



# **HEALTH, HYGIENE AND ENVIRONMENTAL MANAGEMENT PROGRAM**

## **MAGELLAN LEAD PROJECT**

August 2004

Revised September 2007

# Magellan Metals Pty Ltd – Lead Carbonate Project

## Health, Hygiene, and Environmental Management Program

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# **1 INTRODUCTION:**

This document presents the Health Hygiene and Environmental Management Program (HHEMP) for Magellan Metals Pty Ltd (Magellan) for the Magellan Lead Carbonate Project in Western Australia.

The project utilises open cut mining methods to access a shallow lead-carbonate resource, the ore is concentrated via flotation and the final lead concentrate is shipped to overseas customers. The mining waste stream comprises waste rock disposed into a rock dump and the concentrator stream generates in gangue residues discharged into and retained by a standard paddock-style tailings storage facility (TSF).

Commonwealth and State legislation through conditions on mining tenements and licences issued from the Environmental Protection Authority (EPA), Department of Environment and Conservation (DEC), Department of Industry & Resources (DoIR) and Department of Water (DOW – part of DEC) will regulate the Magellan HHEMP practices.

Given the nature of the lead mineralisation at Magellan, the occupational health issues associated with lead minerals are managed in conjunction with best practice. The objective of the HHEMP is to:

- Provide an operating strategy that minimises the potential for contamination of the environment and therefore protect the general community from deleterious health effects;
- Provide an operating strategy that effectively manages the health and safety of both employees and the general community;
- Provide a record of baseline conditions of the biophysical and social environments, against which any changes arising from the activities of the Magellan Project can subsequently be compared, and
- Outline environmental management programs that describe how operations are managed in order to maintain appropriate environmental standards.

An annual review of this document is undertaken as part of the operations continual improvement process and is a key component of the Magellan Management System.

## **1.1 Project Location**

The Magellan Mine is located 30 km west of Wiluna and 2 km north of the Wiluna-Meekatharra Road (Figure 1) in the north-eastern Goldfields of Western Australia (WA). The primary ore body is located at latitude 26° 31'S and longitude 119° 57'E on the Glengarry (SG50-12 – 1:250,000) and Merewether (2844 – 1:100,000) sheets. The Magellan Mine is located approximately 900 km northeast of Perth.

## **1.2 Project Schedule**

The project has the following schedule:

Project approval by Minister for the Environment	1 November 1999
Commencement of construction	1 June 2004
Commissioning of the project	1 December 2004
Commencement of concentrate export	2 April 2005
Anticipated closure of the project	>2015

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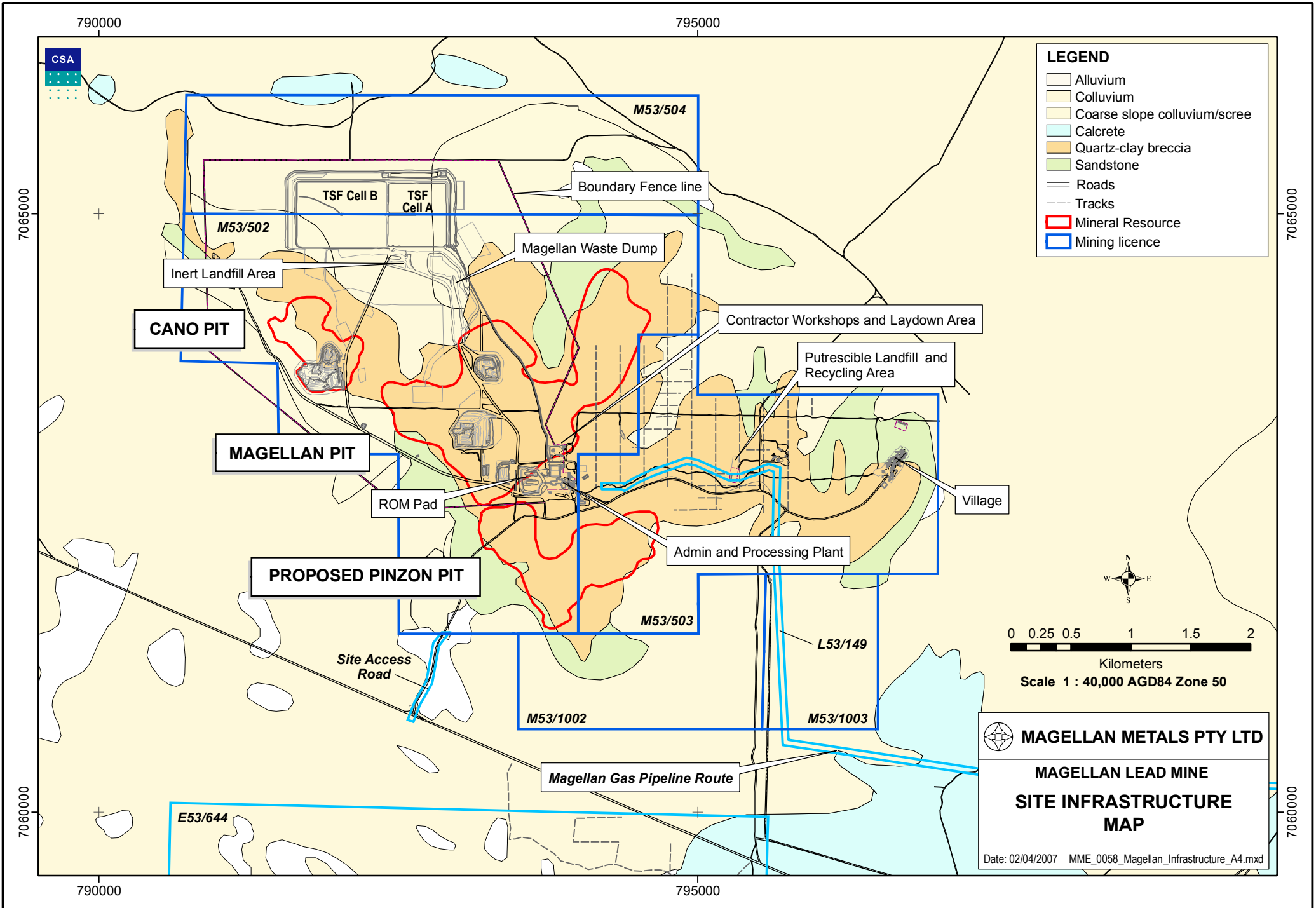
### 1.3 Project Parameters

