

Lead Concentrate Storage and Handling

OPTION ANALYSIS – TEP SUPPORTING INFORMATION

HSEC Department

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Introduction

Mount Isa Mines Limited's (MIM's) Lead Smelter is currently unable to operate for a period of at least three months following fire damage to the ASARCO Baghouse on 19 June 2014. The Baghouse captures and filters emission from the Lead Smelter during normal operation.

As a consequence, excess lead concentrate is being produced from MIM's lead-zinc mining activities that is unable to be smelted until the Lead Smelter returns to operational status.

While MIM is seeking to export the excess lead concentrate, to the extent possible in current market conditions, the production of a significantly larger volume of lead concentrate product may exceed the currently authorised stockpile capacity on ML8058.

MIM has undertaken an option analysis to assess viable concentrate management options in order to prevent a significant adverse effect on the MIM's zinc lead operations, with consequential detrimental impacts on MIM's workforce, the Mount Isa community and other Glencore operations.

An assessment of the required repair work to the ASARCO Baghouse together with the production and logistics profile of the operations has been undertaken to determine the approximate quantity of lead concentrate that may be produced in excess of currently authorised stockpile capacity.

Based on this assessment, a number of options were considered with several viable options identified and six operating scenarios subsequently modelled in respect of both mass emission levels and dispersion. The results for each of the six operating scenarios resulted in the same or lower predicted concentrations at each monitoring site in comparison to a "base case" scenario (i.e. normal lead smelter and production operations).

The analysis in this document has formed the basis for the actions proposed in MIM's draft Transitional Environmental Program (TEP) that Mount Isa Mines is voluntarily submitting and which details the transition of MIM's lead concentrate storage and handling activity into compliance with MIM's environmental authority (EA).

Background

On Thursday 19 June 2014 at 2am emergency response processes were triggered when a fire at the American Smelting and Refining Company (ASARCO) Baghouse (Figure 1) was reported to Mine Control. Emergency response teams, together with the Queensland Fire and Rescue Service, extinguished the fire by 6am. At the time of the incident, the Lead Smelter was shut down for maintenance activities.



Figure 1: Lead Smelter Operational Footprint (outlined by red broken line)

The ASARCO Baghouse is the final stage of off gas treatment for both the sinter plant roaster and blast furnace prior to release via the 270m lead stack. Figure 2 below shows the location of the ASARCO Baghouse in the Lead Smelter ventilation system. The ASARCO Baghouse operates under negative pressure with a fan located at the base of the stack drawing air through the baghouse. The ASARCO Baghouse covers a filter area of 32,200m² and consists of 4564 filter bags separated into 14 chambers or sections. Chambers are routinely isolated and mechanically shaken to remove particulates from the filtration bags, which drop into a hopper below from which the particulates are conveyed and mixed with process water producing slurry for filtration and reprocessing through the Sinter Plant.

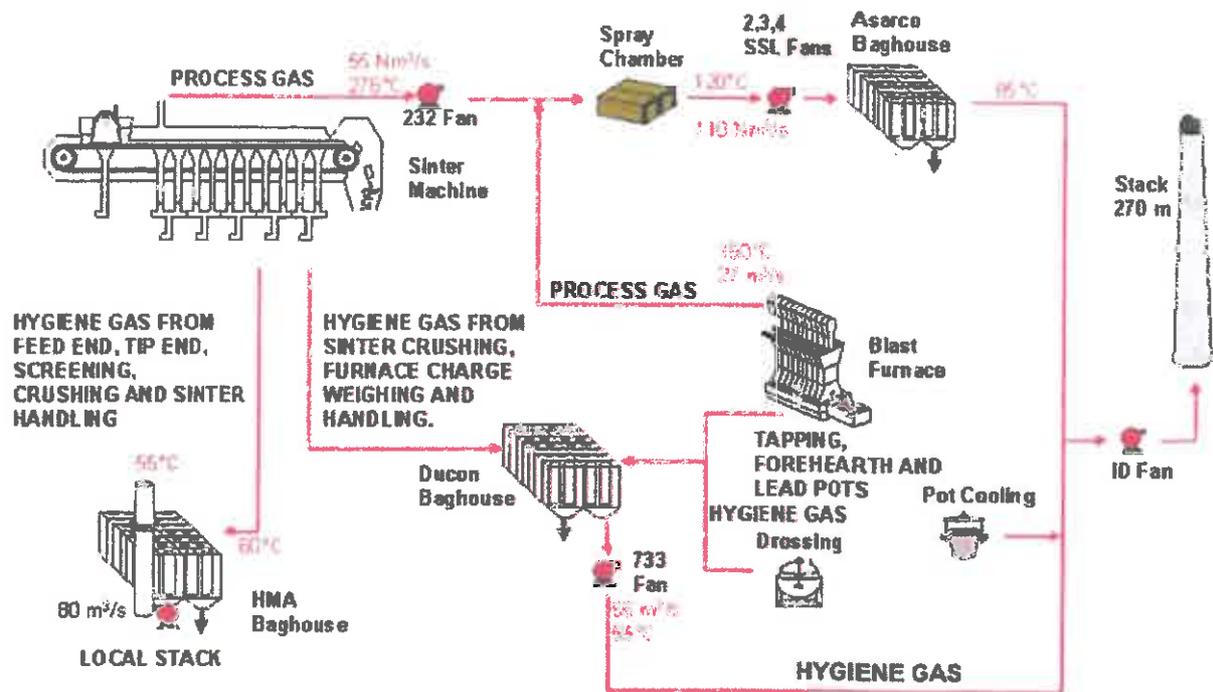


Figure 2: Lead Smelter Process Chart

The ability to isolate individual chambers allows for maintenance and bag replacement activities to occur as required. The Lead Smelter requires 12 of the 14 chambers of the baghouse to be operational.

Initial assessment indicates eight of the fourteen chambers in the baghouse were damaged requiring replacement. As a result of this incident the Lead Smelter remains offline, with all lead concentrate being directed to the Lead-Zinc Filter Plant for drying, storage and/or transport.

Baghouse Recovery Work Schedule

The fire resulted in major internal and structural damage to the ASARCO Baghouse and is expected to take an estimated three months from the incident date to repair based on initial assessment of the damage.

The following is the current forecast and estimated timeline for the restoration of the Lead Smelter subsequent to the ASARCO Baghouse fire. There are various factors that reduce the ability to confirm a start up date for the Lead Smelter, and as a result, the provided information is currently estimates only. The original estimate for downtime of the Lead Smelter was 8-12 weeks from the 19 June 2014, giving start up dates by approximately 10 September. While these estimates are still current, they are being progressively refined as new information arises.

Critical path works that are affecting these estimates and preventing a tighter estimation for the Lead Smelter start-up date are;

1. Removal of the ASARCO Baghouse roof to enable a full and detailed inspection of the adjoining structures.
 - a. Asbestos related products were identified under the roof and these products need to be removed in an appropriate manner. Detailed work plans are being developed to complete these tasks (which besides the presence of asbestos products) is complicated due to the height at which the works will be undertaken and how this impacts on the timing of parallel work plans for the completion of other rehabilitation and recovery tasks.
2. Confirmation of the Technical Specifications and availability of alternative insulating products related to the functional operation of the ASARCO Baghouse in a manner that minimises the fire risk associated with the installation.
 - a. Preliminary investigation of the fire has identified that the current products utilised for insulation of the Baghouse contributed to the extent and rapid spread of the fire. There is a strong view that if appropriate alternative materials are available then the products will be altered.
3. Confirmation of the availability and delivery timing of the filtering bags for the Baghouse.
 - a. An approximate total of 4000 – 5000, 9 m high bags need to be manufactured and installed to enable the functional operation of the ASARCO Baghouse and start-up of the Lead Smelter.

- b. This equipment is purpose manufactured for the application and the supply chain related to the bags includes raw materials and parts manufacture spread between South America, Asia and Australasia.
- c. Typically less than 1000 bags per annum would be manufactured.
- d. Current estimations have bags being supplied to site starting from late July and stretching into late August. The suppliers still cannot confirm all supply chain elements for the requested order level.
- e. Operationally we will not be able to estimate start up dates until we have physically received an appropriate number of bags for installation at the site.

Whilst actions progress to confirm, integrate and refine the work schedule and critical path, confirmed repair works are being conducted in parallel to reduce impact on smelter downtime. Actions being conducted include:

1. External access structures and services including electrical cable & LCU's / water / air have been removed and replacement items have been ordered or are being manufactured.
2. Electrical Substation works and general electrical work plans have been developed and have commenced in some areas and will advance relatively quickly over the next 2-3 weeks after completion of blasting and painting in the lower areas of the building, which allows installation of cable trays and services corridors.
3. Structural inspections of main weight bearing columns and cross members has been completed, work plans have been developed , materials ordered, and repairs are underway. The outstanding structural inspections relate to the roof structure and cannot be completed until the removal of the asbestos products under the roof sheeting.
4. A multitude of other operational and mechanical works is underway in the area to service and remove products, equipment and complete repairs where necessary.

Notwithstanding normal health and safety protocols for work tasks at the MIM site, recovery works are also complicated by the associated lead exposure risk in the work area and the damage to infrastructure that would normally allow access to work fronts and enable work to progress at height as well as in lower areas of the affected area. This aspect adds to the additional time estimated to enable appropriate health and safety risk assessments to be completed in order to functionally develop multiple integrated work plans. As a

consequence, timing estimates have been significantly impaired and estimates have been complicated. The uncertainty associated with startup complicates inventory management, as MIM's logistics are impacted on both the upstream and downstream ends of the concentrate handling system.

All available resources are and will continue to be utilised to ensure repair works are sufficient to return the Baghouse to its functioning specifications, improvements required as incident investigation occur concurrently are incorporated, repair works are complete to ensure safety of all personnel involved, and the downtime period of the Lead Smelter is minimised as much as possible.

Process and Logistics

At MIM both zinc and lead minerals are found in the same ore and are mined and crushed as one product and then product metal concentrates are separated during the concentrating process. It is not possible to separate the mining of "lead ore" from the mining of "zinc ore" to cease lead concentrate production.

After processing ore via the Zinc-Lead Concentrator to produce separate zinc and lead mineral slurries, lead concentrate is processed either via the Lead Smelter or in parallel to zinc concentrate via filtration at MIM's Zinc-Lead Filter Plant before storage and/or export of dry concentrates.

The Zinc-Lead Filter Plant operates three filter presses which are designed to process the full output of zinc production from MIM's operations while allowing for batch filtering of lead concentrate by utilising excess capacity.

The Lead Smelter filters lead concentrate separate to the Zinc-Lead Filter plant and processes the concentrate in a Sinter Plant. From there the material is blended to required composition and consistency to allow combustion of the material to make a suitable feed material (sinter) for the Blast Furnace. The Blast Furnace utilises combustion of coke to smelt sinter to liquid lead and molten slag. The liquid lead is processed to remove contaminants via drossing and cast into bullion for export to the Britannia Refined Metals facility.

MIM's normal operations involve the mining of approximately 9 million tonnes of zinc and lead containing ores and treatment to produce approximately 660,000 tonnes of zinc concentrate and 390,000 tonnes of lead concentrate from the Zinc-Lead Concentrator. Under normal operating conditions, zinc concentrate is shipped for export from the Zinc Shed at the Zinc-Lead Filter Plant and approximately 280,000 tonnes of lead concentrate smelted into bullion at the Lead Smelter, with the remaining approximate 110,000 tonnes of concentrate is filtered and exported via rail and the Glencore Port Operations in Townsville.

Figure 3 illustrates tonnages and capacities in MIM's logistics train as concentrate. Filtered concentrates are exported from site via rail to Glencore's facility at the Townsville Port, where zinc and lead concentrates are stockpiled and sent to market via shipping. Combined with MIM's total zinc concentrate production, this means that, ordinarily, approximately 60% of the output of the Zinc-Lead Concentrator is filtered through the Zinc-Lead Filter Plant.

To allow for the continuity of the business and to minimise economic impact and workforce/supplier disruption, it is proposed that MIM's Zinc-Lead Concentrator will continue to process ore from MIM's George Fisher and Black Star mines as well as Glencore's Lady Loretta mine, albeit at a reduced rate. Continued production by the Zinc-Lead Concentrator enables MIM to minimise disruption to its mining activities; however, without the Lead Smelter in operation, there is an increase in the quantity of lead concentrate produced from site. If the Lead Smelter is unavailable to process lead concentrate, the Zinc-Lead Filter Plant will be required to filter 100% of the output of the Zinc-Lead Concentrator, both zinc and lead concentrate streams.

Direct export of this additional lead concentrate is the preferred outcome and MIM are currently working on securing additional buyers of the lead concentrate as well as increasing rail and shipment scheduling and optimising current authorised storage facilities.

Given the capacity limitations on the filtering, storage and export facilities, both onsite and at the Townsville port, and taking into account the impact of potential rail/logistics disruptions, MIM considers a contingency plan which will allow alternative storage capacity on ML8058.

MIM is currently exposed to upstream and downstream logistic and market risks that have potential to see an accumulation of lead concentrate stocks to authorised storage limits (refer Figure 4).

If alternative storage capacity cannot be secured and/or if there are any delays in sale arrangements or ship/rail movements, there would be a flow on effect to MIM's business, workforce and the Mount Isa community. This flow on effect could include suspension of operation across MIM's site.

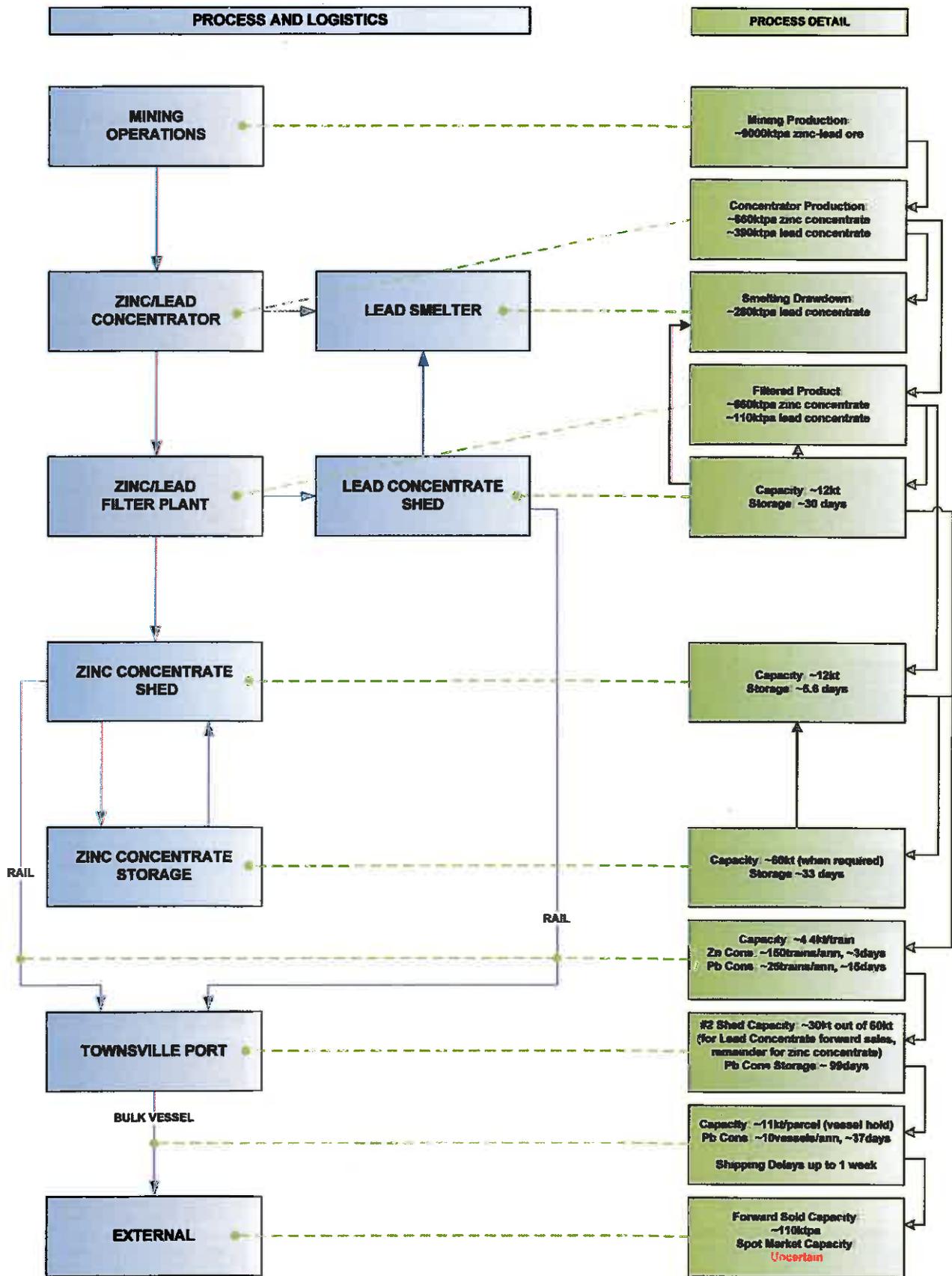


Figure 3: MIM's Lead and Zinc General Flowchart with Logistic Rate and Capacities

