sample ID column, along with the MRM ID (sample code, reversed date and samplers' initials; ie. DUST090401MHB for dust sampled 1/4/09 by MHB) and consignment note number, as well as other relevant information listed

The submission sheet is to be saved in G:₩Environ₩4. Operational Control₩Monitoring Data₩Sample Management₩Lab dispatches & receipt notices₩1 Dispatch Notes₩Mt Isa₩2009 under the appropriate month with the MRM ID used as the file name. Two copies of this submission sheet are to be printed signed by the dispatcher, the purpose of both copies will be explained below.

Samples are to be dispatched in the storage tubs with sufficient padding to prevent movement during transit as this may damage bottles. Once the samples have been packed, place one, signed copy of the submission sheet into a zip-lock bag and ensure it is properly sealed, before placing it in the tub which will have the consignment note attached when completed. This is to allow the laboratory to identify the samples and the analysis required. The tubs are then to be sealed by placing at least one zip-tie on both ends of the tub, securing the lid to the base. These can then be taken to the warehouse where a consignment note will be supplied. This is to be completed with all required information and the dangerous goods declaration signed; the address and contact information for this can be obtained from the second copy of the submission sheet. Ensure that all tubs for dispatch have an additional item sticker (from the back of the consignment note) with the completed consignment note attached to the tub containing the submission sheet. The customer copy of the consignment note will be provided by warehouse staff, this is to be filed in the consignment note file located in the Environment Department office.

Information on all samples sent for analysis are to be entered into the sample management spreadsheet which can be located at G:₩Environ₩4. Operational Control₩Monitoring Data₩Sample Management. This spreadsheet contains dispatch, receipt and result information to allow for efficient tracking of samples and data. The additional submission sheet printed earlier can be used to provide all the information required for this spreadsheet, all fields under the dispatch banner are to be completed after dispatch. Once this is completed, the submission sheet is to be put in a new A4 sleeve in the dust sample folder, located in the Environment office.

As soil monitoring does not require any in-situ data, the only data management required is in terms of the analysis results, this process is detailed in Section 22.

14.7. Safety

Standard site wide PPE is required when conducting sampling on site with a hard hat and safety glasses required whenever in operational areas. Ensure all personnel are aware of blast times and remain outside the blast zone until the all clear has been given. Always carry sufficient drinking water whenever on site, with high temperatures on site increasing the risk of dehydration. Sun protection in terms of a long sleeve shirt, wide brim hat (or hard hat brim) and tinted safety glasses are strongly recommended for adequate protection from UV rays.

Personal safety is extremely important, especially when travelling to remote or difficult to access areas as is often the case with dust sampling. Ensure to carry a fully charged hand held radio when sampling to allow regular communication. Always appoint a contact and organise regular contact intervals to ensure rapid response in the case of an incident or failure to communicate. Take care when driving on un-maintained roads/tracks as certain areas may be damaged or blocked since last travelled. When undertaking work in remote areas always carry a charged satellite phone with knowledge of its operation as well as any passwords.

Due to the height of the dust bottle holders a step ladder may be required to safely access the bottles, if this is utilised ensure it is located on level, stable ground before use. Extreme care must be taken during the wet-season as the bottles are likely to be full from rainwater and subsequently present manual handling and safety issues when being removed from the holder. If required, two people may be used to aid in handling the full bottles when removing them from the holder. When removing bottles from the holders take care as there is the potential for spiders and other fauna to shelter in the holders or on the outside of the bottles.

15. Soil

The soil monitoring program is conducted on an annual basis, in the late dry season and consists of sites both at MRM and Bing Bong, these sites are based around the existing dust sample site network. Soil is monitored for both health and ecological risk assessment and therefore the sample consists of the soil strata to which people and other receptors could feasibly be exposed to (0-5cm).

15.1. Location

Soil samples are taken adjacent to the dust sample sites (dust sites as per Figure 14.2 and Figure 14.3). The exact location is determined through the use of a compass bearing and distance estimate as detailed below (**Error! Reference source not found.**). For GPS positions of sampling locations refer to 24.

Table 15.1 Sampling site locations, codes and sample location relation to the dust site

Site	Adjacent Dust Site	Distance (m)	Bearing (deg.)
S1	D1	7.84	136
S2	D2	8.99	175
S3	D3	6.42	269
S4	D4	6.84	199
S5	D5	5.19	78
S6	D6	5.54	185
S7	D7	6.56	272
S8	D8	8.60	138
S10	D10	8.48	63
S12	D12	7.88	127
S13	D13	9.55	83
S15	D15	7.40	341
S17	D17	5.79	18
S19	D19	7.50	140

Site	Adjacent Dust Site	Distance (m)	Bearing (deg.)
S21	D21	8.58	35
S22	D22	7.06	171
S23	D23	5.77	35
S24	D24	6.12	258
S26	D26	6	90
S27	D27	4	160
S29	D29	TBC	TBC
S30	D30	TBC	TBC
S31	S31	TBC	TBC
BBS1	BB1	6.93	119
BBS2	BB2	7.69	36
BBS3	BB3	6.01	315
BBS4	BB4	5.87	285
BBS5	BB5	3	90

S20	D20	6.62	235

BBS6	BBD6	TBC	TBC

15.2. Frequency

Soil samples are collected on an annual basis, immediately prior to the wet season (usually October) and are usually sampled in conjunction with the dust sampling regime as many of the sites correspond.