The key elements of the project are:

Element	Quantities/Description
Life of the project (mine production)	Approximately 10 years
Size of ore body	Approximately 8.2 million tonnes
Depth of mine pit	Approximately 50 metres
Area of disturbance (including access)	Approximately 320 hectares
List of major components: <ul style="list-style-type: none"><li>• Open pit</li><li>• Waste dumps</li><li>• Infrastructure (plant site water supply, roads, accommodation camp, etc)</li><li>• Tailings storage facilities</li></ul> TOTAL	55 hectares 138 hectares  57 hectares 70 hectares 320 hectares
Tailings storage facility (2 cells)	Combined total capacity of 4 million tonnes
Ore mining rate (maximum)	1 million tonnes per year
Solid waste materials (maximum)	2.4 million tonnes per year
Water supply: <ul style="list-style-type: none"><li>• Source</li><li>• Maximum hourly requirement</li><li>• Maximum annual requirement</li></ul>	Calcrete and chert aquifers southeast of the mine site 170 kilolitres per hour 1.5 million kilolitres per annum
Lead concentrate transport	Road to Leonora and then rail to the Port of Fremantle in sealed bulk bags within bolt-secured steel shipping containers.
Power generation	Natural gas – up to 139 terrajoules/annum
Fuel storage: <ul style="list-style-type: none"><li>• Capacity</li><li>• Quantity used</li></ul>	50 kilolitres of storage 1.8 million litres per year (approximately)


### 1.4 Project Layout


The project layout (general arrangement) for the Magellan site is shown in Figure 1.



**LEGEND**

- Alluvium
- Colluvium
- Coarse slope colluvium/scree
- Calcrete
- Quartz-clay breccia
- Sandstone
- Roads
- Tracks
- Mineral Resource
- Mining licence

  
 0 0.25 0.5 1 1.5 2  
 Kilometers  
 Scale 1 : 40,000 AGD84 Zone 50


**MAGELLAN METALS PTY LTD**  
**MAGELLAN LEAD MINE**  
**SITE INFRASTRUCTURE**  
**MAP**  
 Date: 02/04/2007 MME\_0058\_Magellan\_Infrastructure\_A4.mxd

## **1.5 Mining Program**

### **1.5.1 Mine Design**

The ongoing development of the project's mining strategy is dynamic, however the operation's current pits (Cano and Magellan) will continue to be mined concurrently during the early phases of development. It remains the intention of Magellan to back-fill mining areas where possible with low grade waste as referenced in the Non Substantial Change detailed in July 2003, however the sequencing will be changed to reflect mining strategies as they evolve (proposal referred to Non Substantial Change, July 2003 – DEC).

Based on current resource evaluation, mining of the relatively flat-lying ore bodies is by open-cut methods to a final depth of approximately 50 m. The overall waste to ore ratio is 3.7:1. Based on an average processing rate of 1.7 Mt per annum (tpa), total rock movement of 64 M tonnes over the deposit life is anticipated.

### **1.5.2 Mining Operations**

Open-pit mining operations using drill and blast techniques to loosen the near surface siliceous hard cap are used to mine both Magellan and Cano. The main ore zones are soft and unconsolidated and 30% free dig is commonly achieved. The pits are being mined in stages; with the final pit shape determined by changing economic and operational parameters. A conservative approach to pit design and waste dump design has been adopted.

Ore and waste rock is loaded by hydraulic shovel and loaded into off-road haul trucks and removed to the run-of-mine (ROM) pad or the waste rock dump respectively. The ROM pad has been constructed with low grade ore material and is designed to minimise wind fetch and reduce dust generation. It is planned that the ROM pad (low grade ore) to be milled at the close of operations at Magellan Mine.

### **1.5.3 Waste Rock Disposal**

Waste rock totalling approximately 50 Mt over the life of mine will be removed by haul truck and retained in a waste dump located to the west of the open pits and to the south of the TSF. Both the waste rock dump and the TSF are located north of the site and within a small, poorly defined sub-catchment. The final disturbed area for the operations waste dump footprint is expected to be approximately 102 ha.

As the waste material contains small amounts of lead mineralisation, waste disposal has been scheduled so that higher-grade waste is contained within the dump by adopting a horseshoe-shaped dump with barren waste forming the outer rim (cover) and the mineralised waste in the core. As strip mining of the resource is undertaken, there is the opportunity to backfill part of the open pit with mineralised waste.

Waste is classified as "barren" (< 0.5%Pb), "mineralised waste" (<1.5%Pb) or "low grade" (< 2.5%Pb). Current mine schedules indicate that, due to the proposed in-pit disposal of low grade waste, there will be sufficient barren material for closure purposes. The quantities will be reviewed internally as part of the bi-annual review process.

Test work has shown that it is unlikely that any lead will be mobilised (Campbell & Associates 1999a, 1999b). In the event that some lead does leach from mineralised waste it will be readily adsorbed within the underlying soil strata. Rainfall runoff is diverted via drains to be collected at the toe (northern end) of the TSF and returned to the process water dam, or to an environmental control pond located to the north-east of the plant. The final top surface of the waste dump is anticipated to be level with or slightly above the natural crest height of the ridge, but should not be visible from the Wiluna-Meekatharra Road.

Magellan is preparing a Decommissioning and Rehabilitation Plan as per the requirements of Section 7, Ministerial Statement 559. The plan is separated into two key reports, including:

- Landform design – Waste dump and tailing storage facility.
- Sustainability – Mine Closure.

## **1.6 Processing**

### **1.6.1 Ore Storage**

Ore is delivered to the ROM pad where it is stockpiled according to a predetermined strategy designed to maximise blending. Surface stockpiles are maintained to a minimum to avoid the risk of dust mobilisation.

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### 1.6.2 Comminution & Classification

Ore is fed through a grizzly into the crusher bin and then to a single toggle jaw crusher by the apron feeder.

The crushed product is fed directly into the primary mill where water is added turning the rock into slurry. The product from this mill is classified by a cluster of hydrocyclones with the overflow being the final product. The majority of the underflow from the cyclones returns to the primary after going over a grit screen where coarse (~5-10mm) lumps of siliceous material are removed.

A bleed stream from this cyclone underflow goes to the secondary mill for further grinding. The product of the secondary mill is fed to a second set of hydrocyclones with the overflow is once again the product and the underflow reports directly back to the mill.