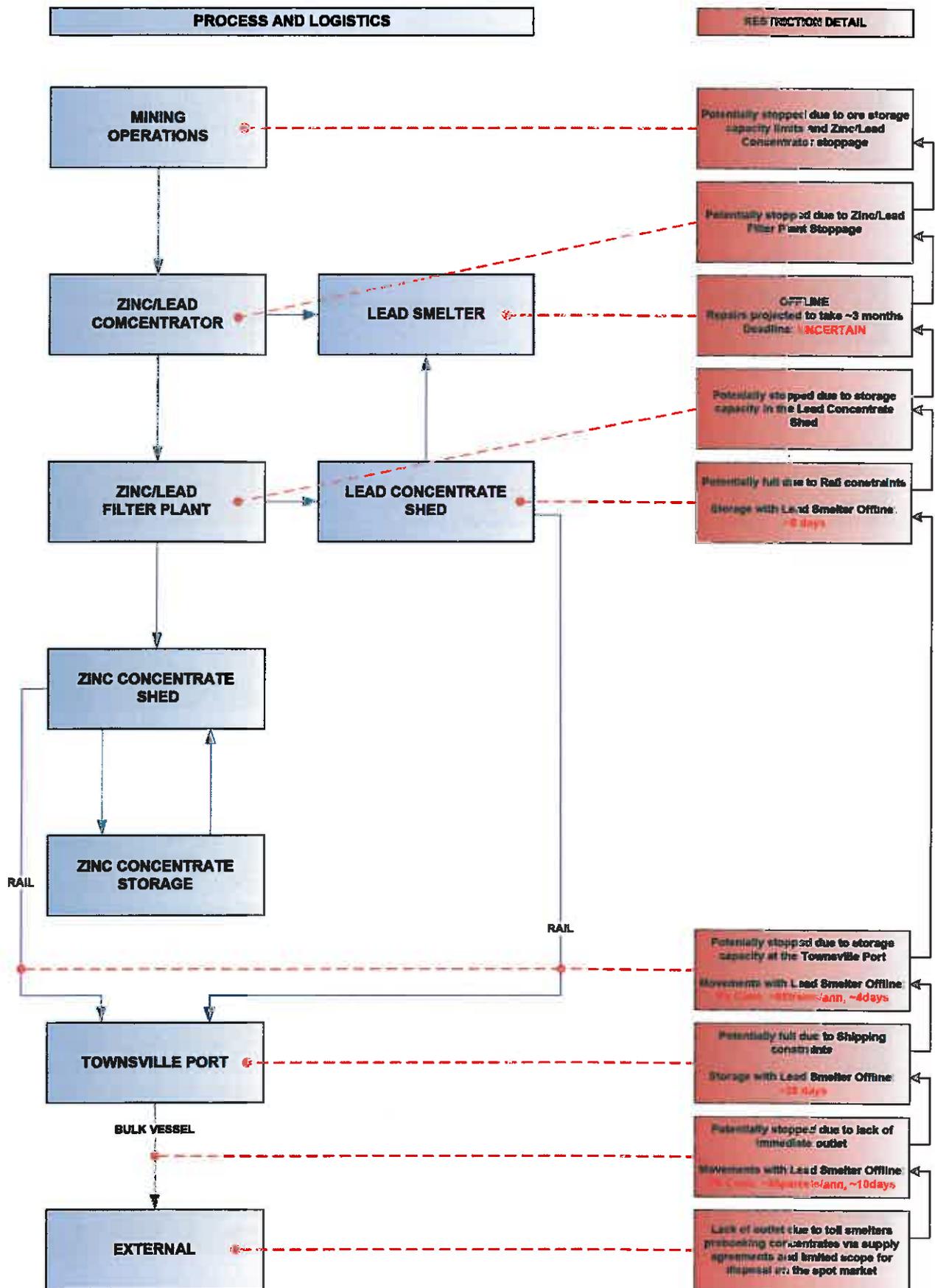


Figure 4: MIM's Lead and Zinc General Flowchart with Restrictions due to Lead Smelter Stoppage

Concentrate Storage and Capacities

Stock held at Mount Isa varies according to scheduled shipments, aimed to manage stock levels under normal circumstances.

Current Storage Capacity

MIM is currently authorised:

- [condition C22] to store zinc concentrate in enclosed buildings and, in abnormal operating conditions, also within the designated zinc storage area specified in Schedule K – Figure 7;
- [condition C25] to store, handle and load lead concentrate only within either holding tanks for the smelter or within the designated enclosed concentrate storage facility specified in Schedule K – figure 26.

Specific requirements are stipulated in MIM's EA regarding control measures applicable to the above conditions.

Accordingly, currently authorised capacity on site comprises:

- The zinc shed at the Zinc-Lead Filter Plant, for zinc concentrate;
 - Capacity of ~12,000 tonnes of zinc concentrate
- The designated zinc storage area, outside the zinc shed, for zinc concentrate;
 - Capacity of ~90,000 tonnes of zinc concentrate
- The designated enclosed concentrate storage facility, for lead concentrate;
 - Capacity of ~12,000 tonnes of lead concentrate
- The holding tanks at the lead smelter, for lead concentrate in slurry form, for the purposes of smelter feed
 - Capacity of ~5,000 tonnes of lead concentrate as slurry

Production Estimates

The 2014 production budget forecasted ~380ktpa of lead concentrate is produced of which ~280ktpa is smelted and ~110ktpa is filtered and exported. Under these conditions, the normal production of lead concentrate in a three month period would be ~ 37,000 tonnes. Under these conditions the storage

capacity ratio (tonnage of storage per production rate, expressed as weeks) for filtered lead concentrate in the enclosed concentrate storage facility, is 4.3 weeks.

As a result of the shutdown of the Lead Smelter for three months, the production of lead concentrate in this period would be expected to be approximately 100,000 tonnes. Under these conditions the storage capacity ratio would be less than 2 weeks.

Contingency

If a buyer can be sourced for the direct export of lead concentrate (which is MIM's preferred option), there is the ability to maximise rail capacity and storage in MIM's Townsville storage facility to keep lead concentrate within authorised storage areas.

However, this sudden volume of lead concentrate can only be sold into the spot market with limited available buyers as most consumers of lead concentrate have contracts for supply already in place.

Significant work will continue the attempts to reduce the amount of concentrate that may need to be stored by MIM (such as sourcing a buyer for the additional lead concentrate, optimising current storage capacity through production to export alignment, or alternative storage at the port). However MIM needs to have contingency options in place for storage of lead concentrate to cover conditions where the production of concentrate exceeds authorised site storage capacities as a result of lead smelter operations being compromised and delays in export.

Contingences are required due to:

- Variability in projected lead smelter start-up date,
- Rail availability, including potential for derailments,
- Storage and export capability at Townsville Port , considering marketing, shipping schedules and the requirement to store zinc concentrates, and
- Availability of willing buyers of the lead concentrate.

Option Assessment

Various concentrate storage options have undergone preliminary assessment taking into consideration both the environmental and operational impact of each option presented; a number were found unviable and are detailed in Table 1. The options included the following options listed in preference of environmental impact both on ML8058 at the Townsville Port:

- Storage of concentrate in slurry form.
- Containerisation of dry concentrate.
- Storage of dry concentrate in enclosed buildings.
- Storage of dry concentrate in outside locations.

Preliminary Assessment Outcomes

Table 1: Options Assessments

Option	Assessment Outcome
Storage of Concentrate in slurry form	
1. In onsite storage tanks.	<p>Unviable</p> <p>There are no storage tanks with the anticipated capacity available onsite. Recovery of stored material requires agitation, otherwise a settled pulp must be manually extracted with potential for significant spillage and spread of the semi-liquid.</p>
2. In onsite dams on ML8058	<p>Unviable</p> <p>Onsite dams considered included the Lead Smelter superpit, Max's pond, Lower Star Gully and Mine Side dams. Unviable due to restricted storage capacities at locations; impact on storm water containment capacities and contamination in surface water containment systems, operational input to ponds as part of normal operating and cross contamination of product, requirement of specialist transport equipment (Vac Truck) with small and frequent load trips, and ability to handle production</p>

	output
3. In alternative storage containers	<p>Unviable</p> <p>Storage containers considered included bladder tanks and Xstrata Technology Zipa tanks (semi permanent tanks with the ability of quick construction).</p> <p>Bladder tanks were found unviable due to the significant number required (80-90 tanks) and available storage area, safety concerns in handling and storage as well as recovery logistics increasing risk of spillage.</p> <p>Zipa tanks were found unviable due to availability (15 tanks required) and the lead times associated (22 weeks).</p>

Containerisation of dry concentrate

4. Storage in Rotaboxes outside at the port	<p>Potentially Viable</p> <p>The use of Rotaboxes would only be viable for use at the port in an outside storage location (given full capacity within the shed). The Rotaboxes can be opened and discharged within the ship hull and reduce the handling requirements and potential dust generation significantly. The Rotaboxes would have to be loaded within the port shed and go through a wash prior to being stored outside and any logistical constraints are not currently known. However, this option becomes unviable given the number of Rotaboxes required (~450 boxes to store 10,000t) and available storage room in the outside port area. Availability, lead times and storage capacity currently unknown.</p>
5. Storage in Rail Carriages with lids	<p>Unviable</p> <p>Storage in rail carriages provides effective environmental control in that it can be loaded as per current authorisation. There is no suitable rolling stock available (wagons with lids). All wagons are being utilised for transport of the lead concentrate between Mount Isa and Townsville. This option is also unviable due to the number of carriages required estimated at 1,200 wagons.</p>
6. Storage in Bulky Bags	Unviable

Availability of Bulky Bags is achievable onsite however the sheer quantities required (100,000) significantly increases handling requirements (dust generation potential) and significant safety concerns in handling as well as recovery issues and increased risk of spillage. Furthermore storage location of the bags is very limited due to potential deterioration of the bags in sunlight.

Storage in enclosed building

7. Storage in Zinc Concentrate Shed

Unviable

Only 2 of the 3 storage bays within the Zinc Concentrate Shed could be utilised as the zinc concentrate conveyor from the filter plant always requires 1 bay to feed into. The total capacity available with the other 2 bays is 7,000t which equates to approximately 1 week production of lead concentrate and additional storage options would be required.

This option presents a significant increase in handling of zinc concentrate to be able to manage feed storage availability within the shed. Modelling indicates this would increase the Mass Emissions Estimates.

8. Storage in alternative shed on

ML8058

Unviable

There are no storage sheds with the anticipated capacity onsite. Any shed are located in close proximity to sensitive receptors (community) or require significant travel distance ..

9. Storage in alternative authorised sheds at the port

Potentially viable pending agreement, capacity and authorisation

The storage options potentially useable for storage of lead concentrate at the port are:-

BHPB – authorised to store however availability uncertain

NSS – negative pressure however dependant on EA amendment approval to store lead concentrate. Not available until September.

This option requires transport from Glencore shed to NSS with loading via Berth 8 or containerised by NSS for loading into the vessel hold.

10. Storage in erected shed on ML8058	Unviable
	Investigations have been conducted into available products on the market including circus tents and inflatable enclosures. Due to the number of enclosures that would be required available footprint, durability concerns and long lead times rendered this option unviable.
Storage in outside area	
11. Zinc designated storage area	Viable
	The Zinc concentrate designated storage areas provide sufficient capacity required, however, this restricts contingency for the zinc concentrate stream and additional storage would still be required. If the storage area outside of the currently fenced storage area needed to be utilised a temporary fence structure would need to be erected. Although both locations provide added dust mitigation control with the fencing the locations are in close proximity to the town.
12. Previously authorised lead concentrate storage area (Cannington Pad)	Viable This location has sufficient required capacity and is located further away from the community. Although it does not have the benefit of fencing as a air quality control, additional controls such as wind breaks, dust suppressants, etc. may prove just as effective. One of the key considerations would be logistics (trucks being able to access the shed and cleaning facility) and transport distances.
13. Alternative stockpile areas on ML8058	Unviable Other areas located on the mine site were considered such as I54, Rowles Reserve and other storage pads; however, due to increased traffic movement, handling requirements, access issues, product cross contamination, and increase in contamination footprint these options were unviable.
14. In mining pits located on ML8058	Unviable There are 5 mining pits located onsite that were considered and

were found unviable. BSOC and TD5 are currently operational and this would impact production as well as presents cross contamination risks; BROC and HHOC cannot be accessed due to safety risks; and KSOC is the main process water storage location onsite.

Preferred Options

Based on the preliminary assessment above, two preferred options were identified for storage of lead concentrate namely:

- [Option 11] Within the Designated Zinc Storage Area as specified in Schedule K – Figure 7 of the EA
 - By displacing a portion of current zinc concentrate storage, a site adjacent at the Zinc-Lead Filter Plant where appropriate controls can be implemented and vehicle transport of stocks can be minimised for the purposes of dust control; and
- [Option 12] The location known as “Cannington Pad” which was previously described as the Designated Lead Concentrate Storage Area under condition C25 (b) (and Schedule K – Figure 10) of MIM’s EA (No. MIN102700011) dated 13 December 2012.
 - A site with precedence, previously utilised for lead concentrate storage with minimal environmental impact.

Refer to Figure 5 for these locations. Storage of lead concentrate in the above locations is not authorised by MIM’s EA.

Figure 6 illustrates the additional storage and materials movements that would arise from use of these locations.

Taking into account different operational factors, a number of different scenarios were selected around each of these preferred storage areas which also encompassed combinations of options (both location and storage timeframes). These scenarios were based on inventory and shipment modelling to estimate the extent of impacts caused by disruption to external movements.

MIM has used these scenarios as the basis for its assessment of air quality impacts as outlined below.



Figure 5: Zinc-Lead Filter Plant Outside Storage Area and Cannington Pad Storage Area

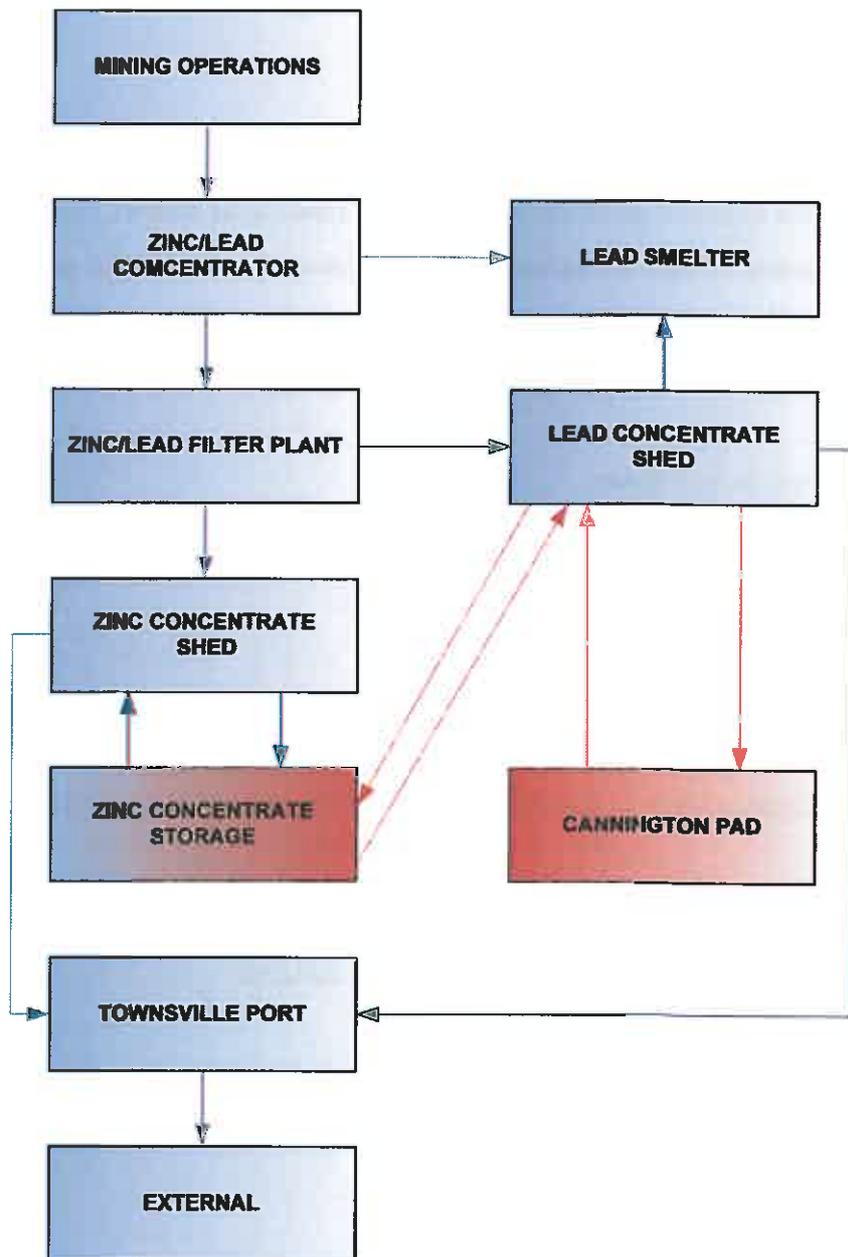


Figure 6: General Zinc-Lead Flowchart with Additional and Reallocated Storages and Movements

Air Quality – Assessment

Assessment of air quality impacts has focussed on the operations impacted by the fire, in the knowledge that operations outside of the impacted processes would ideally continue as normal. Consequently impacts can be assessed by comparison of options against a baseline (normal Lead Smelter and Lead Storage Shed Operations) to establish if mass emissions and modelled impacts increase or decrease. All other operational activities are not considered under the Base Case scenario. Please refer to Appendix 3 for sources considered.

The Base Case parameters are as follows:

- Lead Smelter Downtime – 0 months
- Fraction through Lead Smelter – 1
- Control – paved roads are regularly cleaned.

Based on the outcomes of the Preliminary Assessment above, Pacific Environment Limited (PEL) was engaged to undertake assessment of air quality impacts and controls under various scenarios.

Figure 8 illustrates the assessment process with the following detailed:

- Base assumptions
- Controls
- Mass emission rates and contributors
- Forecast impacts and contributors.

Scenario Analysis

MIM's assessment focussed on not only feasible storage options but also aimed at optimising stockpile drawdown methods. As a result, a number of potential scenarios were identified for assessment. These scenarios are described in Table 2 and encompass combinations of options (both location and storage timeframes).