15.3. Analysis

Soil samples undergo laboratory analysis through ALS Environmental (as per ALS quote ENV/a280/02), a NATA accredited laboratory, on an annual basis.

Annual Parameters:

- Particle Size Distribution;
- Paste pH, EC;
- Major cations; Ca, Mg, Na, K; and
- Metals; As, Cd, Cu, Fe, Pb, Zn (2mm fraction).

The sample submission form, containing the parameters listed are available on Pasidium (GEN-ENV-FRM-6040-0039 Soil Sample Submission).

15.4. Equipment

- 1 Zip-lock bag per site;
- 1 Plastic spade;
- 1 Large plastic tray;
- 1 Permanent marker;
- 1 Compass; and
- 1 GEN-ENV-FRM-6040-0035 Soil Sample Data Form.

15.5. Methodology

Soil samples are taken adjacent to the dust sample sites, at a compass bearing and distance as detailed below (Table 15.1**Error! Reference source not found.**).

- Ensure the large plastic tray and plastic spade have been thoroughly cleaned with deionised water and dried prior to use to prevent contamination of samples.
- Label two zip lock bags with the site name, date and samplers' initials.
- Face the direction of the compass bearing (from the dust gauge holder), as specified in **Error! Reference source not found.** below, for the specific sample site.
- From this point (following the compass bearing) estimate the distance specified in **Error! Reference source not found.** (for that site) as this will be the sample point.
- The soil sample data sheet must be completed at each site with the sample date and any comments about the site.
- Take care not to walk over the sample point as this may contaminate the area. Using the spade, collect a sample of the top 2-3cm of soil and place this into the plastic tray. Approximately 200g of sample is required (more if the sample contains a significant amount of gravel), this may take more than one scoop of soil. Ensure that any additional soil is not collected from the sample place as the first as only the top 2-3cm of soil is to be collected, this can be taken beside the first.
- Once sufficient soil has been collected in the sample tray, mix the sample to ensure uniformity throughout the sample. Place the sample inside one of the labelled zip-lock bags and seal the bag, eliminating as much air as possible. Place this in the second zip-lock bag and put the sample into an esky with ice bricks to keep the sample cool until it can be placed in the sample fridge.

15.6. Dispatch

On return to the office, samples must be stored in the sample fridge until dispatch.

Notify the airport of freight before samples are dispatched. Samples must be appropriately packed (see below for packing requirements) and taken to the airport at least 1 hour before flight departure.

Soil sample analysis is conducted by ALS Environmental on an annual basis (ALS quote 195/01). ADM-ENV-FRM-6040-0039 Soil Sample Submission Form is to be completed prior to sample dispatch. Ensure all site locations sampled are listed in the sample ID

column, along with the MRM ID (sample code, reversed date and samplers' initials; ie. SOIL090401MHB for soil sampled 1/4/09 by MHB) and consignment note number, as well as other relevant information listed. The submission sheet is to be saved in G:₩Environ₩4. Operational Control₩Monitoring Data₩Sample Management₩Lab dispatches & receipt notices₩1 Dispatch Notes₩NTEL₩NTEL 2009 under the appropriate month with the MRM ID used as the file name. Two copies of this submission sheet are to be printed signed by the dispatcher, the purpose of both copies will be explained below.

Samples for dispatch are to be removed from the sample fridge and placed in an appropriately sized esky (the number of which is entered on the submission sheet). Sufficient frozen ice bricks are to be placed around or on top of the samples to keep them cool until they reach the laboratory (usually 2/3 depending on sample numbers), the ice bricks should be strategically placed to prevent movement of the samples during transit. Eskies are to be packed to a weight of no more than 10 kilograms (kg) due to manual handling issues, if required split the samples over more than one esky to keep the weight within limits.

Once the samples have been packed, place one, signed copy of the submission sheet into a zip-lock bag and ensure it is properly sealed, before placing it in the packed esky (only one copy of the submission sheet is required regardless of the number of eskies the samples are dispatch in). This is to allow the laboratory to identify the samples and the analysis required. Prior to dispatch a consignment note must be obtained (located in the Environment Department) and completed with destination address (this can be obtained from the submission form), sender information and the dangerous goods declaration signed. This is to be affixed to the side of the esky (any additional eskies for the same laboratory require an additional item sticker from the back of the consignment note for identification). The lid then needs to be sealed with packing tape before it is ready for dispatch. The packed eskies then need to be taken to the airport at least 1 hour prior to flight departure. The customer copy of the consignment note will be provided by airport staff, this is to be filed in the consignment note file located in the Environment Department office.

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