The overflows from both sets of cyclones are sent to the surge tank.

The grits are stockpiled along with the scats, which are larger chunks of waste material and worn steel balls that come from the mills. This material is stockpiled in the concentrator area against the front wall of the ROM Pad, of which will be removed to the mining waste dump.

### 1.6.3 Sulphurisation & Flotation

The product slurry from the comminution circuits is pumped to the sulphurisation tank where sodium hydrosulphide is added to sulphurise the lead carbonate and lead sulphate allowing them to be concentrated by flotation. After sulphurisation a second conditioning stage occurs where flotation collector (sodium ethyl butyl xanthate) and frother (Interfroth 66) are added.

The slurry then is concentrated in a four stage flotation process to yield a final product with a typical grade of 63-68% lead. The lead recovery for this process is generally between 75-85% depending on prevailing ore types.

Ideally Magellan expects a metal recovery of 85%, which leaves 15% of the lead from the ore contained in the residue. As the feed contains approximately 6.0% lead, the tailings contain approximately 1% lead. Tailings production is expected to average 1.5 Mtpa and will be placed in the dam at approximately 40% solids.

The tailing from flotation is sent to the tailings thickener where there density is increased (water recovered for the process) prior to being sent to the tailings dam.

### 1.6.4 Concentrate Dewatering & Packaging

The concentrate is converted to a thickener to reclaim as much water as possible. The dense slurry is then sent to a holding tank prior to being fed to the Metso VPA pressure filter. The product from the pressure filter is between 7.5-9.5% moisture. The concentrate will then be packaged in United Nation (UN) approved bulk bags, which are sealed and have the exterior vacuum cleaned to prevent material escape. The bulk bags are then placed inside standard shipping containers, which are bolt-secured.

The containers will be loaded onto triple road trains, which will pass through a washdown facility before leaving site. The washdown facility contains spray hoses that hose down the entire container body (both sides, bottom and top), the truck body and the wheels.

An independent inspector will inspect the handling and transport process to ensure that all bags, containers and trucks that leave the mine site are free from lead dust.

### 1.6.5 Process Tailings

The TSF is located to the north of the open pit and the waste rock dump. The TSF and waste rock dump have been positioned on the host rock from which they have been extracted to ensure that the same geological processes that have formed the lead carbonate deposits will also stop any contaminants leaving the site, since the underlying materials retained the lead carbonate in the natural state. This is considered to be the optimal long-term solution for safe disposal.

Decant water reclaimed from tailings is directed to the process-water storage dam for re-use within the concentrator. The proportion of water reclaimed from the TSF is approximately 30%.

- The remaining 70% of the water will either evaporate (80%) or remain trapped in the solids (20%).

The tailings contain approximately 1.5Mt per annum of 1% Pb or 15,000 t of contained lead present as insoluble oxidised lead minerals, i.e. the same form in situ before mining. The material has simply been relocated without

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chemical alteration.

### 1.7 Infrastructure

#### 1.7.1 Water Supply

Historically, the Wiluna district has contained abundant quantities of reasonable quality process water for mining and agricultural operations. A detailed hydro-geological survey was undertaken to quantify both quantity and quality of ground water in the area (K H Morgan and Associates 1999).

Groundwater abstraction occurs in compliance with a Licence to Take Water issued under section 5C of the *Rights in Water and irrigation Act 1914* on 18 May 2004 and valid until 17 May 2014.

#### 1.7.2 Potable Water

Total residential water requirement ranges from 25 to 50 kL/day with similar amounts required for laboratory and ablution uses.

Potable supplies are available a number of shallow aquifers within the Magellan mine site and are used for stock watering. Seven water bores have been drilled and four are presently in production. The bore water has proven to be of low salinity.

A reverse osmosis (RO) plant is used to treat ground water for domestic demand. The waste stream from the RO plant is directed to the process water circuit.

Potable water sampling and analysis is being carried out monthly to ensure that the potable water is fit for human consumption (Australian Drinking Water Guidelines, 1996). Sampling sites include the raw water from the bore field, the supply tanks and exit pipeline, tap supply at camp, tap supply at concentrator, and tap supply at offices. The results from the water quality monitoring are presented in the Annual Environment Report that is issued to the DEC.

#### 1.7.3 Process Water

The replacement groundwater requirement for the project is estimated to be 2.04 Mm<sup>3</sup>/yr. Additional water for processing is obtained from recycling decanted tailings water and from the concentrate and tailings thickeners.

#### 1.7.4 Power Supply

Electrical power to operate the mine site facilities was initially provided through a diesel fired power station. The power station was then converted to a gas-fired power station once the spur line from the Goldfields Gas Transmission Line was commissioned. The spur line is 37 km in length and passes close to the township of Wiluna. Electrical power will eventually be reticulated around the site by both overhead lines and underground cables. At present all areas remote from the plant site are powered by hired genset.

#### 1.7.5 Transportation

All heavy goods and services required at the minesite are transported by road primarily from Perth via the Great Northern Highway to Meekatharra and then eastwards to the minesite near Wiluna. Some goods are also sourced from Kalgoorlie via Leonora and some lighter goods may be carried in by air. The airstrip at Wiluna is utilised by Magellan for the transport of personnel and other goods.

Vehicles arriving onsite are diverted to a sterile area for unloading, whilst concentrate trucks (and other minesite vehicles) must pass through the wash-down facility before leaving site.

Lead carbonate concentrate will be transported in sealed bulk bags within standard sea shipping containers by road to the rail head at Leonora and then by rail to the Port of Fremantle.

### 1.8 Other

#### 1.8.1 Communications

Standard telephone systems are installed at both the village and mine/plant complex and are linked into the national telephone system. The CDMA Telstra communications service is available on site but is not very reliable unless the signal is boosted; it is expected to be replaced by Telstra's Next-G network late 2007. Local mine site communication between vehicles, contractors and management, etc, utilise normal commercial 40 channel UHF

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band radio systems.

#### **1.8.2 Accommodation**

The mine village has been installed to accommodate up to 130 persons (of which approximately 65 personnel are on-site at any one time) with catering and cleaning services provided by a suitable contractor. The village is located 3.5 km east of the mine. Employees work on a fly in/fly out basis. Each camp resident has a dedicated room with shared ablution facilities as a minimum. The village has the following facilities:

- Site Office and First Aid Facility.
- Kitchen and Dining Facility.
- Wet Mess / Television Room.
- Laundries.
- Recreation Facilities, including - Gymnasium, Recreation Room with outdoor Barbecue Area, swimming pool and Multi-purpose Court.