The outcomes from scenarios assessed varied as information was received including:

- Mass rates from operations,
- Storage capacities,
- Mass emission rates from PEL,

- Receptor modelling from PEL; and
- Development of a stockpile model to simulate:
 - Potential drawdown rates and activities,
 - Stock levels and timeframes to refine time based footprints,
 - Potential adverse downstream impacts such as derailment, lack of end market, and delayed Lead Smelter start-up.

Table 2: Description of Operation Scenarios

<u>Scenario 1:</u>	<u>Scenario 2:</u>
Lead Smelter Downtime – 4 months	Lead Smelter Downtime – 4 months
Fraction through Lead Smelter – 0.65	Fraction through Lead Smelter – 0.65
Railing outage – 0 days	Railing outage – 0 days
Railing Rates – Every 14 Days	Railing Rates – Every 7 Days
Outside Filter Plant Stored Concentrate – 31,815 t	Outside Filter Plant Stored Concentrate – 13,887 t
Stockpile Area – 0.325 ha	Stockpile Area – 0.325 ha
Total Storage Time – 238 Days	Total Storage Time – 81 Days
Initial Concentrate Moisture Content – 10%	Initial Concentrate Moisture Content – 10%
Removal Concentrate Moisture Content –10%	Removal Concentrate Moisture Content –10%
Control – High walls all sides. Water sprinklers.	Control – High walls all sides. Water sprinklers.
<u>Scenario 3:</u>	<u>Scenario 4:</u>
Lead Smelter Downtime – 4 months	Lead Smelter Downtime – 4 months
Fraction through Lead Smelter – 0.65	Fraction through Lead Smelter – 0.65
Railing outage – 0 days	Railing outage – 28 days
Railing Rates – Every 5 Days	Railing Rates – Every 5 Days
Outside Filter Plant Stored Concentrate – 0 t	Outside Filter Plant Stored Concentrate – 21,721t
	Stockpile Area – 0.325 ha
	Total Storage Time – 57 Day
	Initial Concentrate Moisture Content – 10%
	Removal Concentrate Moisture Content –10%
	Control – High walls all sides. Water sprinklers.

Scenario 5:

Lead Smelter Downtime – 6 months
Fraction through Lead Smelter – 0.51
Railing outage – 28 days
Railing Rates – Every 5 Days
Outside Filter Plant Stored Concentrate – 26,909 t
Stockpile Area – 0.325 ha
Total Storage Time – 120 Day
Initial Concentrate Moisture Content – 10%
Removal Concentrate Moisture Content –10%
Control – High walls all sides. Water sprinklers.

Scenario 6:

Lead Smelter Downtime – 6 months
Fraction through Lead Smelter – 0.51
Railing outage – 28 days
Railing Rates – Every 14 Days
Outside Filter Plant Stored Concentrate – 35,000 t
Stockpile Area – 0.325 ha
Total Storage Time – 313 Day
Initial Concentrate Moisture Content – 10%
Removal Concentrate Moisture Content –10%
Control – High walls all sides. Water sprinklers.
Cannington Pad Stored Concentrate – 27,109 t
Stockpile Area – 0.4 ha
Total Storage Time – 85 Day
Initial Concentrate Moisture Content – 10%
Removal Concentrate Moisture Content –10%
Control – Wind Barriers, Wind direction limited activities, Water and Surface treatments.

These scenarios were based on inventory and shipment modelling to estimate the extent of impacts caused by disruption to external movements. Figure 7 shows the areas covered by dispersion modelling based on mass emission tabulation.

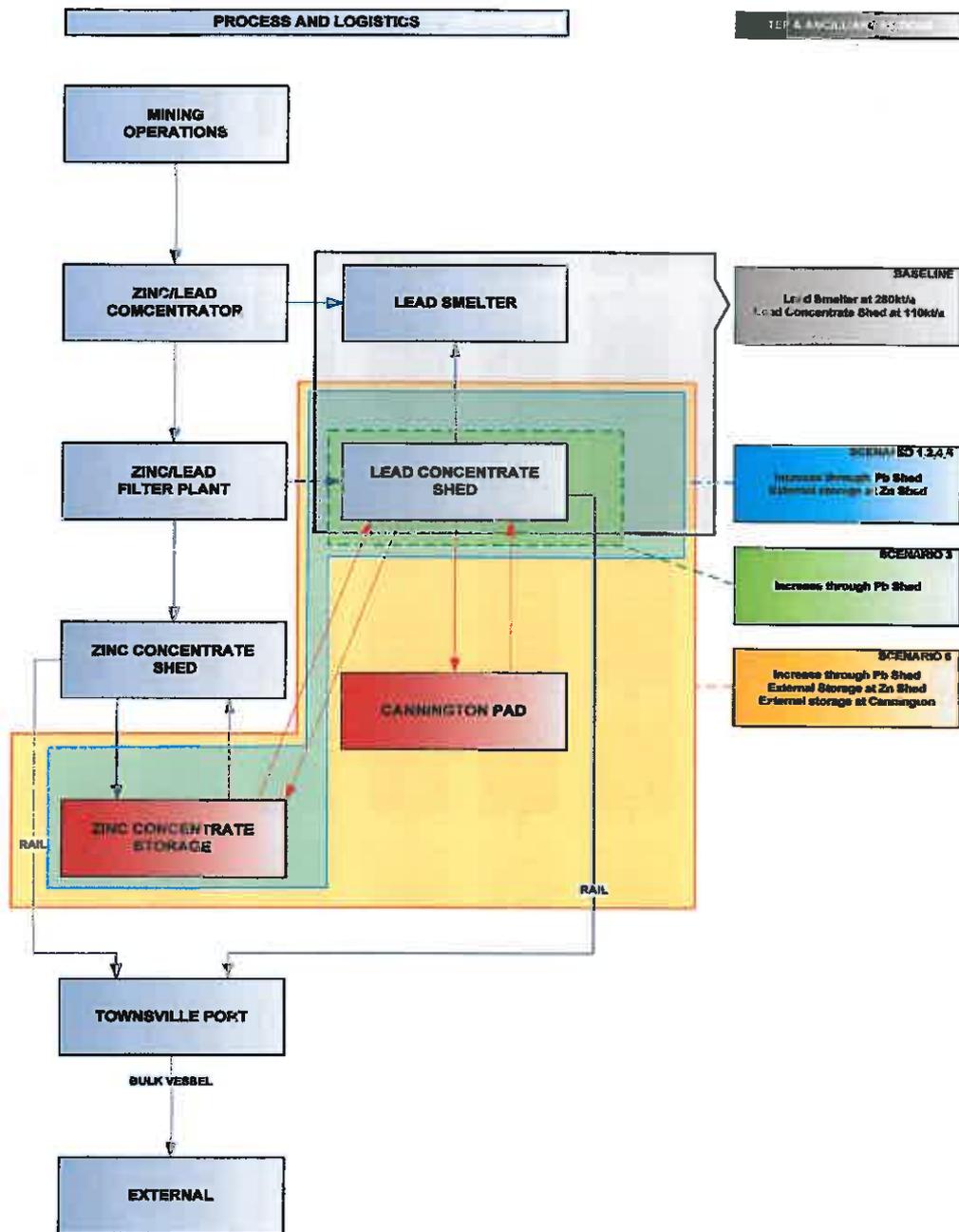


Figure 7: Areas Covered By Scenarios Established for Options 11 and 12

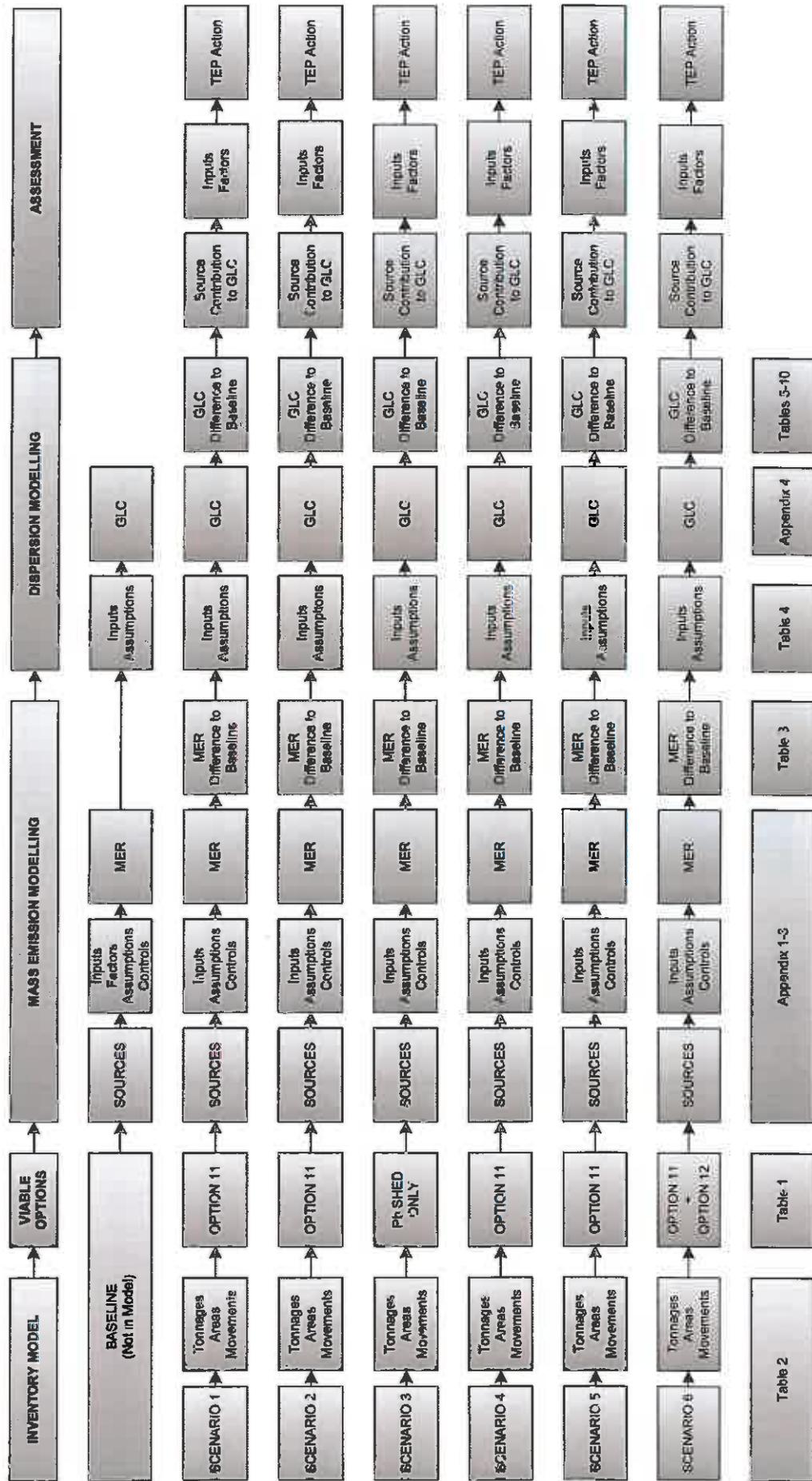


Figure 8: Flowchart of Assessment Process

Mass Emission Rates and Contributors

The emissions for normal operations and the storage operations were estimated using the methods defined in the PAE report “MIM Dust Modelling and Areas of Concern Investigation (2013)” submitted to EHP on 15 May 2014. This assessment used stack testing results to define the lead smelter emissions. The stack emissions were linearly scaled with concentrate throughput.

The emission from concentrate storage used the estimation methods in the US EPA AP-42 *Compilation of Air Pollutant Emission Factors*. The emission sources included were:

- Lead concentrate transfers - US EPA AP-42 Chapter 11.24: *Metallic Minerals Processing*.
- Wind erosion from stockpiles - US EPA AP-42 Chapter 13.2.5: *Industrial Wind Erosion*.
- Wheel generated dust - US EPA AP-42 Chapter 13.2.2: *Unpaved Roads*.

This assessment compares the emissions from normal operating condition to the alternative operations of concentrate storage and smelter operations. Appendix 1 shows the emission estimation method used to estimate TSP emissions for each scenario. The material speciation profiles for lead concentrate and haul roads, as shown in Appendix 2, were used to determine the metals emissions.

Explanation notes for mass emission rates and impacts in Mount Isa have been provided as appendix 7.

Results

The resulting annual emissions for each Scenario are provided in Appendix 3. The difference between total annual emissions for each scenario and the Base Case scenario is shown in Table 3. This Table shows that emissions for all of the alternative operations presented (Scenarios 1 to 6) are lower than for emissions from normal operating conditions (i.e. Base Case) for all substances assessed.

Table 3: Comparison to Base Case Total Annual Emissions (kg/year)

Scenario	TSP	PM ₁₀	PM _{2.5}	Arsenic	Cadmium	Copper	Lead	Zinc
S1	-17,144	-15,991	-15,925	-470	-1,050	-205	-9,428	-924
S2	-17,415	-16,108	-15,939	-470	-1,050	-206	-9,561	-944
S3	-17,603	-16,188	-15,948	-471	-1,050	-206	-9,653	-958
S4	-17,353	-16,085	-15,937	-470	-1,050	-206	-9,530	-939

S5	-24,038	-22,273	-22,065	-651	-1,454	-285	-13,201	-1,302
S6	-22,614	-21,765	-21,943	-651	-1,453	-283	-12,881	-1,249

Dispersion Modelling

Dispersion modelling has been conducted using the CALMET/CALPUFF modelling suite. CALMET generated meteorological fields for the year 2013 have been used in this assessment. Dispersion modelling for proposed facilities is reliant on historic weather and forecast emissions, with significant assumptions of future emissions. As such modelling provides an indicative guide for potential impacts and will not identify the impacts of unforeseen conditions or incidents.

Ultimately, good modelling will identify the major contributors to impacts and the primary drivers of those contributors and due to different weather and operating conditions. Controls proposed are based on the identified input metrics that have a generally greater impact on modelled emissions and results. The modelled emissions are represented as either point or area sources. Typically, only emissions released from a stack are modelled as a point source. Area sources represent emissions that are released from a relative horizontal plane such as wheel generated dust and wind erosion.

The emission sources release parameters are summarised in Table 4.

Table 4: Source Model Parameters

Source	Type	Parameter	Value	Emission Release
Wheel Generated Dust	Area	Effective Height (m)	2	Base Case – Constant
		Initial Sigma Z (m)	0.5	Scenario 1 -6 – Variable during smelter operations based on wind directions from 15° to 165°
		Effective Rise (m/s)	0	Scenario 6 – Variable during
		Effective Radius (m)	17.84	Cannington pad use based on wind directions from 15° to 165°
Cannington Pad	Area	Effective Height (m)	3	Scenario 6 – Loading variable during
		Initial Sigma Z (m)	0.5	Cannington pad use based on wind directions from 15° to 165°
		Effective Rise (m/s)	0	Scenario 6 – Wind erosions variable
		Effective Radius (m)	171.45	during Cannington pad storage period

				Dependent on a cubic function of wind speeds greater than 5.4 m/s
Lead Filter Storage	Area	Effective Height (m)	3	Scenario 1,2,4,5,6 – Loading variable during Cannington pad use based on wind directions from 15° to 165° Scenario 1,2,4,5,6 – Wind erosions variable during Cannington pad storage period. Dependent on a cubic function of wind speeds greater than 5.4 m/s
		Initial Sigma Z (m)	2.5	
		Effective Rise (m/s)	0	
		Effective Radius (m)	35.5	
Lead Smelter Stack	Point	Stack Height (m)	270	Base Case – Constant emission rate Scenario 1-4 – Variable rate. No emissions during June to September. Constant emission for other months
		Stack Diameter (m)	4.40	
		Exit Velocity (m/s)	40.8	
		Exit Temperature (°C)	341	Scenario 5,6 – Variable rate. No emissions during June to November. Constant emission for other months.
		Sigma y (m)	1.1	
		Sigma z (m)	1	
HMA Stack	Point	Stack Height (m)	40	Base Case – Constant emission rate Scenario 1-4 – Variable rate. No emissions during June to September. Constant emission for other months.
		Stack Diameter (m)	2.97	
		Exit Velocity (m/s)	16.1	
		Exit Temperature (°C)	338	Scenario 5,6 – Variable rate. No emissions during June to November. Constant emission for other months.
		Sigma y (m)	0.74	
		Sigma z (m)	1	
Zinc Filter Storage Shed Stack	Point	Stack Height (m)	170	Building Downwash Included Constant rate for all scenarios.
		Stack Diameter (m)	1.95	
		Exit Velocity (m/s)	10.0	
		Exit Temperature (°C)	298	

Results

The ground level concentrations at each monitoring station for each scenario are shown in Appendix 4. The changes in concentration at each monitoring station from Base Case for each scenario are shown in Table 5 to Table 10. These tables show that concentration at each monitoring station is either the same or less than the Base Case concentration for each scenario considered.

Figures showing the percentage contribution of each source to the ground level concentration at each monitoring location are provided in Appendix 5 for TSP, PM₁₀, lead and zinc. Figures for PM_{2.5}, arsenic, cadmium and copper have not been included as stack sources contribute close to 100% of ground level concentrations for all scenarios for these substances.

The figures displayed in Appendix 6 show the contribution of each emission source to the ground level concentrations and the monitoring locations. These figures show that the stack sources have the greatest contribution to ground level concentrations for all scenarios. For scenario 1, 2 and 4 material transfer is the greatest contributor to ground level concentration of the fugitive emission sources. For scenario 6, both material transfer and wheel generated dust are the greatest contributors of the fugitive emission sources, due to the additional transport to the Cannington Pad. For scenario 3, wheel generated dust is the only fugitive emission source considered. It has a minimal contribution to ground level concentration compared to the stack sources.