#### **1.8.3 Site Administration Complex**

The Administration Complex is made up of:

- General Manager.
- Administration Staff.
- Metallurgy (Processing) Department.
- Mining Department.
- Geology Department.
- OHS&E Department / Training Centre.
- Emergency Services / First aid facility.
- Change rooms (clean and dirty).
- Central Crib Room.

#### **1.8.4 Other Infrastructure**

A contractor's workshop / office / crib area is located adjacent to the plant for the operations of the mining contractor (see Figure 1).

#### **1.8.5 Airstrip**

The mine is approximately 30km from Wiluna, which has an all-weather airstrip. Personnel are flown between Perth and Wiluna by charter airline on a timetable to suit operational needs. Magellan transports site personnel between the airstrip and site using the Magellan bus.

#### **1.8.6 Sewage Disposal**

The accommodation village has primary sewage collectors installed with effluent macerators discharging to evaporation ponds located approximately 400 m below the village. The unit has been installed as per the requirements of Wiluna Shire Council.

Sewage treatment for the administration complex, plant (concentrator), and contractor's workshops/offices/crib is also managed by sewage collectors installed with effluent macerators discharging to evaporation ponds, also with both areas obtaining the approval of the Wiluna Shire.

To further improve the situation a purpose built waste treatment plant is proposed for treating effluent generated from the village. Treated waste water will either be pumped to a lined evaporation dam or pumped to the operations process water dam for reuse.

The site laundry and lab facilities generate potentially contaminated grey water, this water is directed to the tailings thickener, with any lead residues ultimately delivered to, and contained within the Tailings Storage Facility.

#### **1.8.7 Refuse Disposal**

All refuse generated at site (including protective clothing) is disposed of on-site unless it passes contamination examination/tests. Two designated land fill sites have been established. One of the sites is situated outside of the contaminated area and is used for putrescible rubbish generated by the camp and kitchen. The other has been set up in the current waste rock dump. This site takes all the hard and contaminated rubbish which is generated from within the contaminated area.

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### **1.9 Major On-Site Contractors**

Major site contractors include:

- Village caterer.
- Mining contractor.
- Plant maintenance (for shutdowns).

## 2 DOCUMENTATION:

### 2.1 Commonwealth and State Legislation

Magellan Metals, its employees and contractors will comply with Commonwealth and State legislation that applies to Magellan’s operations. Legislation relevant to the Magellan site is outlined in the following table.

<b>COMMONWEALTH ACTS</b>	<b>APPLICATION</b>
Environmental Protection and Biodiversity Act 1999	Federal environmental impact assessment
<b>WA (STATE) ACTS</b>	<b>APPLICATION</b>
Environmental Protection Act 1986	WA environmental impact assessment, works approvals, pollution control licences
Conservation & Land Management Act 1984	Management of flora and fauna reserves
Rights in Water & Irrigation Act 1914	Water rights & management of impacts on downstream users/beneficial uses, licences for groundwater extraction
Soil and Land Conservation Act 1945	Control of land degradation and clearing of land.
Health Act 1911	
Radiation Safety Act 1975	
Mining Act 1978	Right to mine, land access and environmental assessment.
Mine Safety & Inspection Act 1994	Occupational health & safety issues
Waterways Conservation Act 1976	
Wildlife Conservation Act 1950	
Explosives & Dangerous Goods Act 1961	Specifies storage, handling and blasting requirements.
Contaminated Sites Act 2003	
Dangerous Goods (Transport) Act 1998	Placarding and licensing of transport vehicles leaving site
<b>WA (STATE) REGULATIONS</b>	<b>APPLICATION</b>
Mining Regulations 1981	Especially powers of environmental inspectors.
Explosives and Dangerous Goods (Dangerous Goods Handling and Storage) Regulations 1992	Storage & handling of dangerous goods and lead concentrate
Mines Safety and Inspection Regulations 1995	Occupational health & safety issues
Environmental Protection Regulations 1987	
Environmental Protection (Controlled Wastes) Regulations 2004	Disposal of controlled wastes, including used vehicle tyres
Environmental Protection (Unauthorised Discharges) Regulations 2004	Prohibition on unauthorised releases of smoke or other specified pollutants
<b>OTHER</b>	<b>APPLICATION</b>
AS/NZS Standard 5667.1:1998 Water quality - Sampling	Design of sampling programs, sampling techniques and preservation and handling of samples
Australian Code of Practice for the Transport of Dangerous Goods by Road and Rail 1998	Licensing, placarding and safety equipment requirements for lead concentrate transport vehicles
Landfill wastes Classifications and Waste Definitions 1996	
Australian Standard AS 2636 – 1994	Sampling of venous and capillary blood
Australian Standard AS 3640 - 2004	Methods for sampling – inspirable dust
Australian Standard AS 2985 - 2004	Methods for sampling – respirable dust
Australian Standard AS 3580 - 1991	Determination of particulates – gravimetric methods
Australian Standard AS 2724 - 1987	H.V. sampler gravimetric method
Australian Standard AS 2800 - 1985	Determination of particulate lead
Australian Standard AS 4874 - 2000	Guide to investigation of potentially contaminated soil
Australian Standard AS 4482 - 1997	Guide to sampling and investigation
Australian Standard AS 1716 - 2003	Respiratory protective devices
Australian Standard AS 2922 - 1987	Ambient air – siting of sampling units
National Environmental Protection (Ambient Air quality) Measure (NEPM) - 1998	
<b>WA (State) Guidelines</b>	
Biological Monitoring Guideline – Document No:ZMR7741Y DoIR – December 1997	
Water Quality Protection Guidelines No. 1 - Water quality management in mining and minerals processing	
Water Quality Protection Guidelines No.2 - Tailings facilities	
Water Quality Protection Guidelines No.4 - Installation of minesite groundwater monitoring bores	
Water Quality Protection Guidelines No.5 - Minesite water quality monitoring	
Water Quality Protection Guidelines No. 10 - Above-ground fuel and chemical storage	
Adjustment of Exposure Standards for Extended Work Shifts	
Occurrence, Accident, and occupational disease legislative Reporting Requirements	
Contam Procedures – a guide to the departments atmospheric contaminants monitoring system	
Health surveillance program for mine employees	
Noise control in mines	
Management of Hazardous Substances on Mine Sites	
<b>National Codes of Practice</b>	

National Code of Practice for the Control and Safe Use of Inorganic Lead at Work [NOHSC:2015 (1994)] (Worksafe Australia 1994)
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Minerals Council of Australia - Code for Environmental Management (2000)
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### **3 TRAINING & EDUCATION:**

#### **3.1 Training Overview**

The objective of the Magellan training program is to ensure that the entire workforce is trained such that they are motivated and encouraged to learn and are committed in a manner that minimises impact to their health, safety and environment. The Magellan training system is based upon three important principles:

- Be clear about what people need to be able to do in order to be effective, safe, and healthy in their position.
- Provide the training that results in people having the skills, knowledge, and behaviours that enable them to be effective, safe and healthy in their position.
- Perform competency based assessments in order to check and determine that people can, in fact, perform to the standard required in their position.

The Magellan training program is designed to ensure mandatory competency standards are implemented and maintained for all high risk processes as identified through the Magellan's risk identification and management regime.

All training courses include a competency assessment in order to ensure that the key learning outcomes required, have been met. In any cases where the competency of an individual does not meet expectations, a personal training plan is developed in consultation with the individual, their supervisor/manager, and the OHSE Coordinator.

Promotion and recognition is very important in training and maintaining competence levels, and as such, the Magellan training program:

- Promotes the training program well in advance of the proposed date.
- Communicates the purpose and objectives of the program.
- Promotes the benefits of the program (Individual and business).
- Advises what is required or expected from the participant.
- Provides feedback to participants, management, and relevant authorities on the achievements of the program.

The training and competency program is reviewed annually by management who:

- Measure performance against plans.
- Meet and discuss training performance and expected requirements.
- Evaluate alignment of training resources and plans against risk.
- Evaluate changes in process/legislation and impact upon training requirements.
- Evaluate workforce competency and training programs against requirements and industry benchmarks where available.
- Use this information to develop the following years training and competency objectives and targets, and training plans.

#### **3.2 Training System Requirements**

Appendix 1 details requirements relating to the Magellan Training System. Each requirement has a related accountability

Appendix 2 details the Training and Competency Management Plan

### **3.3 Lead Control Specific Training**

All personnel (visitors and permanent) are required to complete the operation's induction process, with all inductions including a "lead awareness" component. The Magellan training program contains lead specific training explaining of lead exposure risk including details on the effects of lead on the body, the mechanisms by which lead enters the body and strategies to prevent lead entering the body.

At job application and induction, personnel are advised, trained and assessed in:

- The hazards of lead, medical effects on human beings, and that some people may be assessed as unsuitable for working in lead-risk jobs based on medical criteria.
- Hygiene requirements, including the need to be clean-shaven and non-smoking. Smoking is only allowed in designated (non-operational) areas of the village.
- The nature and reason for atmospheric monitoring and access to results of same.
- The regular monitoring for lead exposure by periodic (monthly) blood tests and medical examination and access to results. As an incentive to have the blood monitoring undertaken it is linked into all employees' bonuses.
- The need for counselling or to have duties re-allocated if monitoring indicates lead exposure has been unacceptably high, based on elevated lead in blood measurement.

Training in risk management techniques is conducted on an ongoing basis in order to develop and maintain competency. The risk management techniques and training are tailored to address the specific requirements related to lead exposure and controls. The techniques available to employees are related to their position, their possible lead exposure risk, and includes the following elements:

- Basic 'Take-5, 'stop-assess-make changes' approach to managing risk at a basic, operational level - Applicable to all personnel.
- Operational risk management techniques such as the Job Safety Analysis (JSA) approach to managing operational risk – Applicable to all operational personnel.
- Formal risk identification, assessment and control methods such as broad-brush risk assessments, 'what-if analysis', HAZOP analysis – Applicable to supervisors and management.

Training in safety, health and lead hygiene related to the exposure risk will be conducted on an ongoing basis in order to develop and maintain competency, and will include the following elements:

- The use and maintenance of general personal protective equipment
- The use and maintenance of specialist personal protective equipment (such as powered air respirators)
- The importance of, and practices required to minimise the creation of lead dust in the workplace
- Decontamination methods required if exposure to lead contamination occurs
- Cleaning, showering and hygiene requirements before eating, drinking or leaving site.

This training is conducted annually, or for new personnel (visitors and permanent) on site. All training and meetings include a component or discussion of workplace safety, hygiene and the environment.

## **4 WORK METHOD CONTROL - Rules and Procedures:**

### **4.1 Introduction**

When lead is scattered in the air as a dust or fume it can be inhaled and absorbed through the lungs and upper respiratory tract. Inhalation of airborne lead is generally the most important source of occupational lead absorption. Lead can also be absorbed through the digestive system if allowed to enter the mouth and is swallowed.

As ingestion can be a significant route of absorption, exposure to lead is dependent not only on the concentration of lead in workplace air but also on the personal habits (such as smoking and chewing fingernails) of the employee. As such, employee work practices include thorough hand washing before lunch as well as showering before going home for the day.

Once in the blood stream, lead is circulated throughout the body and stored in various organs and body tissues. Some of the lead is filtered out of the body and excreted, however some remains in the blood and tissues. The

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operation's blood monitoring program identifies any elevation in an employee's blood lead level and allow for the appropriate strategies to be implemented.

The health and hygiene management procedures are based on the National Code of Practice for the Control and Safe Use of Inorganic Lead at Work [NOHSC: 2015 (1994)] (Worksafe Australia 1994).

A preliminary risk assessment of activities performed on site has identified work activities that could potentially present a risk of exposure to lead, and due to results of the assessment, areas of potential lead exposure have been delineated into 'clean' and 'dirty' areas. The delineation is based upon the relative risk regarding exposure, and may be modified on a permanent or temporary basis dependant upon activities (i.e. construction or upgrades), extra-ordinary weather conditions, or where opportunities for improvement are identified.

#### 4.2 Personal Hygiene

The absorption of lead carbonate into the blood stream is essentially via the lungs and the gut, i.e. by breathing or by eating. Hygiene practices for both working and eating need to be controlled in a lead operation.