Table 5: Change in Concentration ($\mu\text{g}/\text{m}^3$) from Base Case for Scenario 1

	TSP	PM ₁₀	PM _{2.5}	Arsenic	Cadmium	Copper	Lead	Zinc
Station 1	-0.0041	-0.0044	-0.0045	-0.0001	-0.0002	0	-0.0026	-0.0003
Station 5	-0.0009	-0.0009	-0.0009	0	0	0	-0.0005	-0.0001
Station 6	-0.0028	-0.0033	-0.0037	-0.0001	-0.0002	-0.0001	-0.0018	-0.0002
Station 4	-0.0010	-0.0011	-0.0012	-0.0001	-0.0001	0	-0.0006	-0.0001
Station 9	-0.0018	-0.0020	-0.0021	-0.0001	-0.0001	0	-0.0011	-0.0001
Station 10	-0.0008	-0.0010	-0.0012	-0.0001	0	0	-0.0005	0
Station 11	-0.0096	-0.0099	-0.0102	0	-0.0002	-0.0002	-0.0058	-0.0007
Station 12	-0.0026	-0.0027	-0.0028	-0.0001	-0.0001	0	-0.0016	-0.0002

Table 6: Change in Concentration ($\mu\text{g}/\text{m}^3$) from Base Case for Scenario 2

	TSP	PM ₁₀	PM _{2.5}	Arsenic	Cadmium	Copper	Lead	Zinc
Station 1	-0.0043	-0.0044	-0.0045	-0.0001	-0.0002	0	-0.0026	-0.0003
Station 5	-0.0009	-0.0009	-0.0009	0	0	0	-0.0006	-0.0001
Station 6	-0.0033	-0.0035	-0.0037	-0.0001	-0.0002	-0.0001	-0.0021	-0.0002
Station 4	-0.0011	-0.0012	-0.0012	-0.0001	-0.0001	0	-0.0007	-0.0001
Station 9	-0.0020	-0.0021	-0.0021	-0.0001	-0.0001	0	-0.0011	-0.0001
Station 10	-0.0010	-0.0011	-0.0012	-0.0001	0	0	-0.0006	0
Station 11	-0.0100	-0.0101	-0.0102	0	-0.0002	-0.0002	-0.0060	-0.0007
Station 12	-0.0027	-0.0028	-0.0028	-0.0001	-0.0001	0	-0.0016	-0.0002

Table 7: Change in Concentration ($\mu\text{g}/\text{m}^3$) from Base Case for Scenario 3

	TSP	PM ₁₀	PM _{2.5}	Arsenic	Cadmium	Copper	Lead	Zinc
Station 1	-0.0045	-0.0045	-0.0045	-0.0001	-0.0002	0	-0.0027	-0.0003
Station 5	-0.0010	-0.0009	-0.0009	0	0	0	-0.0006	-0.0001
Station 6	-0.0037	-0.0036	-0.0037	-0.0001	-0.0002	-0.0001	-0.0022	-0.0003
Station 4	-0.0012	-0.0012	-0.0012	-0.0001	-0.0001	0	-0.0007	-0.0001
Station 9	-0.0022	-0.0021	-0.0021	-0.0001	-0.0001	0	-0.0012	-0.0001
Station 10	-0.0012	-0.0011	-0.0012	-0.0001	0	0	-0.0007	0
Station 11	-0.0105	-0.0103	-0.0102	0	-0.0002	-0.0002	-0.0062	-0.0007
Station 12	-0.0028	-0.0028	-0.0028	-0.0001	-0.0001	0	-0.0017	-0.0002

Table 8: Change in Concentration ($\mu\text{g}/\text{m}^3$) from Base Case for Scenario 4

	TSP	PM ₁₀	PM _{2.5}	Arsenic	Cadmium	Copper	Lead	Zinc
Station 1	-0.0042	-0.0044	-0.0045	-0.0001	-0.0002	0	-0.0026	-0.0003
Station 5	-0.0008	-0.0009	-0.0009	0	0	0	-0.0005	-0.0001
Station 6	-0.0031	-0.0034	-0.0037	-0.0001	-0.0002	-0.0001	-0.0019	-0.0002
Station 4	-0.0010	-0.0011	-0.0012	-0.0001	-0.0001	0	-0.0006	-0.0001

Station 9	-0.0018	-0.0020	-0.0021	-0.0001	-0.0001	0	-0.0011	-0.0001
Station 10	-0.0009	-0.0010	-0.0012	-0.0001	0	0	-0.0005	0
Station 11	-0.0095	-0.0099	-0.0102	0	-0.0002	-0.0002	-0.0057	-0.0007
Station 12	-0.0026	-0.0027	-0.0028	-0.0001	-0.0001	0	-0.0016	-0.0002

Table 9: Change in Concentration ($\mu\text{g}/\text{m}^3$) from Base Case for Scenario 5

	TSP	PM ₁₀	PM _{2.5}	Arsenic	Cadmium	Copper	Lead	Zinc
Station 1	-0.0061	-0.0063	-0.0063	-0.0002	-0.0003	-0.0001	-0.0037	-0.0004
Station 5	-0.0013	-0.0013	-0.0013	0	0	0	-0.0008	-0.0001
Station 6	-0.0047	-0.0051	-0.0055	-0.0001	-0.0002	-0.0001	-0.0029	-0.0003
Station 4	-0.0015	-0.0016	-0.0016	-0.0001	-0.0001	0	-0.0009	-0.0001
Station 9	-0.0023	-0.0025	-0.0026	-0.0001	-0.0001	0	-0.0014	-0.0001
Station 10	-0.0013	-0.0015	-0.0017	-0.0001	0	0	-0.0008	0
Station 11	-0.0152	-0.0155	-0.0159	0	-0.0003	-0.0003	-0.0091	-0.0011
Station 12	-0.0032	-0.0033	-0.0034	-0.0001	-0.0001	-0.0001	-0.0019	-0.0002

Table 10: Change in Concentration ($\mu\text{g}/\text{m}^3$) from Base Case for Scenario 6

	TSP	PM ₁₀	PM _{2.5}	Arsenic	Cadmium	Copper	Lead	Zinc
Station 1	-0.0056	-0.0061	-0.0063	-0.0002	-0.0003	-0.0001	-0.0036	-0.0004
Station 5	-0.0012	-0.0013	-0.0013	0	0	0	-0.0008	-0.0001
Station 6	-0.0041	-0.0049	-0.0054	-0.0001	-0.0002	-0.0001	-0.0028	-0.0003
Station 4	-0.0014	-0.0016	-0.0016	-0.0001	-0.0001	0	-0.0009	-0.0001
Station 9	-0.0022	-0.0025	-0.0026	-0.0001	-0.0001	0	-0.0014	-0.0001
Station 10	-0.0011	-0.0014	-0.0017	-0.0001	0	0	-0.0008	0
Station 11	-0.0149	-0.0155	-0.0158	0	-0.0003	-0.0003	-0.0091	-0.0011
Station 12	-0.0027	-0.0031	-0.0033	-0.0001	-0.0001	-0.0001	-0.0018	-0.0002

Environmental Risk Controls Measures

The air quality emissions estimates included as supporting documentation indicate that the following controls are required for MIM to maintain compliance with condition B8 of the EA, with respect to the maximum concentration of particulate matter in ambient air quality, and ensure environmental harm from the storing, handling and transporting of lead concentrate is avoided or minimised. These controls are shown in Figure 9 and detailed in the sections below.

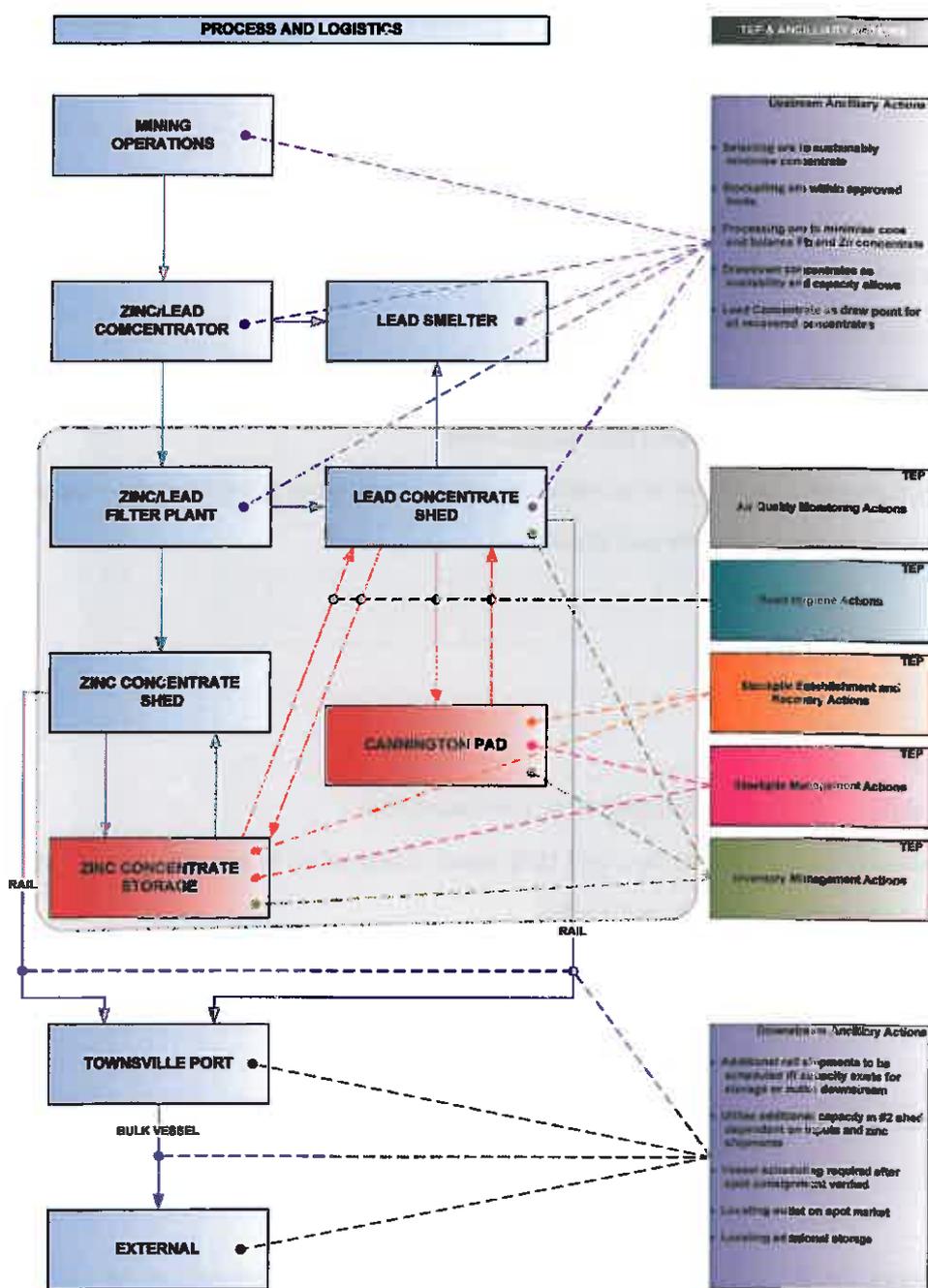


Figure 9: Additional Storages for Approval and Associated and Ancillary Actions

Inventory Management

Manage to minimised the volume of concentrate stored outside

1. Maintain, project and track forward estimates of the stockpiles and logistics.
2. Use of external stockpiles will only occur if inventories exceed shed on site and transport for export capacity.
3. If viable alternate internal storage facilities become available, the stockpiles will be recovered.
4. Establishment order will be Zinc Storage Area then Cannington Pad to minimise travel distance and stockpiling outside of a currently defined area.

Material Handling

To minimise the release of dust and particulate matter

1. Minimal load movements of concentrate conducted.
2. Load preparation such as wet down of loaded material to reduce windblown dust.
3. Recovery order will be Cannington Pad then Zinc Storage Area.
4. Movement to and discharge at a stockpile area will only occur when wind is blowing from easterly direction (0 – 180 degrees) between 08:00h and 18:00h.

Stockpile

To minimise the release of dust and particulate matter

1. Preparation of the stockpile footprint to minimise cross contamination.
2. Movement to and discharge at a stockpile area will only occur when wind is blowing from easterly direction (0 – 180 degrees) between 08:00h and 18:00h.
3. Storage area (except for access areas) will have a wind break (fence, other material stockpile or natural terrain) as a minimum on the prevailing wind side; stockpiles will be lower than the wind break by a minimum of 0.5m.
4. Application and maintenance of dust sealants on stockpiles and using water carts/water sprayers as required in the area to reduce dust off stockpiles, during material movement or wheel generated dust.
5. Final clean-up of the stockpile areas to be completed with residual material re-processed or disposed of in authorised area.

6. Installation of erosion and sediment control measures such as bunding or sediment traps to minimise potentially contaminated stormwater run-off to neighbouring areas.
7. Removal of residual concentrate from stockpiled area to be reprocessed or disposed of in an authorised location

Transport Management

To minimise the release of dust and particulate matter

1. Minimal load movements of concentrate conducted, the most direct route.
2. Minimisation of traffic access to the area (access of storage areas will be restricted to vehicles only required to work in the area) and compaction of trafficable areas.
3. Recovery of lead concentrate from external stockpiles will only occur when there is sufficient information available to conclude that there is no requirement to add to the stockpile.
4. Recovery of concentrates from external stockpiles will be to the Lead Shed. Recovery order will be Cannington Pad then Zinc Storage Area.

Conclusion

MIM intends to seek approval for a Transitional Environmental Program (TEP) to authorise the temporary storage of lead concentrate in order to avoid, or at least minimise, the potential detrimental impact on MIM's business, workforce and the Mount Isa community in response the lead smelter shutdown.

Based on the analysis of options and the modelling of Mass Emission and Dispersed Impact the storage of lead concentrate outside managed under the strategies as outlined in the TEP can be achieved without causing an exceedance of any limits required in the existing TEP and EA limits and, it is predicted, without an increase in forecast baseline ground level concentrations at any monitoring location.

Appendix 2 – Material Speciation (kg Metal/kg TSP) for Metal

Emissions

Material	Arsenic	Cadmium	Copper	Lead	Zinc
Lead Concentrate	0.503	0.308	2.50	490	75.3
Haul Road Dust	0.0810	0.0150	0.826	2.98	5.24

Appendix 3 – Annual Emissions (kg/year)

Source	TSP	PM ₁₀	PM _{2.5}	Arsenic	Cadmium	Copper	Lead	Zinc
Base Case								
Lead Smelter	36,168	36,168	36,168	1,320	2,810	433	21,991	2,047
HMA Stack	9,017	9,017	9,017	19	178	151	5,493	658
Filter Plant	4,018	1,631	849	3	2	468	341	807
Wind Erosion	-	-	-	-	-	-	-	-
Wheel Generated Dust	4,964	916	220	0.40	0.074	4.1	15	26
Concentrate Transfers	-	-	-	-	-	-	-	-
Total	54,167	47,732	46,254	1,342	2,991	1,055	27,839	3,538
Scenario 1								
Lead Smelter	23,464	23,464	23,464	856	1,823	281	14,266	1,328
HMA Stack	5,850	5,850	5,850	12	116	98	3,564	427
Filter Plant	4,030	1,636	850	3	2	468	347	808
Wind Erosion	140	70	10.5	0.071	0.043	0.350	6.9	11
Wheel Generated Dust	3,220	594	143	0.26	0.05	3	10	17
Concentrate Transfers	318	127	13	0.160	0.098	0.79	156	24

	Total	37,023	31,741	30,329	872	1,941	850	18,411	2,614
Scenario 2	Lead Smelter	23,464	23,464	23,464	856	1,823	281	14,266	1,328
	HMA Stack	5,850	5,850	5,850	12	116	98	3,564	427
	Filter Plant	4,030	1,636	850	3	2	468	347	808
	Wind Erosion	49	24	3.7	0.024	0.015	0.122	24	4
	Wheel Generated Dust	3,220	594	143	0.26	0.05	3	10	17
	Concentrate Transfers	139	56	6	0.070	0.043	0.35	68	10
	Total	36,752	31,624	30,315	872	1,941	849	18,278	2,594
Scenario 3	Lead Smelter	23,464	23,464	23,464	856	1,823	281	14,266	1,328
	HMA Stack	5,850	5,850	5,850	12	116	98	3,564	427
	Filter Plant	4,030	1,636	850	3	2	468	347	808
	Wind Erosion	-	-	-	-	-	-	-	-
	Wheel Generated Dust	3,220	594	143	0.26	0.05	3	10	17
	Concentrate Transfers	-	-	-	-	-	-	-	-
	Total	36,564	31,544	30,306	871	1,941	849	18,186	2,580
Scenario 4	Lead Smelter	23,464	23,464	23,464	856	1,823	281	14,266	1,328

HMA Stack	5,850	5,850	5,850	12	116	98	3,564	427
Filter Plant	4,030	1,636	850	3	2	468	347	808
Wind Erosion	33	16	2.5	0.017	0.010	0.082	16	2
Wheel Generated Dust	3,220	594	143	0.26	0.05	3	10	17
Concentrate Transfers	217	87	9	0.109	0.067	0.54	106	16
Total	36,814	31,647	30,317	872	1,941	849	18,309	2,599
Lead Smelter	18,579	18,579	18,579	678	1,443	222	11,296	1,052
HMA Stack	4,632	4,632	4,632	10	92	77	2,822	338
Filter Plant	4,042	1,641	850	3	2	468	352	809
Wind Erosion	69	35	5.2	0.035	0.021	0.172	34	5
Wheel Generated Dust	3,220	594	143	0.26	0.05	3	10	17
Concentrate Transfers	269	108	11	0.135	0.083	0.67	132	20
Total	30,129	25,459	24,189	691	1,537	770	14,638	2,236
Lead Smelter	18,579	18,579	18,579	678	1,443	222	11,296	1,052
HMA Stack	4,632	4,632	4,632	10	92	77	2,822	338
Filter Plant	4,042	1,641	850	3	2	468	352	809

Scenario 5

Scenario 6

Wind Erosion	621	248	25	0.31	0.19	2	304	47
Wheel Generated Dust	3325	691	199	0	0	3	10	17
Concentrate Transfers	354	177	27	0.18	0.11	0.88	173	27
Total	31,553	25,967	24,311	691	1,538	772	14,958	2,289

Appendix 4 – Ground Level Concentrations

The results below represent the concentrations at the monitoring locations in the Mount Isa community. Only the potentially affected emission sources were modelled as part of this assessment (refer to Appendix 1 for sources modelled). The modelling results indicate that all concentrations will be compliant with the EA and TEP limits.