Rules to manage hygiene practices include:

- The workforce (employees and contractors) are required to be clean-shaven. A beard growth of over two days is considered sufficient to prevent proper and effective sealing of respirators to the face. Air can then leak around the filters directly to the nose/mouth along with entrained dust.
- All visitors to the operating site are provided with the appropriate Personnel Protective Equipment (PPE) and clothing which must be worn whilst on site.
- A total, across the site, no-smoking policy is applied for all operational working areas, which include the administration (offices) area, workshops, process plant, mine and tailings storage facilities. Past surveys at several lead operations have shown that smokers have a higher lead-in-blood level than non-smokers. A significant fact is that smokers remove their respirators more often than non-smokers in order to consume a cigarette and that it is this, rather than the smoking per se, which results in higher lead absorption.
- Clean, air conditioned crib rooms for eating is provided. Eating only in these rooms is strictly enforced. Specific entry requirements are enforced based upon the potential exposure to contaminants. This includes wet washing of face, hands and arms, wearing of protective booties, or a complete shower and clothes change. These crib rooms are cleaned and washed daily.
- No work clothing is permitted to be taken into clean areas from dirty areas. This includes helmets, boots and socks. A change house divided into a clean and dirty areas, separated by shower facilities is provided. Laundering of work clothing is performed onsite.

#### 4.3 PPE and Safety

In respect to the other hazards listed at the beginning of this section, the general PPE required to be worn across the entire operations (except inside the offices and crib rooms) include the following:

- Safety helmet / Safety glasses / Safety boots.
- Dust Mask (in specified locations).
- Respirator (in specified locations).
- Hearing protection (in specified locations).

Office and laboratory personnel have their own specific requirements.

Personal Protective Equipment (PPE) are cleaned and maintained regularly. Clothing is laundered on a daily basis. All personnel are issued with several sets of clothing, and separate clean and dirty lockers. All personnel, including site contractors are monitored for lead in blood on a monthly basis.

Plant and general site personnel are required to wear all-cotton long sleeve shirts and trousers. Specific jobs/tasks may also require the wearing additional PPE such as gloves, disposable overalls, PAPR respirators and safety boots.

Safe Working Procedures have been developed and specific training given to personnel whose jobs involve aspects such as dangerous gases, confined spaces, lifting loads, hot environments and working at heights.

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Given a full understanding and appreciation of the hygiene factors involved, the correct design of equipment, formal operating and hygiene procedures, training and monitoring, result in a safe and successful operations at Magellan.

### **4.4 Specific Dust Control Applications**

#### **4.4.1 Mining.**

Due to the potential hazards involved with the generation of lead dust from mining activities, all care and attention is made to those activities that have potential to generate dust.

The primary generator of dust from the mine is considered from the mechanics of haulage units driving along the operations haul roads. To address this water is used as the primary strategy for dust suppression and is sourced from the operations raw water process dam. The raw water is from the raw water pond which is water that is directly from the borefields.

The frequency of watering is based on the degree of dusting identified during operations and is adjusted accordingly to ensure dust is considered to be adequately managed.

There are two other significant dust generating activities arising from mining operations which are dust generated from drill and blast operations and dust generated from the digging face. The dust which is generated from the drilling operation is managed through standard practices including the use of water injection whilst drilling and also with the use of a dust collector on the drilling rig. The dust generated from blasting is primarily managed through the timing of blasts. Blasting times are assessed with respect to wind strength and direction. If the wind is deemed to be of an inappropriate strength and/or direction, then the blast is delayed until the wind has changed enough to be deemed safe.

When there is a risk of excessive dust being generated from the digging face, the water truck wets down the digging face. The water used during the wet down is sourced from the raw process water dam.

#### **4.4.2 Processing**

The potential sources of dust generation at the various process steps in the treatment plant are handled as follows:

- ROM Pad – use of site water truck (as per haul roads) and minimising stockpile surface area.
- ROM Bin - the bin dump pocket is partially enclosed to prevent wind catching the dust and minimise dust escape. It is also fitted with automatic dust suppression mist sprays.
- Crusher - Although the ore should be sufficiently moist to minimise dust. Dust suppression sprays are also in place.
- Conveyor - The feed conveyor is partially enclosed and fitted with belt cleaners. Any spillage is picked up in the conveyor dribble launders. The launders are flushed frequently into the crusher sump and waste returned to the ROM bin. Support steelwork is regularly inspected and cleaned as required.
- Plant areas. From the feed conveyor onwards, all processing is carried out wet, so the potential for dust emissions is minimal.
- Water used for cleanup in the plant area is contained and returned to the grinding circuit.

#### **4.4.3 Concentrate Storage Area (Lead Solar Drying Pad)**

The existing concentrate storage shed at the Magellan Mine site will be modified to:

- Accommodate a stockpile of lead carbonate concentrate, bag-filling machine and conveyor system.
- Allow the movement of mobile equipment inside the shed.
- Temporarily store loaded bulk bags.

Vacuuming equipment will also be moved into the concentrate storage shed to vacuum bulk bags after they have been loaded. The concentrate storage shed will be partitioned to keep the filled bulk bags separate from the bulk concentrate stockpile (if present) in the concentrate storage shed. No open air storage of bulk lead carbonate concentrate will occur at the Magellan Mine once the 18,000 tonne stockpile that is currently located on the concentrate drying pad is removed.

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An amended dangerous goods licence will be obtained from DoCEP for storage of lead carbonate concentrate inside the concentrate storage shed.

A copy of the decommissioning plan for the solar drying pad can be seen in Appendix 8.

#### **4.4.4 Metso Pressure Filter**

The installation of the Metso pressure filter was completed immediately prior to the Magellan Mine being placed into care and maintenance. The new Metso pressure filter discharges concentrate directly from the processing plant into the concentrate storage shed. The advantage of the Metso pressure filter is that it reduces the moisture in the concentrate to deliver a moisture of between 7.5% and 9.5%. At this moisture level, there is little potential for dust generation.

#### **4.5 Other Rules and Procedures**

Rules, procedures and processes have been implemented in areas that have been identified as high risk for lead exposure to ensure that lead escape into the environment and uptake by workforce is minimised.

Rules and procedures have been developed to control lead dust exposure, including:

- Drilling in ore for grade control or blasting holes is conducted wet.
- All other drilling (including exploration) is undertaken with equipment in place to adequately manage and generally eliminate dust production.
- All vehicle movement areas and roads in the mine, process areas and ore stockpiles is kept wet to minimise dust creation.
- All vehicles leaving mining, ore stockpiling and ore processing areas are to pass through the site wash down facility to prevent lead materials being transported into nominally clean areas as well as off-site.
- No compressed air cleaning is permitted. All clean down is conducted wet to minimise dust generation.