Base Case Ground Level Concentration ($\mu\text{g}/\text{m}^3$)

	TSP	PM ₁₀	PM _{2.5}	Arsenic	Cadmium	Copper	Lead	Zinc
Station 1	0.0276	0.0192	0.0164	0.0003	0.0007	0.0018	0.0094	0.0037
Station 5	0.0054	0.0039	0.0034	0.0000	0.0001	0.0003	0.0020	0.0007
Station 6	0.0477	0.0267	0.0199	0.0002	0.0005	0.0043	0.0106	0.0079
Station 4	0.0063	0.0046	0.0040	0.0001	0.0002	0.0004	0.0023	0.0008
Station 9	0.0097	0.0067	0.0057	0.0001	0.0002	0.0006	0.0032	0.0013
Station 10	0.0077	0.0052	0.0045	0.0001	0.0001	0.0005	0.0025	0.0010
Station 11	0.0550	0.0444	0.0410	0.0001	0.0008	0.0026	0.0242	0.0061
Station 12	0.0091	0.0069	0.0062	0.0001	0.0002	0.0005	0.0036	0.0011

Scenario 1 Ground Level Concentration ($\mu\text{g}/\text{m}^3$)

	TSP	PM ₁₀	PM _{2.5}	Arsenic	Cadmium	Copper	Lead	Zinc
Station 1	0.0235	0.0148	0.0119	0.0002	0.0005	0.0018	0.0068	0.0034
Station 5	0.0045	0.0030	0.0025	0.0000	0.0001	0.0003	0.0015	0.0006
Station 6	0.0449	0.0234	0.0162	0.0001	0.0003	0.0042	0.0088	0.0077
Station 4	0.0053	0.0035	0.0028	0.0000	0.0001	0.0004	0.0017	0.0007
Station 9	0.0079	0.0047	0.0036	0.0000	0.0001	0.0006	0.0021	0.0012
Station 10	0.0069	0.0042	0.0033	0.0000	0.0001	0.0005	0.0020	0.0010
Station 11	0.0454	0.0345	0.0308	0.0001	0.0006	0.0024	0.0184	0.0054
Station 12	0.0065	0.0042	0.0034	0.0000	0.0001	0.0005	0.0020	0.0009

Scenario 2 Ground Level Concentration ($\mu\text{g}/\text{m}^3$)

	TSP	PM₁₀	PM_{2.5}	Arsenic	Cadmium	Copper	Lead	Zinc
Station 1	0.0233	0.0148	0.0119	0.0002	0.0005	0.0018	0.0068	0.0034
Station 5	0.0045	0.0030	0.0025	0.0000	0.0001	0.0003	0.0014	0.0006
Station 6	0.0444	0.0232	0.0162	0.0001	0.0003	0.0042	0.0085	0.0077
Station 4	0.0052	0.0034	0.0028	0.0000	0.0001	0.0004	0.0016	0.0007
Station 9	0.0077	0.0046	0.0036	0.0000	0.0001	0.0006	0.0021	0.0012
Station 10	0.0067	0.0041	0.0033	0.0000	0.0001	0.0005	0.0019	0.0010
Station 11	0.0450	0.0343	0.0308	0.0001	0.0006	0.0024	0.0182	0.0054
Station 12	0.0064	0.0041	0.0034	0.0000	0.0001	0.0005	0.0020	0.0009

Scenario 3 Ground Level Concentration ($\mu\text{g}/\text{m}^3$)

	TSP	PM₁₀	PM_{2.5}	Arsenic	Cadmium	Copper	Lead	Zinc
Station 1	0.0231	0.0147	0.0119	0.0002	0.0005	0.0018	0.0067	0.0034
Station 5	0.0044	0.0030	0.0025	0.0000	0.0001	0.0003	0.0014	0.0006
Station 6	0.0440	0.0231	0.0162	0.0001	0.0003	0.0042	0.0084	0.0076
Station 4	0.0051	0.0034	0.0028	0.0000	0.0001	0.0004	0.0016	0.0007
Station 9	0.0075	0.0046	0.0036	0.0000	0.0001	0.0006	0.0020	0.0012
Station 10	0.0065	0.0041	0.0033	0.0000	0.0001	0.0005	0.0018	0.0010
Station 11	0.0445	0.0341	0.0308	0.0001	0.0006	0.0024	0.0180	0.0054
Station 12	0.0063	0.0041	0.0034	0.0000	0.0001	0.0005	0.0019	0.0009

Scenario 4 Ground Level Concentration ($\mu\text{g}/\text{m}^3$)

	TSP	PM₁₀	PM_{2.5}	Arsenic	Cadmium	Copper	Lead	Zinc
Station 1	0.0234	0.0148	0.0119	0.0002	0.0005	0.0018	0.0068	0.0034
Station 5	0.0046	0.0030	0.0025	0.0000	0.0001	0.0003	0.0015	0.0006
Station 6	0.0446	0.0233	0.0162	0.0001	0.0003	0.0042	0.0087	0.0077
Station 4	0.0053	0.0035	0.0028	0.0000	0.0001	0.0004	0.0017	0.0007
Station 9	0.0079	0.0047	0.0036	0.0000	0.0001	0.0006	0.0021	0.0012

Station 10	0.0068	0.0042	0.0033	0.0000	0.0001	0.0005	0.0020	0.0010
Station 11	0.0455	0.0345	0.0308	0.0001	0.0006	0.0024	0.0185	0.0054
Station 12	0.0065	0.0042	0.0034	0.0000	0.0001	0.0005	0.0020	0.0009

Scenario 5 Ground Level Concentration ($\mu\text{g}/\text{m}^3$)

	TSP	PM ₁₀	PM _{2.5}	Arsenic	Cadmium	Copper	Lead	Zinc
Station 1	0.0215	0.0129	0.0101	0.0001	0.0004	0.0017	0.0057	0.0033
Station 5	0.0041	0.0026	0.0021	0.0000	0.0001	0.0003	0.0012	0.0006
Station 6	0.0430	0.0216	0.0144	0.0001	0.0003	0.0042	0.0077	0.0076
Station 4	0.0048	0.0030	0.0024	0.0000	0.0001	0.0004	0.0014	0.0007
Station 9	0.0074	0.0042	0.0031	0.0000	0.0001	0.0006	0.0018	0.0012
Station 10	0.0064	0.0037	0.0028	0.0000	0.0001	0.0005	0.0017	0.0010
Station 11	0.0398	0.0289	0.0251	0.0001	0.0005	0.0023	0.0151	0.0050
Station 12	0.0059	0.0036	0.0028	0.0000	0.0001	0.0004	0.0017	0.0009

Scenario 6 Ground Level Concentration ($\mu\text{g}/\text{m}^3$)

	TSP	PM ₁₀	PM _{2.5}	Arsenic	Cadmium	Copper	Lead	Zinc
Station 1	0.0220	0.0131	0.0101	0.0001	0.0004	0.0017	0.0058	0.0033
Station 5	0.0042	0.0026	0.0021	0.0000	0.0001	0.0003	0.0012	0.0006
Station 6	0.0436	0.0218	0.0145	0.0001	0.0003	0.0042	0.0078	0.0076
Station 4	0.0049	0.0030	0.0024	0.0000	0.0001	0.0004	0.0014	0.0007
Station 9	0.0075	0.0042	0.0031	0.0000	0.0001	0.0006	0.0018	0.0012
Station 10	0.0066	0.0038	0.0028	0.0000	0.0001	0.0005	0.0017	0.0010
Station 11	0.0401	0.0289	0.0252	0.0001	0.0005	0.0023	0.0151	0.0050
Station 12	0.0064	0.0038	0.0029	0.0000	0.0001	0.0004	0.0018	0.0009

Appendix 5 – Monitoring Stations used in the modelling

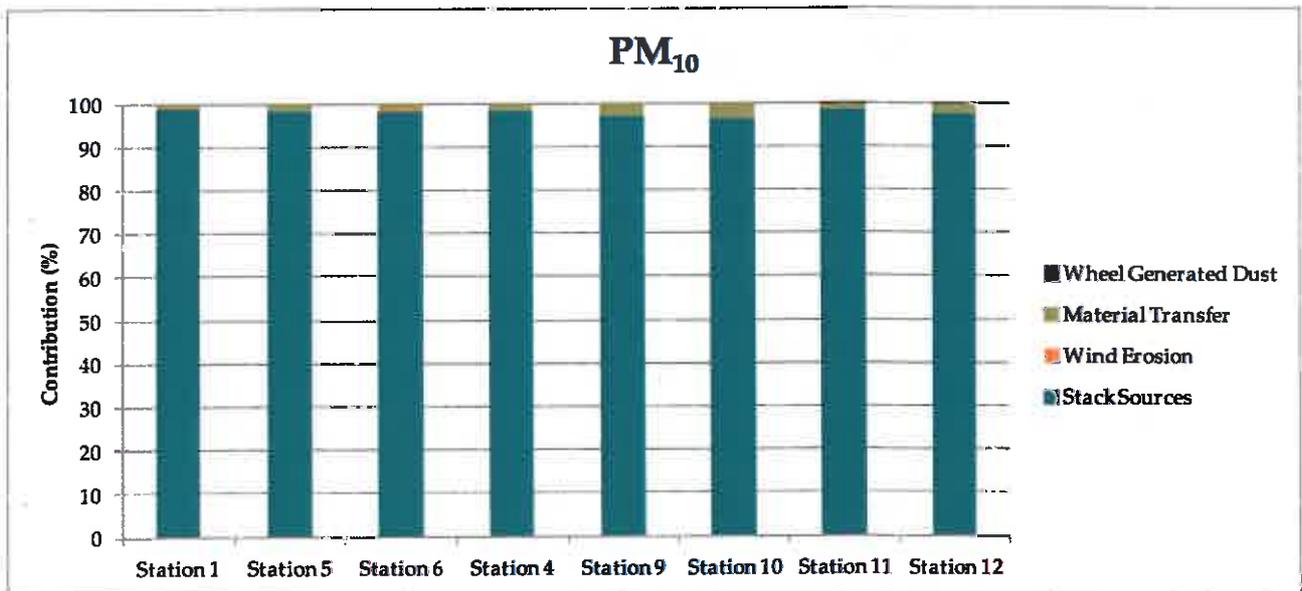
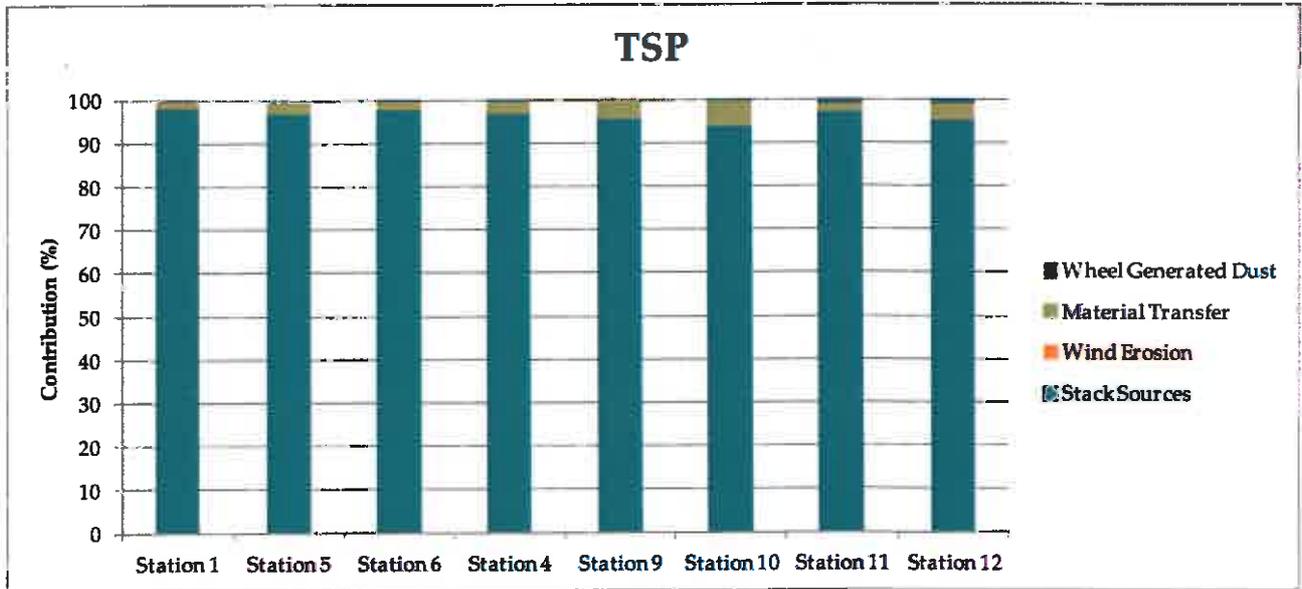


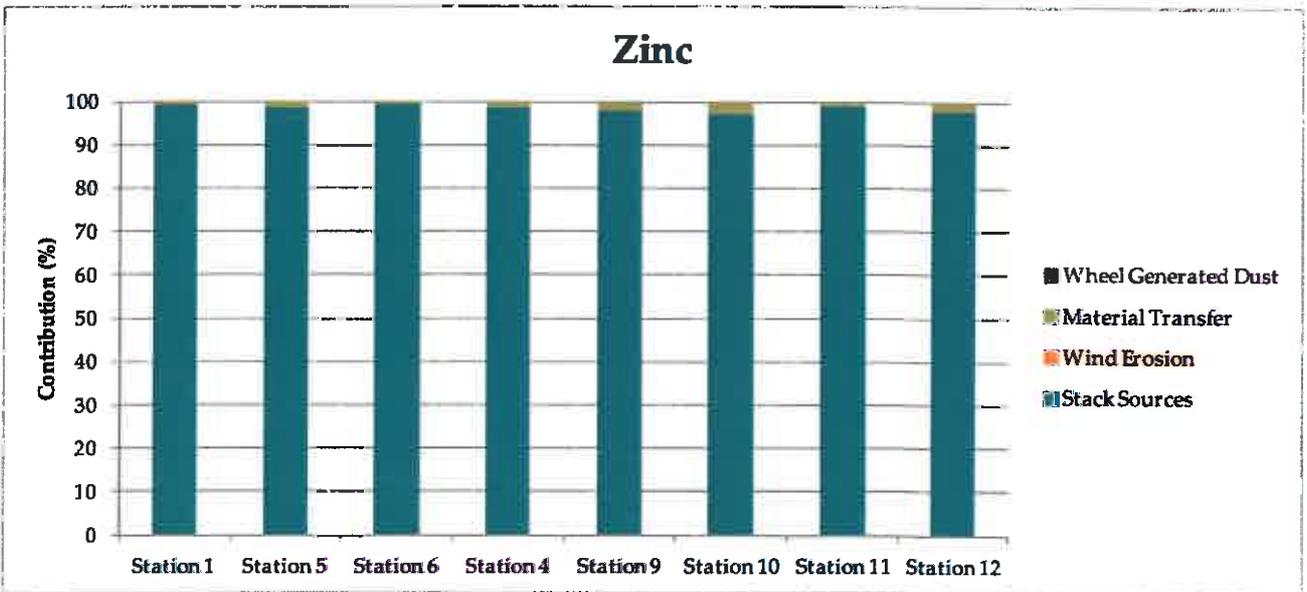
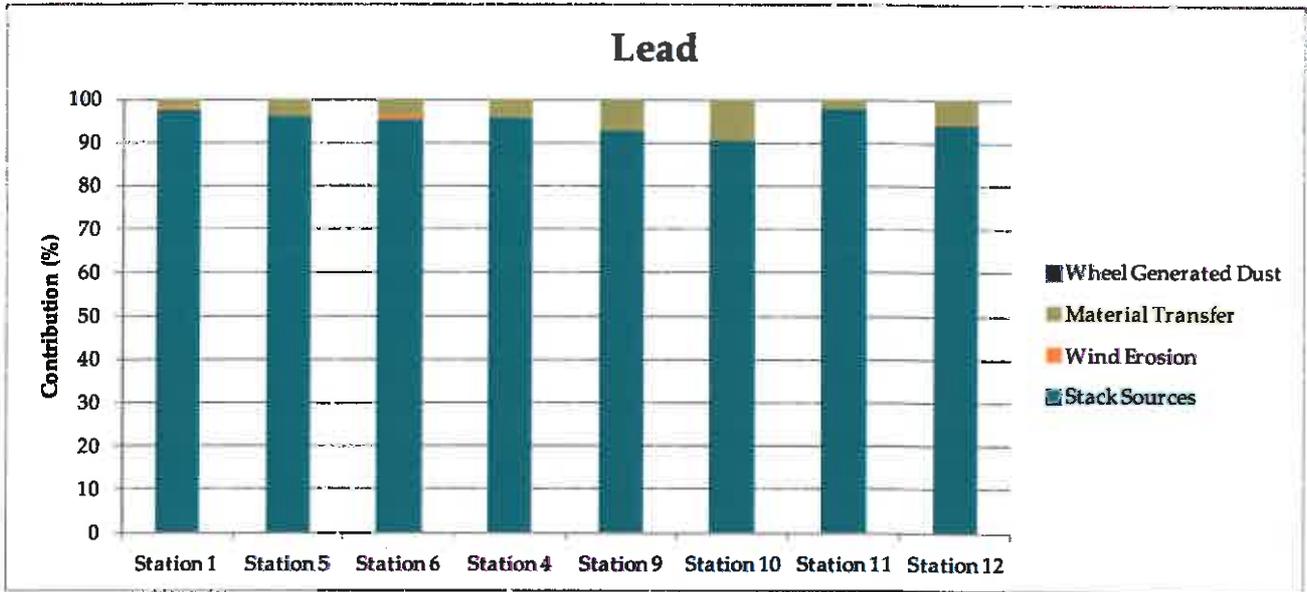
Figure 10: The air quality monitoring stations in the Mount Isa community that were utilised in the modeling results are displayed in this Figure. Station 12 is not included in this Figure, as it is located 26 kilometres north west of Mount Isa, at the May Downs

Appendix 6 – Source Contributions

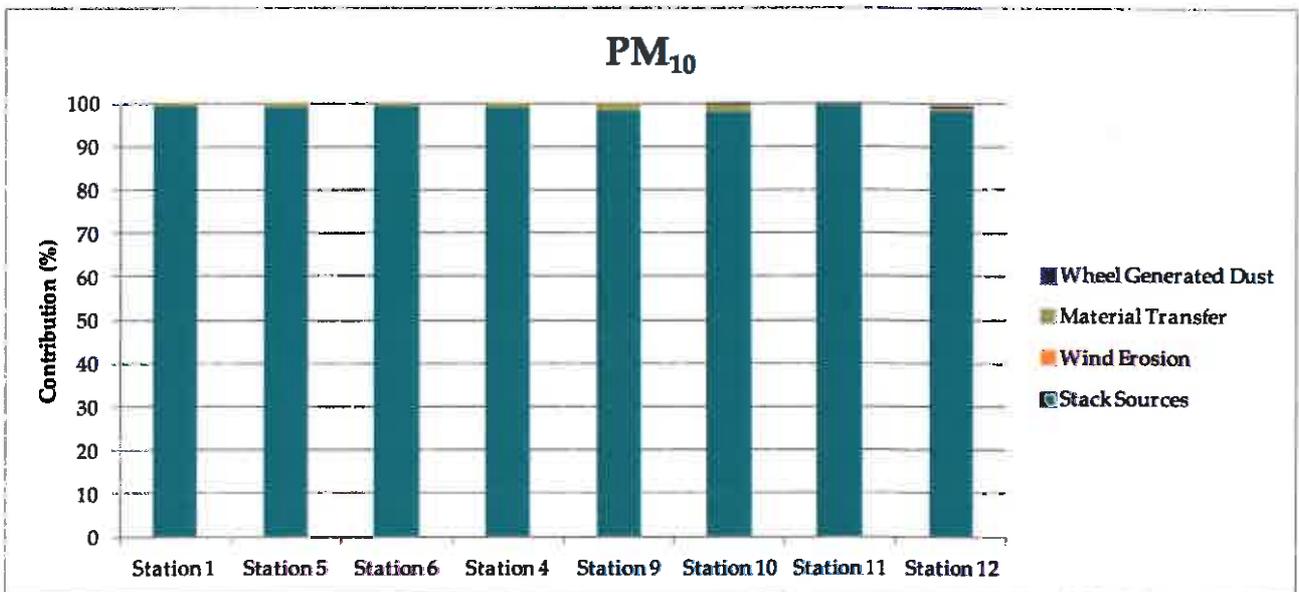
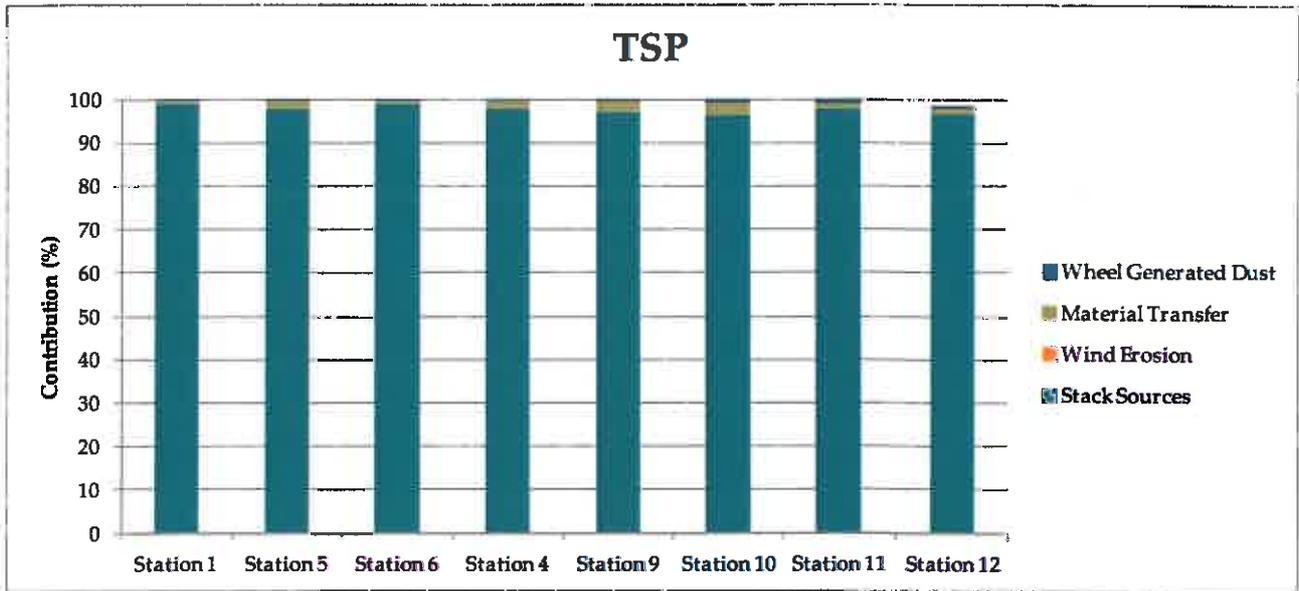
The figures below show that the stack sources are the main contributors to ground level concentrations at the monitoring locations.

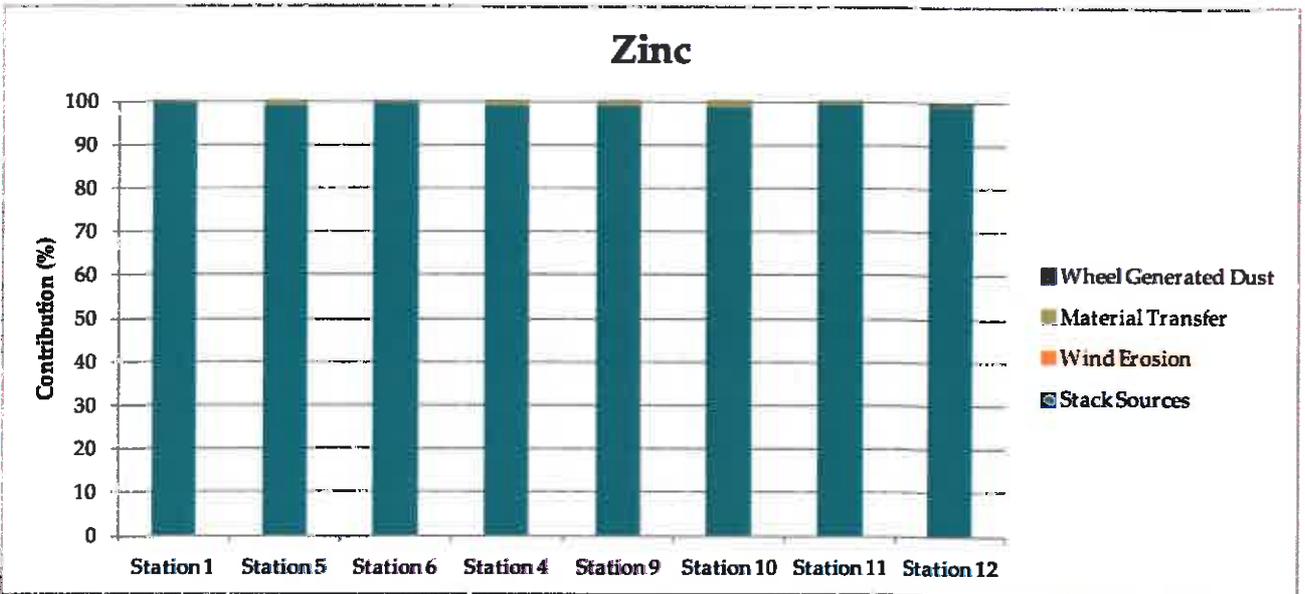
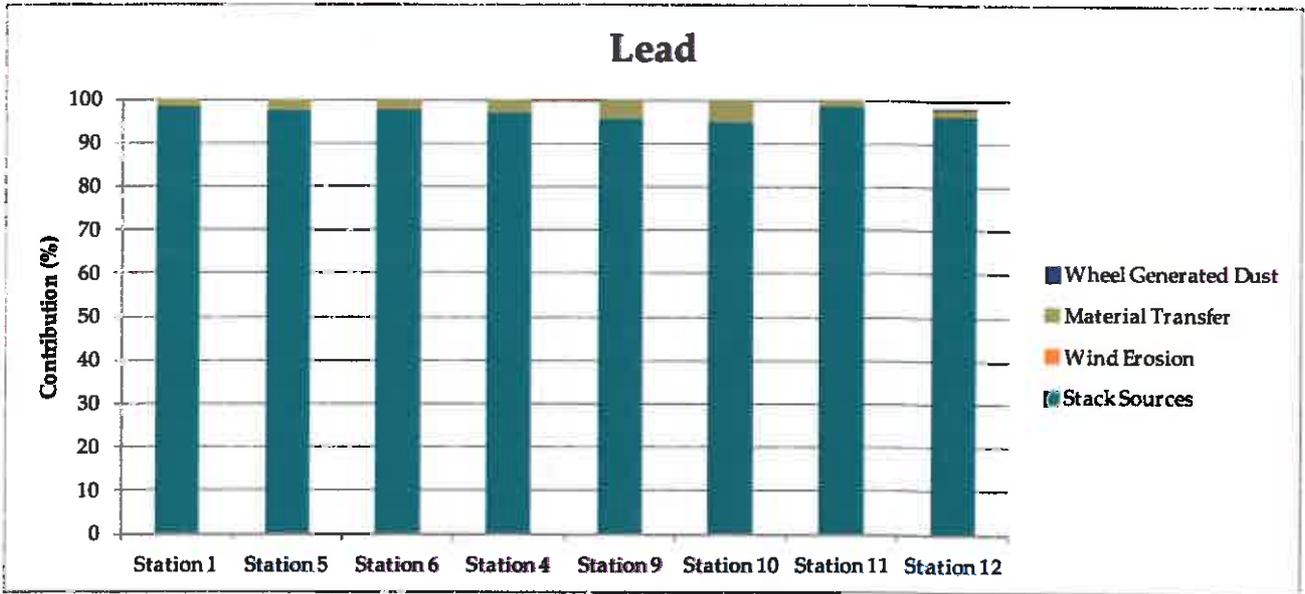
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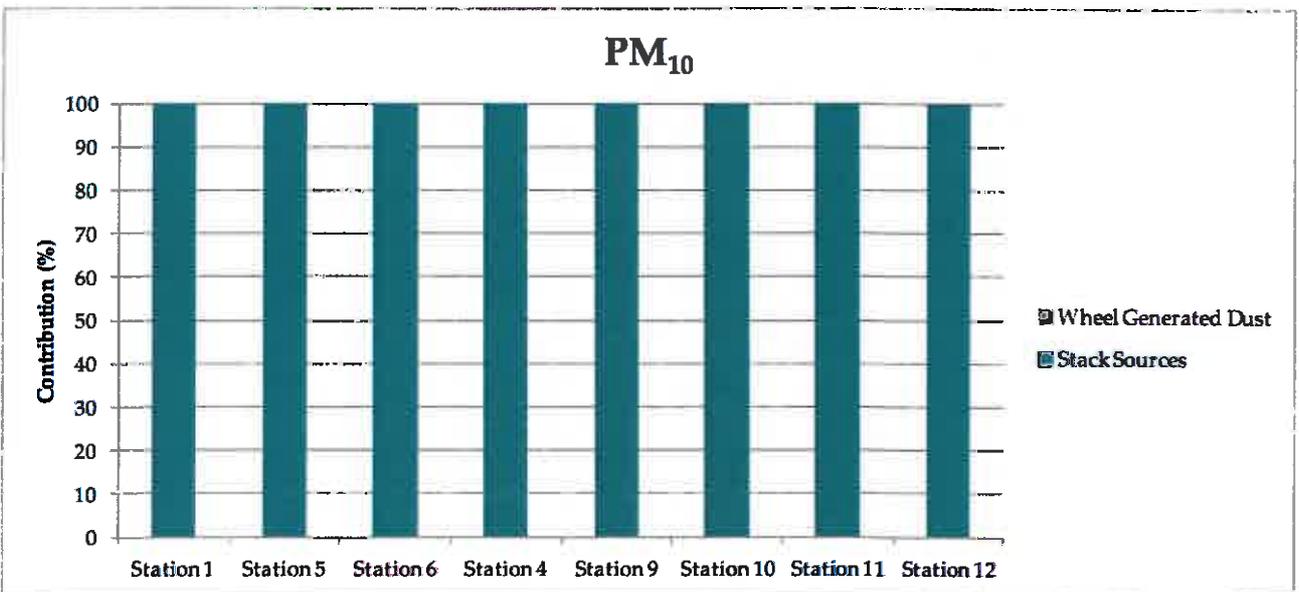
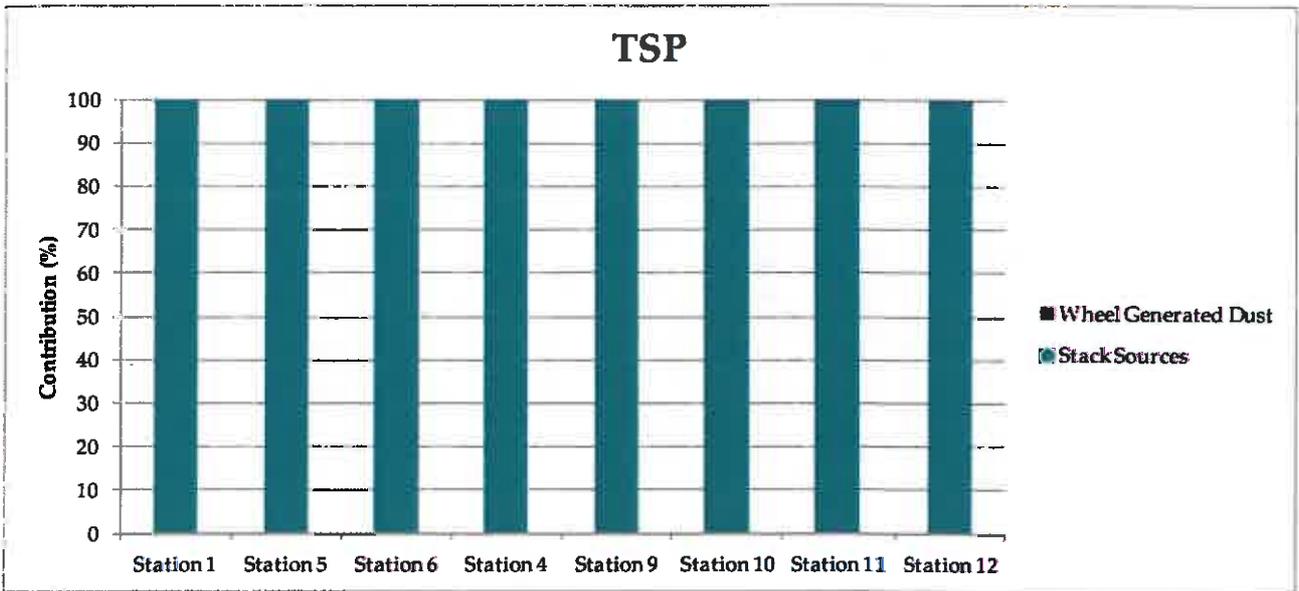