#### **4.6 Continuous Improvement**

As part of the ongoing risk management process, any identified risks will be identified and have mitigation measures implemented to reduce the risk as part of the ongoing review of health, safety and environment policy and procedures.

All policies and procedures will be assessed by the relevant supervisors and/or management for improvement opportunities in the due course of activities.

Rules and/or procedures may be developed and implemented when:

- Identified risk is best controlled (via the hierarchy of control) by the development of such policies or procedures
- A task requiring the formulation of a Job Safety Analysis is performed frequently without major change.
- Certain high risk tasks that require a standardised process.

Appendix 3 details the Work Method Control Management Plan

## 5 OCCUPATIONAL HEALTH MANAGEMENT:

### 5.1 Introduction

Assessment of risk to lead contamination shall be conducted on an ongoing basis to evaluate health risks and determine the appropriate control measures. The strategies employed on site include:

- Personal monitoring of airborne lead levels.
- Monitoring biological lead levels.
- Reporting of exposure incidents so that methods can be reviewed and eliminated (this also allow the relation of exposures to the biological monitoring).

Personal air monitoring measures the composition of the external environment surrounding the employee, while biological monitoring provides a measure of the total absorption of particular workplace substances.

Biological monitoring also accounts for individual variations influencing uptake and absorption of hazardous substances, such as mode of breathing, work practices (including the extent of the use of respiratory protection), work load and individual differences such as personal hygiene habits, age, sex and fitness level. Consequently, biological monitoring is considered to provide a more detailed indicator of health risk than air measurement alone, since it integrates absorption from all sources.

The monitoring program implemented at Magellan is part of a larger program, which includes environmental monitoring. Employees will be educated in its' requirements and objectives, and be informed of how the results will be handled.

### 5.2 Objectives

Magellan is obliged under the Mines Safety Inspection Act 1994 and Environmental Protection Act 1986, to undertake monitoring of potential airborne concentrations at the Magellan Mine site.

Site occupational air monitoring conducted in accordance with recognised technical guidance documents have been designed to demonstrate that:

- Procedures and hierarchical control measures are effective in preventing unacceptable occupational exposures and environmental impacts due to lead dust; and
- Concentrations of airborne lead are maintained within safe limits.

Based on site occupational monitoring data Magellan's procedures and control measures will be amended on an ongoing basis to ensure that a safe working environment is maintained and that impacts on the surrounding environment are minimized.

### 5.3 Occupational Air Monitoring

Monitoring for dust and lead levels in the breathing zone of exposed employees is undertaken using battery powered portable personal air samplers. Based on the results the operation's dust control equipment and procedures are evaluated and, if required, improved. This monitoring program was utilised initially to identify high risk work areas and activities.

Occupational air monitoring is a critical aspect of identifying the potential for adverse exposures to harmful substances such as lead dust. Elevated occupational monitoring results provide a trigger mechanism to:

- Review the procedures and controls applicable to operation activities.
- Review the medical status of the workers who may have been affected by elevated concentrations of airborne lead.

The integrity of the occupational air monitoring program relies on the collection of an adequate number of samples that are deemed to be representative of the exposure of workers to airborne lead at the Magellan mine.

**IMPORTANT NOTE:** All Magellan personnel are committed to working in a safe, healthy and environmentally acceptable manner. Both management and operation personnel share the responsibilities of providing and maintaining a safe working environment, and following safe work practices to ensure that exposures to lead are kept within acceptable limits.

The following documents provide essential procedural guidance for the employer and employees involved in lead risk work and are recognised as sound technical guidance for implementing an occupational lead

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monitoring program.

Document	Purposes
National Standard for the Control of Inorganic Lead at Work NOHSC:1012, National Occupational Health and Safety Commission, October 1994 and National Code of Practice for the Control of and Safe Use of Inorganic Lead at Work NOHSC:2015, National Occupational Health and Safety Commission, October 1994	National standards and guidance notes applicable to: <ul style="list-style-type: none"> <li>employers and employees duties;</li> <li>employers and employee consultation;</li> <li>provision of information;</li> <li>induction and training;</li> <li>workplace assessment;</li> <li>management and control measures;</li> <li>atmospheric monitoring;</li> <li>exclusion of specific individuals from lead-risk jobs;</li> <li>health surveillance, medical examinations, record keeping;</li> <li>counseling; and</li> <li>protective clothing</li> </ul>
Occupational Health and Hygiene Guidebook for the Workplace Health and Safety Officer, David Grantham, December 1991	OH&S guidelines for: <ul style="list-style-type: none"> <li>assessment of workplace hygiene, hazards and patterns of exposure to substances</li> <li>background information, concepts and definitions</li> <li>control measures, ventilation, personal protective equipment (PPE)</li> </ul>
Australian Standard (AS) 3640-2004 Workplace atmospheres – Method for sampling and gravimetric determination of inhalable dust  United States Department of Health and Human Services National Institute for Occupational Safety and Health (NIOSH) method 7105/7082	Standards and definitions for : <ul style="list-style-type: none"> <li>differentiation between respirable and inhalable dust</li> <li>clarification of the appropriateness of measuring inhalable dust where toxic effects would occur if the dust is ingested after deposition in the nasopharyngeal (nose and throat) region</li> <li>provide a method to assess personal exposure to inhalable dust by sampling the workers' breathing zones</li> <li>caution against the use of static samples to evaluate possible health impacts</li> <li>laboratory method of analysis of lead in personal dust samples</li> </ul>
Department of Minerals and Energy (DME) Western Australia Guideline, Adjustment of Exposure Standards for Extended Workshifts, March 1999	OH&S recommended practices for: <ul style="list-style-type: none"> <li>reduction of recommended occupational exposure standards for conventional workshifts (five consecutive eight-hour work days, followed by two days off) to accommodate unconventional workshifts</li> <li>exposure reduction factors for the Western Australian mining industry based on average number of hours worked in the month</li> </ul>
Simplified Monitoring Strategies, David Grantham, November 2001	Further recommended operational practices for: <ul style="list-style-type: none"> <li>application of the National Occupational Health and Safety Commission (NOHSC) Exposure Standards for Atmospheric Contaminants in the Occupational Environment to Australian Hazardous Substance Legislation</li> <li>guidance on adjusting exposure standards</li> <li>when to monitor and duration of monitoring</li> <li>determining frequency of repeat monitoring</li> <li>evaluation of monitoring results</li> </ul>

#### 5.4 Occupational Air Monitoring Strategy

The following strategy has been applied since prior to commencement of productive mining:

1. The size and activities of workforce, including work roster and average working hours per month to address occupational monitoring requirements and Standards are documented.
2. A preliminary review of (existing/proposed) control measures to manage exposures to lead in accordance with NOHSC requirements referenced above is to be conducted.
3. Workforce sampling using personal sample pumps in accordance with AS 3640 and assess lead concentrations in accordance with the NIOSH method referenced was commenced.