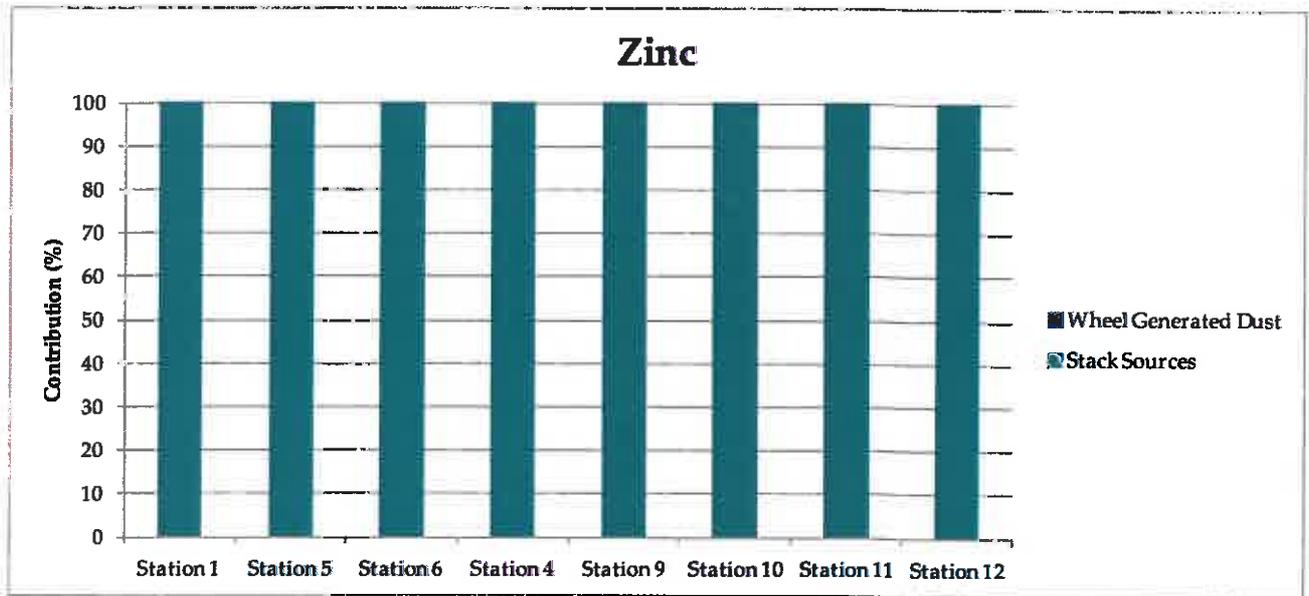
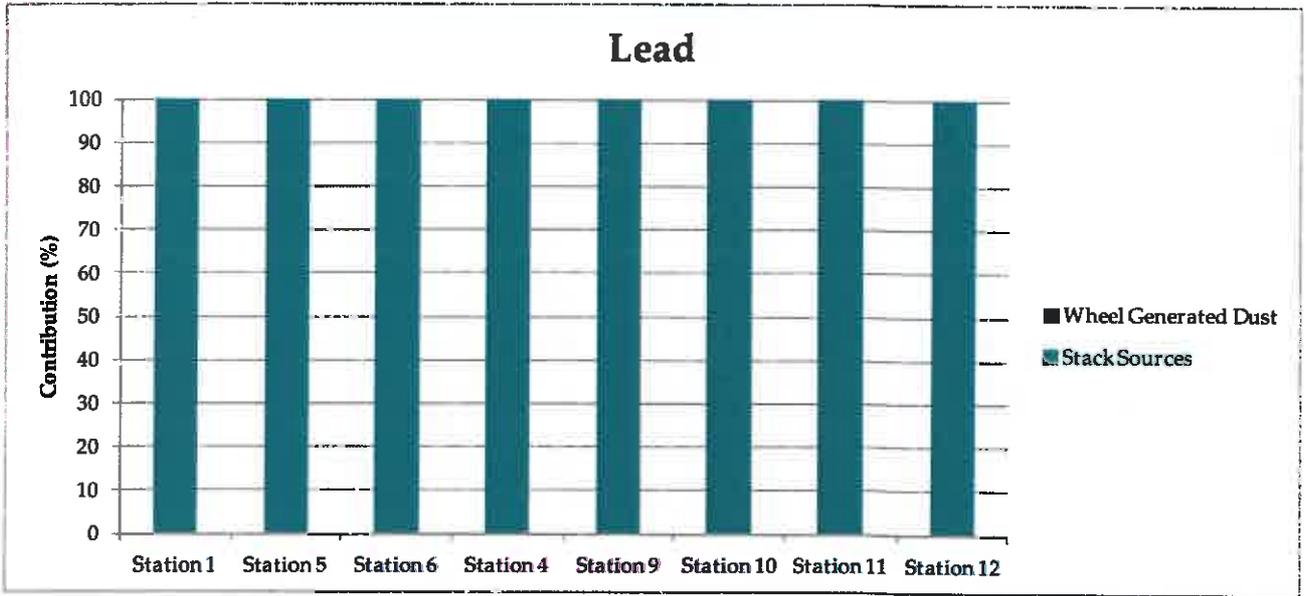
Scenario 2 Source Contributions



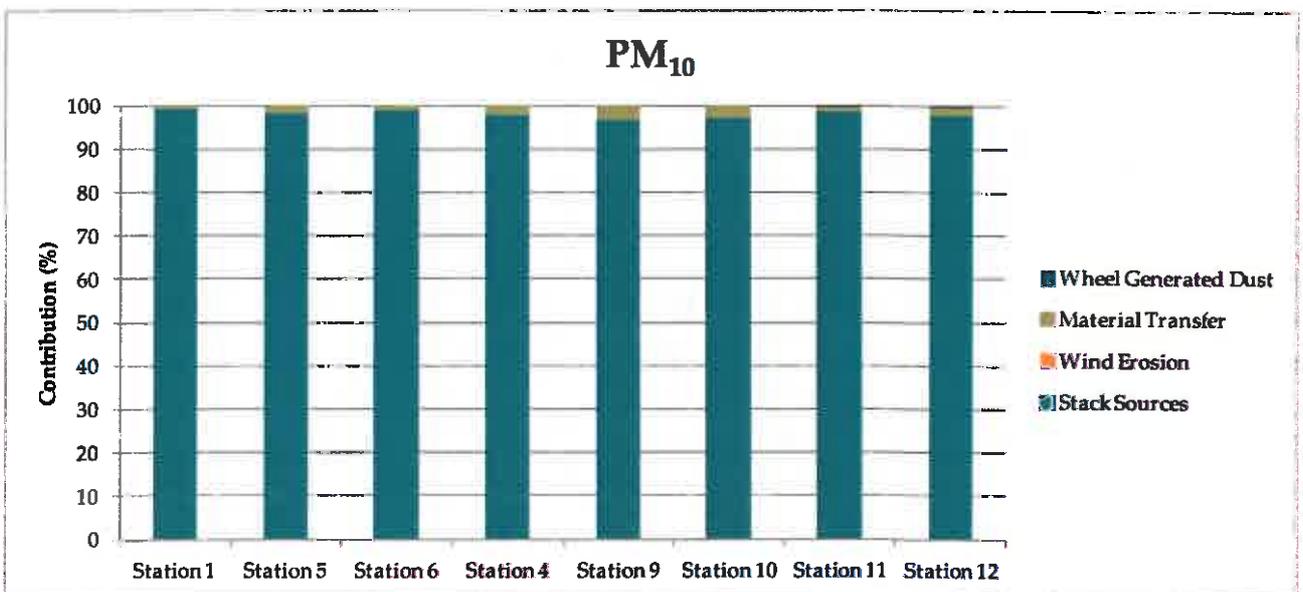
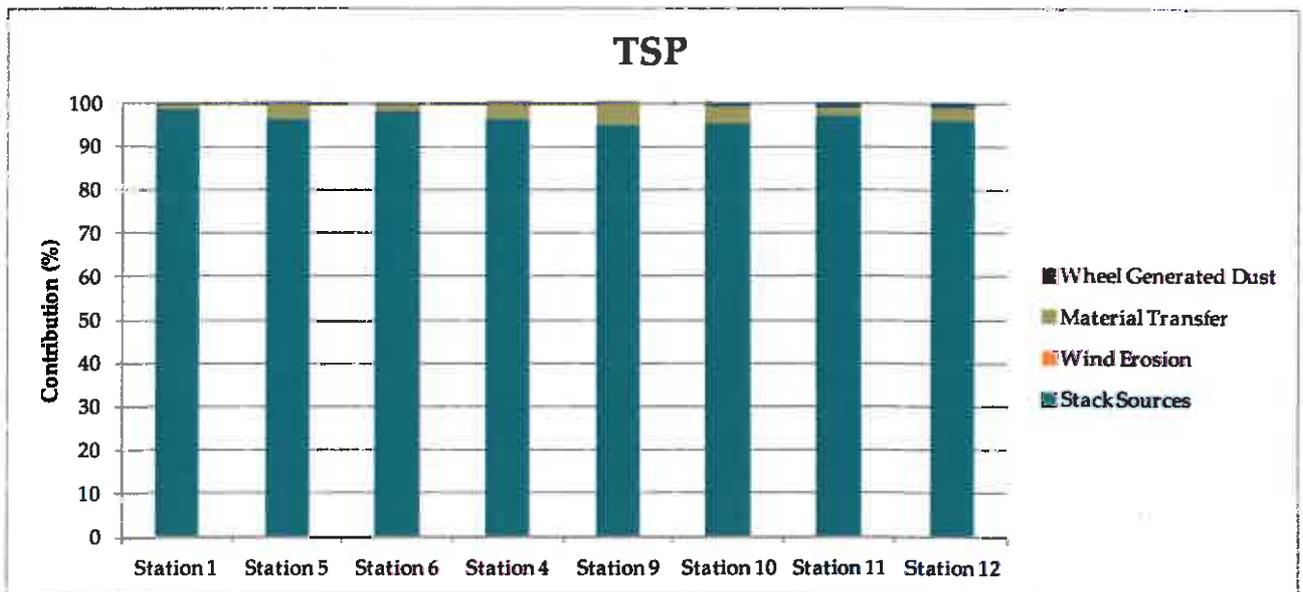


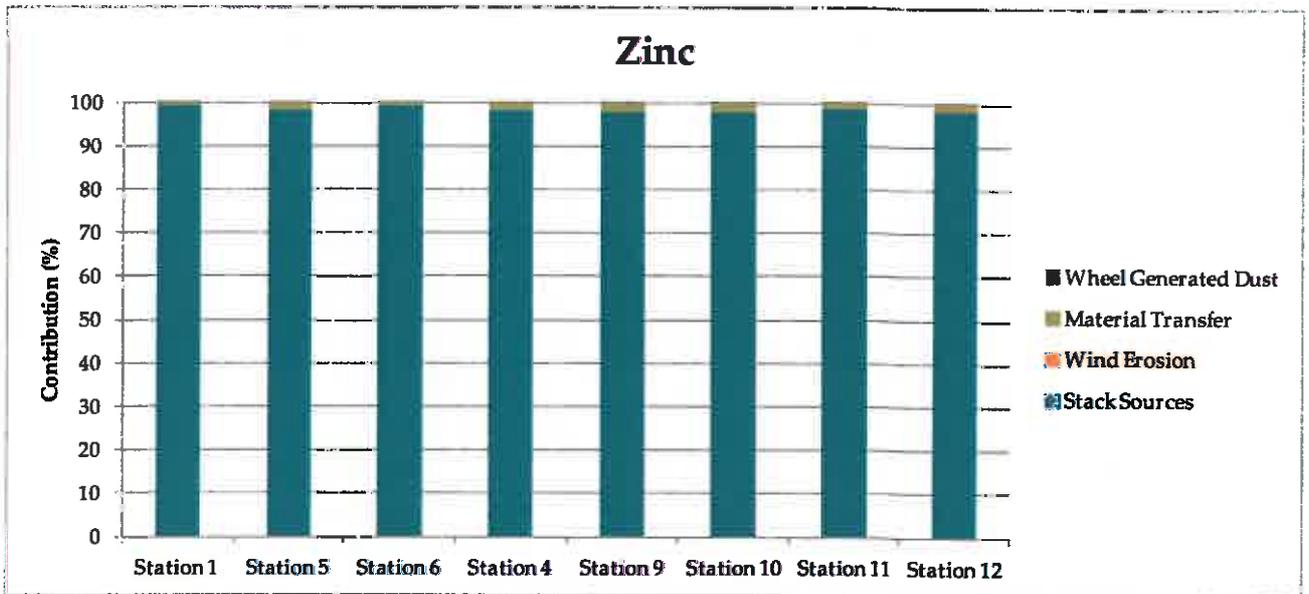
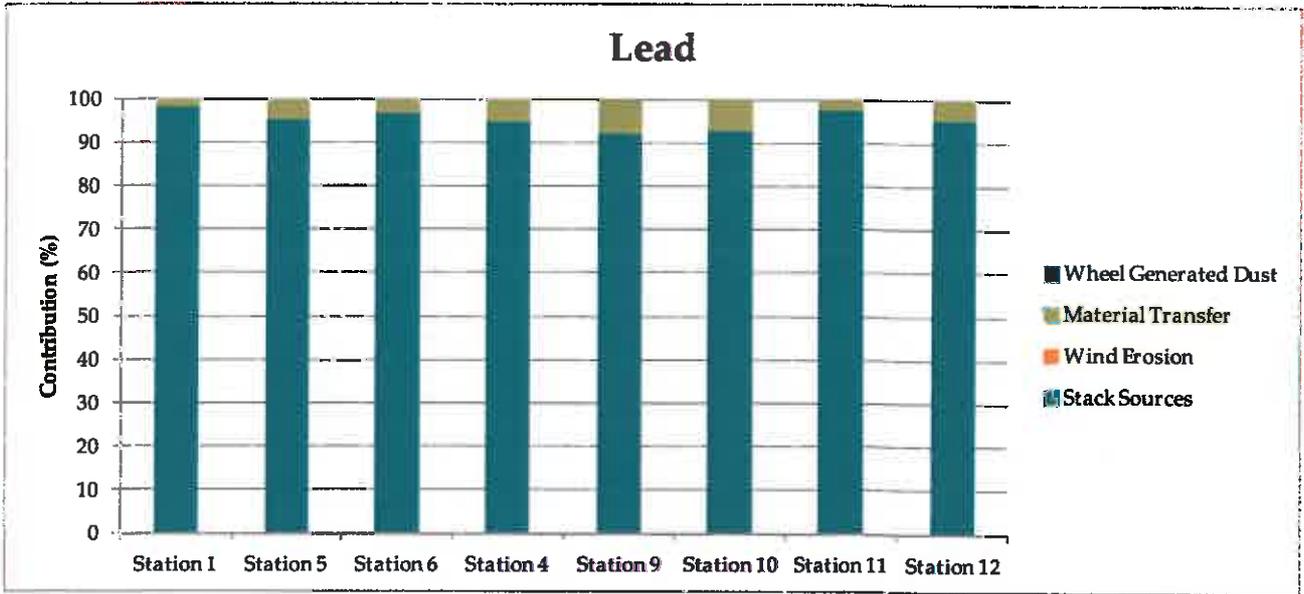
Scenario 3 Source Contributions



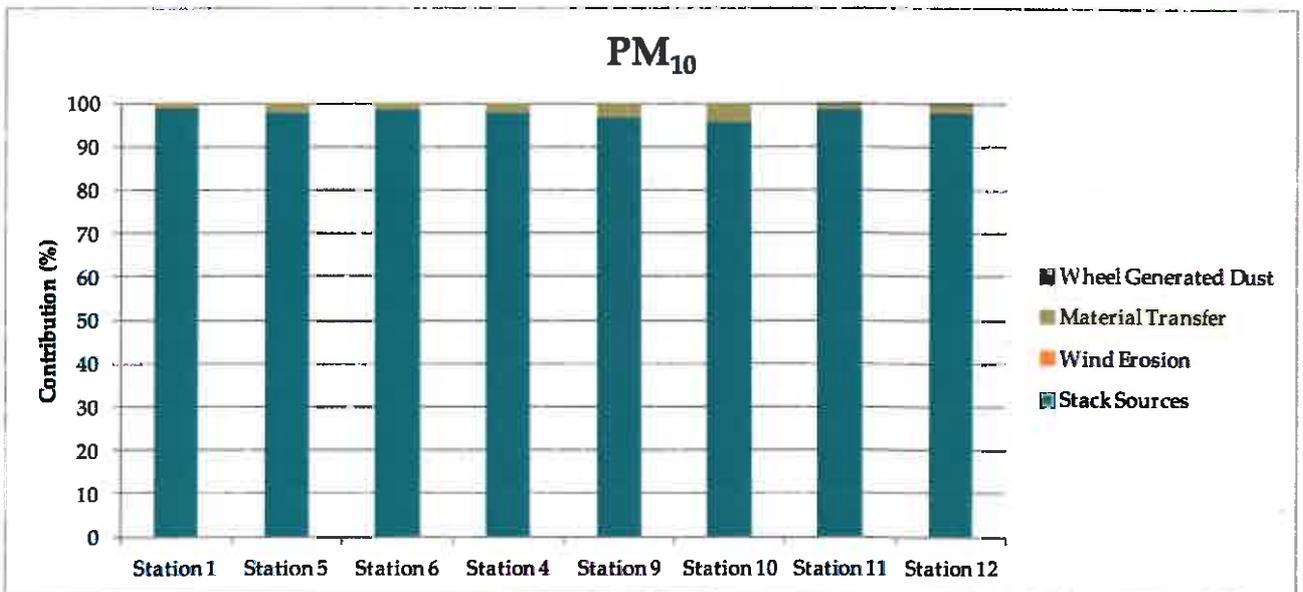
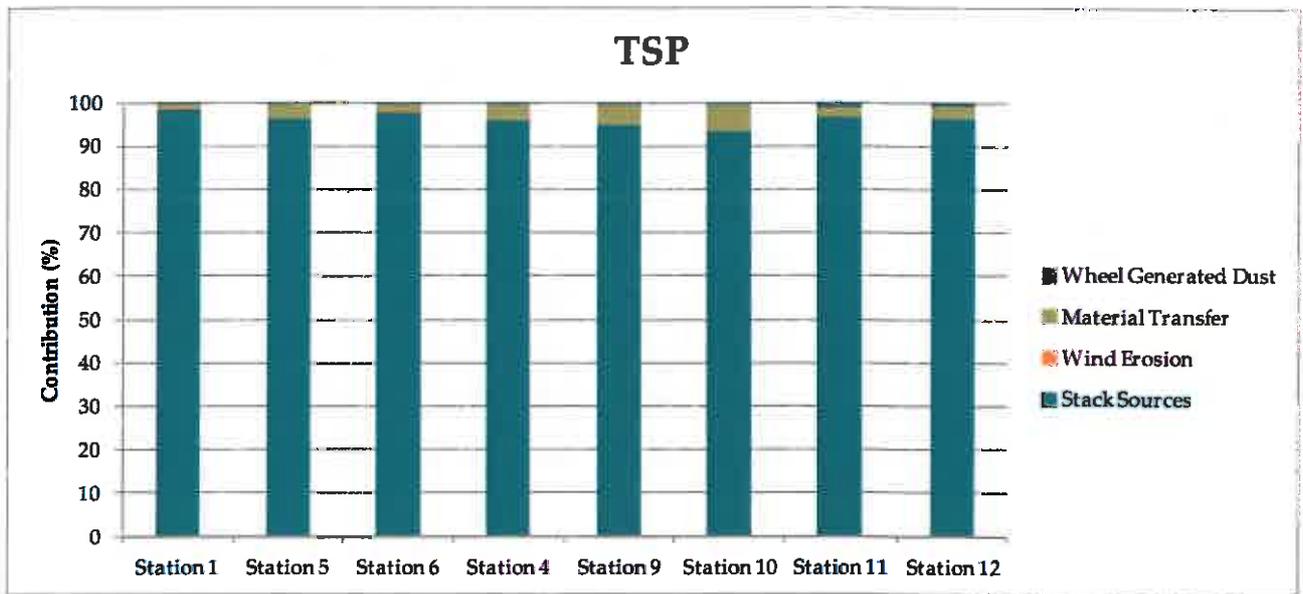


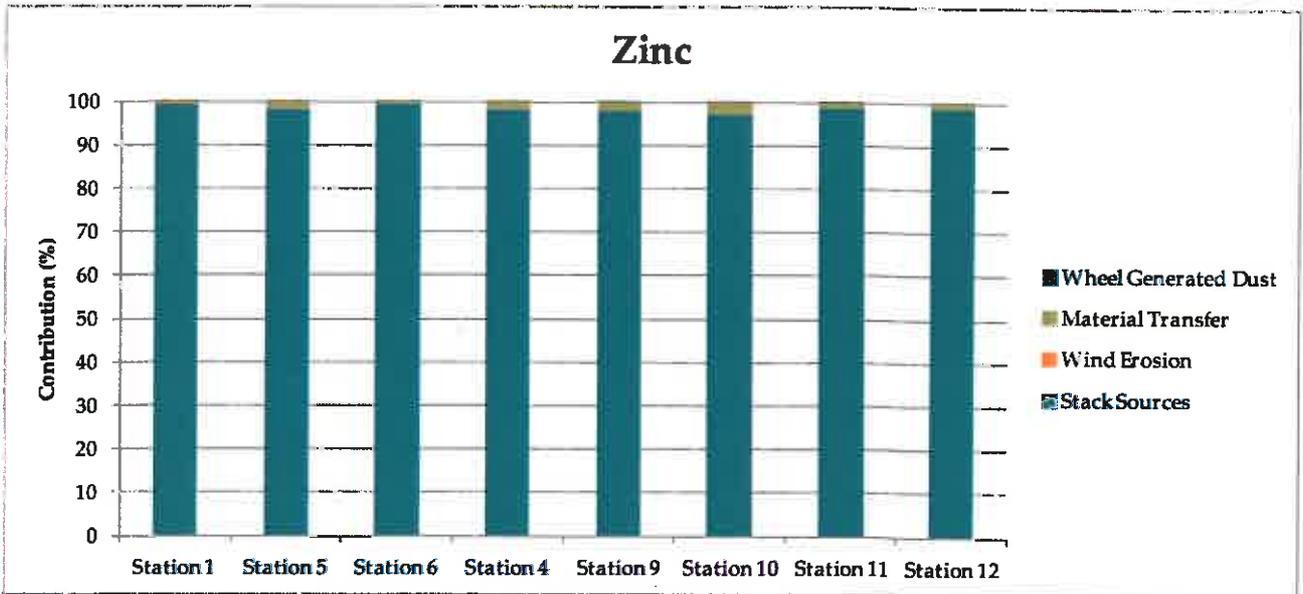
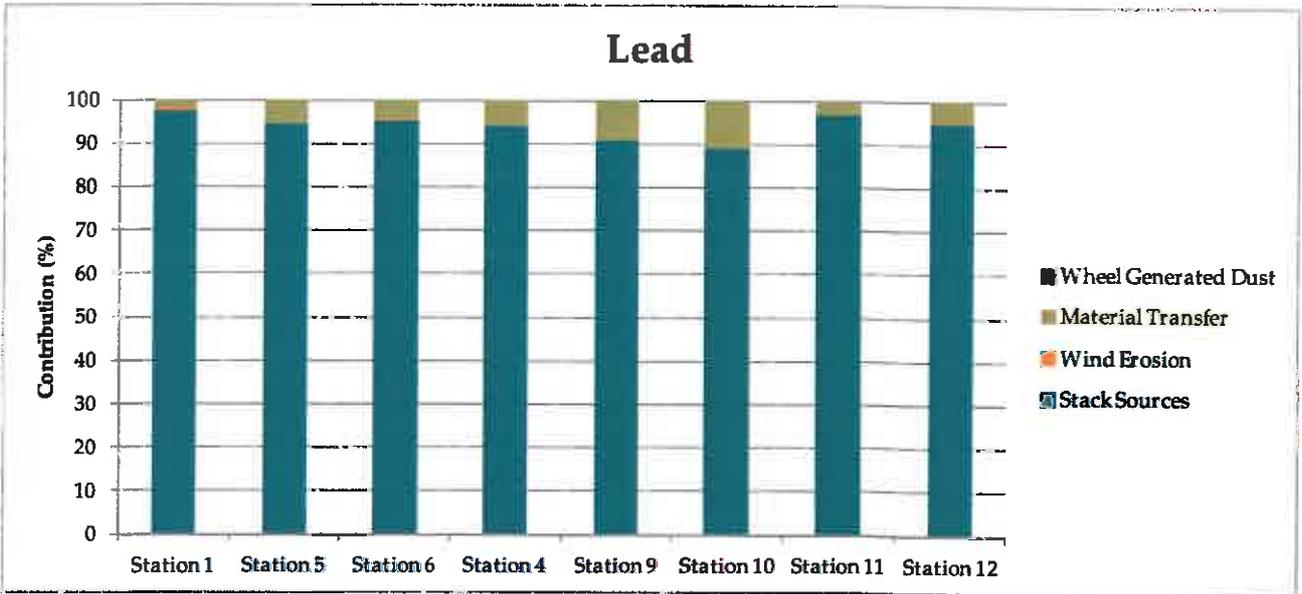
Scenario 4 Source Contributions



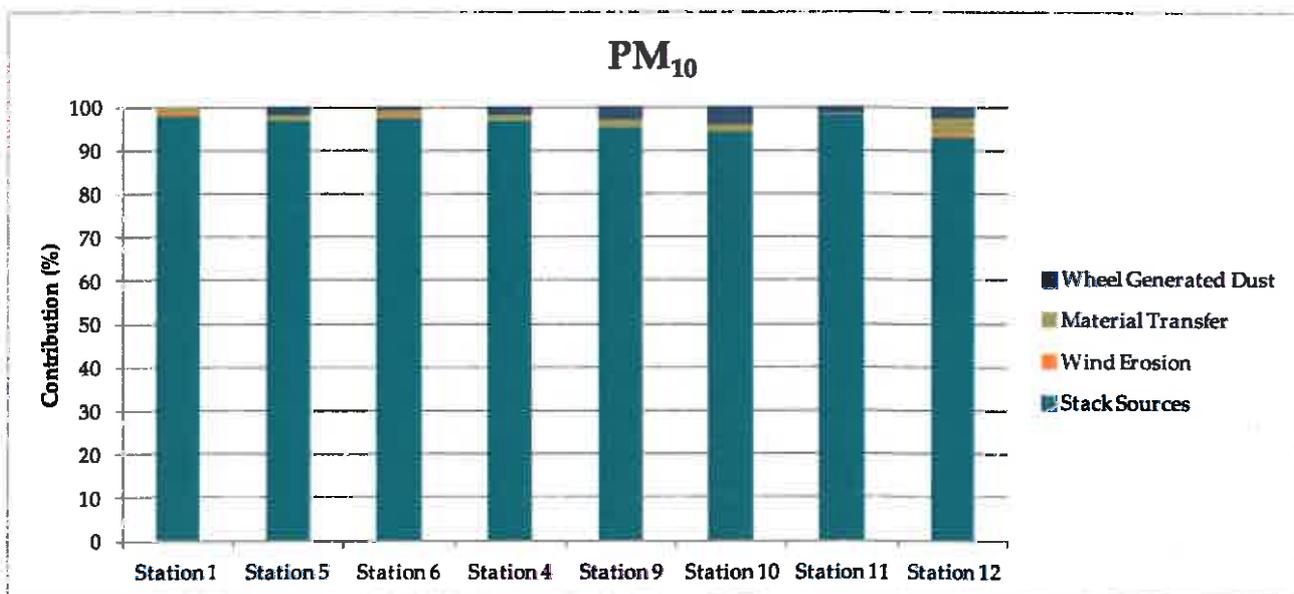
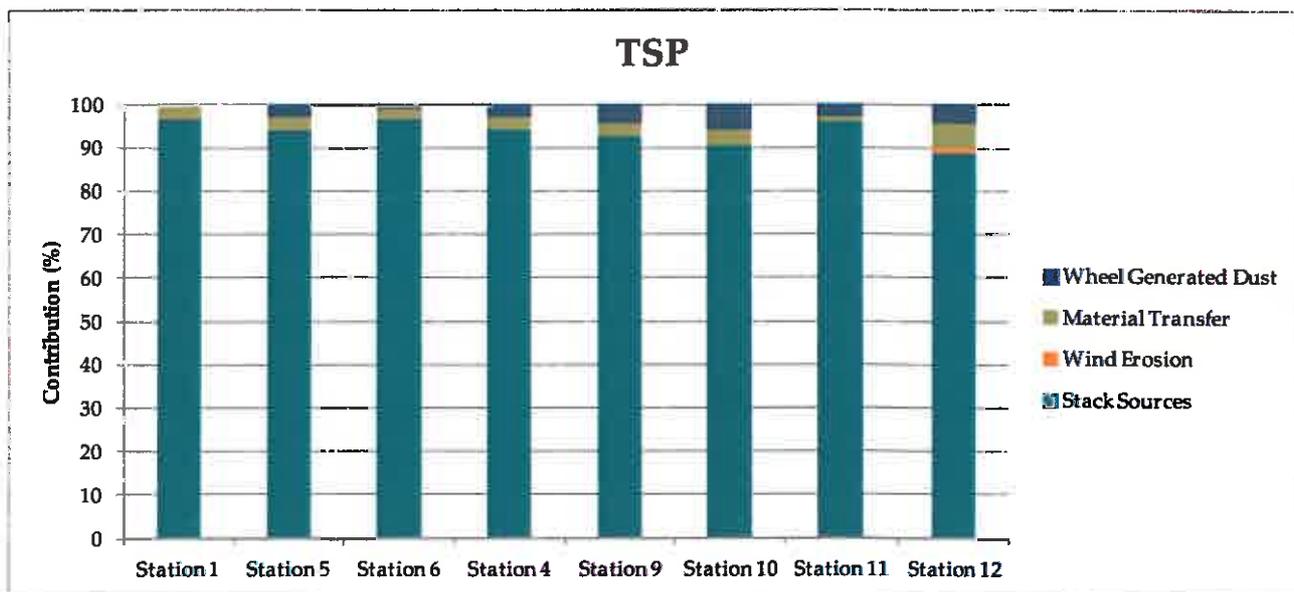


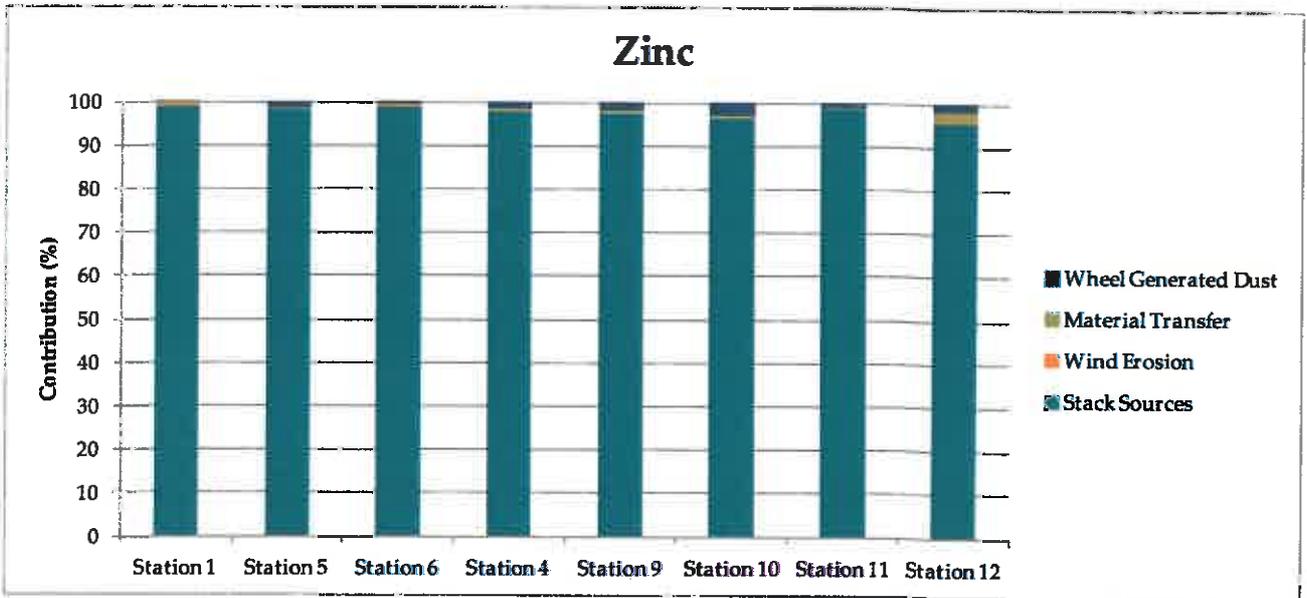
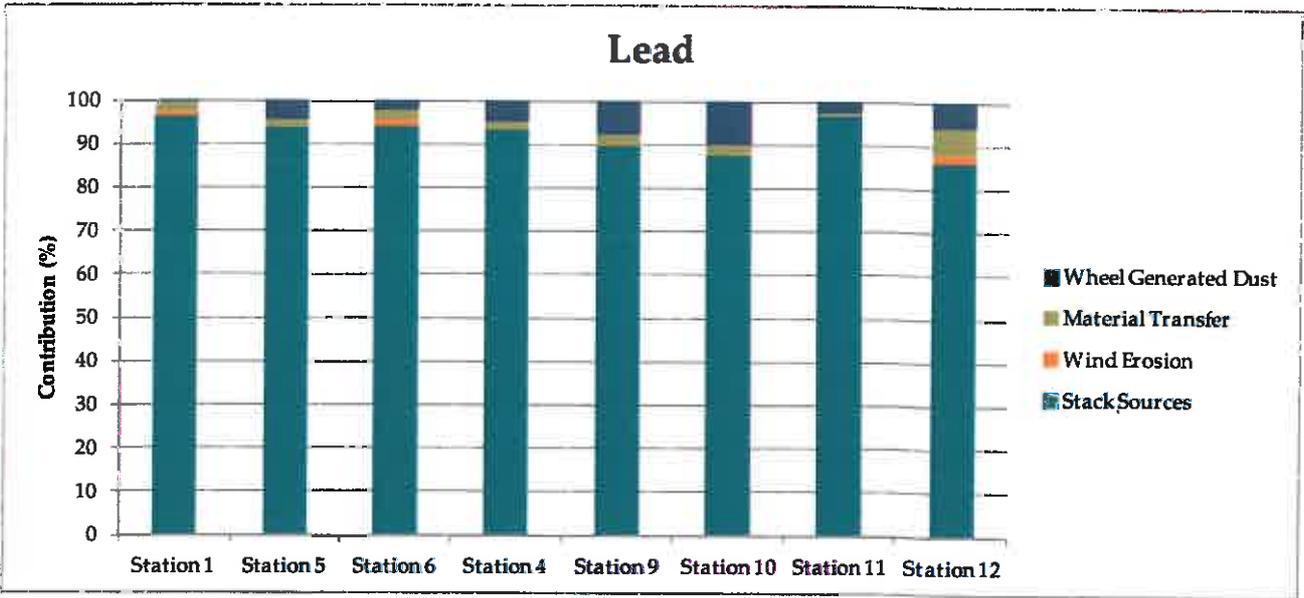
Scenario 5 Source Contributions





Scenario 6 Source Contributions





Appendix 7 – Note on Mass Emission Rates and Impacts

MIM has previously raised concerns regarding the application of limits referenced against standard conditions, namely air quality metrics expressed as mass per unit volume (at 25°C and 101.325kPa).

The method is clearly accepted by convention, and no alternate regulatory method exists, however, the metric fails in an important aspect pertaining to the “normalisation” of results from different locations as a measure of environmental impact. Mount Isa is located at an elevation of approximately 300m, meaning that a volumetric correction for atmospheric pressure from local ambient to standard is greater than at sea-level. The difference is ~10% of a reported contaminant load.

Consequently, for a given mass emission of material and under consistent wind conditions, emissions from Mount Isa will be reported at a higher material load than the equivalent emitted in George Street in Brisbane, despite the material loads being equivalent at the ambient conditions that the local environments are exposed to. The implication is that the difference between compliance and non-compliance may be attributable to location only, with the identical environmental impact.

In effect, this disadvantages operations that operate uphill of the Queensland coastline, as tighter mass emission controls are required for compliance with the standardised metric. Focus on mass emission rates as an assessment measure, especially on metrics that are compliant against the standard atmosphere, is therefore being applied inconsistently across locations.

MIM asserts that assessment of air quality impacts should be based on expected loads at ambient conditions, however to avoid issue in this instance, MIM has targeted reduced mass emissions and reduced local impacts.