The data will be assessed in accordance with documented monitoring strategies (referenced above) to determine the frequency of repeat monitoring events.

Occupational monitoring requirements other than which have been described for airborne lead will also need to address the Department of Industry and Resources (DoIR) March 2002 "CONTAM Procedures". The CONTAM

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Procedures that will apply to Magellan will be subject to the following:

1. DoIR request for Magellan to submit a Workforce Survey Form
2. DoIR's allocation of sampling and analysis requirements as communicated to Magellan on a DoIR Quota Allocation Report

### 5.5 Biological Monitoring

Monitoring employee exposure to lead through blood lead testing has proven to be a very effective means of protecting employees from excessive exposure. It is primarily an indicator of soft tissue concentrations, and represents recent exposure, i.e. exposure over the past month.

The ultimate measure of personnel exposure to lead is provided by lead-in-blood analysis. All lead concentrate plants, smelters and refineries (both primary and secondary) are required to conduct lead-in-blood testing programmes.

The legislative requirements contained in the Mines Safety and Inspection Regulations 1995 concerning biological monitoring states that –

*“The principal employer and each employer at a mine must ensure that biological monitoring is carried out in respect of employees who engage in specified occupational exposure work at the mine, where there is a valid biological monitoring procedure and a reasonable likelihood that accepted values might be exceeded”.*

The Biological Monitoring Guideline, document No:ZMR7741Y issued by the Dept of Minerals and Energy Western Australia (now DOIR), will be referenced in this regard.

Pre-employment medical examinations will also detect potential employees who could, for example, have an existing health problem, which may be made worse by relatively low exposure to lead.

Monitoring of personnel blood lead levels involves all site personnel. A suitably trained medical officer who will also evaluate personnel medical conditions will manage the monitoring program. Frequency of testing is undertaken on a monthly basis.

The biological sampling program at Magellan Metals operations will comply with all the relevant Western Australia and Workplace Australia regulations and guidelines concerning the regular monitoring of blood lead in the entire workforce; employees and contractors. This includes providing information and procedures at initial induction, training in use of PPE, feedback and review of individual results and reclassification in the event of elevated blood lead levels.

### 5.6 Sample Collection

Biological sample collection requires careful consideration and attention. If samples are not representative, or are not correctly collected or stored, the analytical results can be meaningless or misleading. Either occupational health nurses or doctors, who are trained in the correct procedures for collection, storage and transportation, must take blood samples.

All blood samples will be taken in accordance with Australian Standard AS 2636 – 1994 - Sampling of venous and capillary blood for the determination of lead or cadmium concentration.

In addition to sample contamination and analytical error, abnormally high results may indicate atypical exposure from maintenance or emergency repair operations. They may also indicate the failure to use PPE adequately, in which case, improved operator training management and personal hygiene is required.

A registered and recognised laboratory is essential in obtaining accurate results. The most common form of blood sampling is to take a venous sample, using qualified personnel. At the Magellan operation the frequency of testing and results protocols for the biological monitoring of both men and women for lead in blood as provided in the guidelines from the Department of Minerals and Energy, doc No. ZMR7741Y: November 1997, will be followed.

### 5.7 Procedures for Blood Lead Monitoring

Monitoring will only be carried out by a competent person who has sufficient knowledge, skills and experience in the appropriate techniques and procedures. Procedures will be developed for monitoring, and shall detail:

- When and how the monitoring is to be done;
- The sampling procedures and analytical methods to be used;

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- The type and frequency of sampling; and
- How the results are to be interpreted.
- Relevant parties and processes to report results to such.

The results of monitoring shall be recorded in sufficient detail to determine:

- The level of lead measured and when the monitoring was done;
- What monitoring procedures were adopted, including the duration of sampling;

#### 5.8 Evaluation of Monitoring Results

Taken from the National Standard for the Control of Inorganic Lead at Work (NOHSC: 1012, 1994), the maximum level for lead in blood and the related evaluation and action requirements are:

Level (BEIs),	Who	Frequency / Action
< 30 ug/dL	Males / Females not of reproductive capacity	Once every 6 months
< 30 ug/dL	Males of reproductive capacity	
30 – 39 ug/dL	Males / Females not of reproductive capacity	Once every 3 months
30 – 39 ug/dL	Males of reproductive capacity	
<10 ug/dL	Females of reproductive capacity	
> 40 ug/dL	Males / Females not of reproductive capacity	At least once every 6 weeks
> 40 ug/dL	Males of reproductive capacity	
> 10 ug/dL	Females of reproductive capacity	
<b>Review of control measures - 1</b>		
> 40 ug/dL	Males / Females not of reproductive capacity	Actions to identify, assess, and control lead exposure if blood lead level is at or above for 3 consecutive occasions
> 40 ug/dL	Males of reproductive capacity	
> 10 ug/dL	Females of reproductive capacity	
<b>Review of control measures - 2</b>		
> 50 ug/dL	Males / Females not of reproductive capacity	Actions to identify, assess, and control lead exposure if blood lead level is at or above on a single occasion
> 50 ug/dL	Males of reproductive capacity	
> 20 ug/dL	Females of reproductive capacity	
> 15 ug/dL	Females who are pregnant or breast feeding	
<b>Medical removal</b>		
> 50 ug/dL	Males / Females not of reproductive capacity	Immediately relocate from lead-risk job to non lead-risk job. Medical examination arranged.
> 50 ug/dL	Males of reproductive capacity	
> 20 ug/dL	Females of reproductive capacity	
> 15 ug/dL	Females who are pregnant or breast feeding	
<b>Return after medical removal</b>		
< 40 ug/dL	Males / Females not of reproductive capacity	Employee certified by authorised medical practitioner as fit to return.
< 40 ug/dL	Males of reproductive capacity	
< 10 ug/dL	Females of reproductive capacity, or ceased pregnancy and not breast feeding	

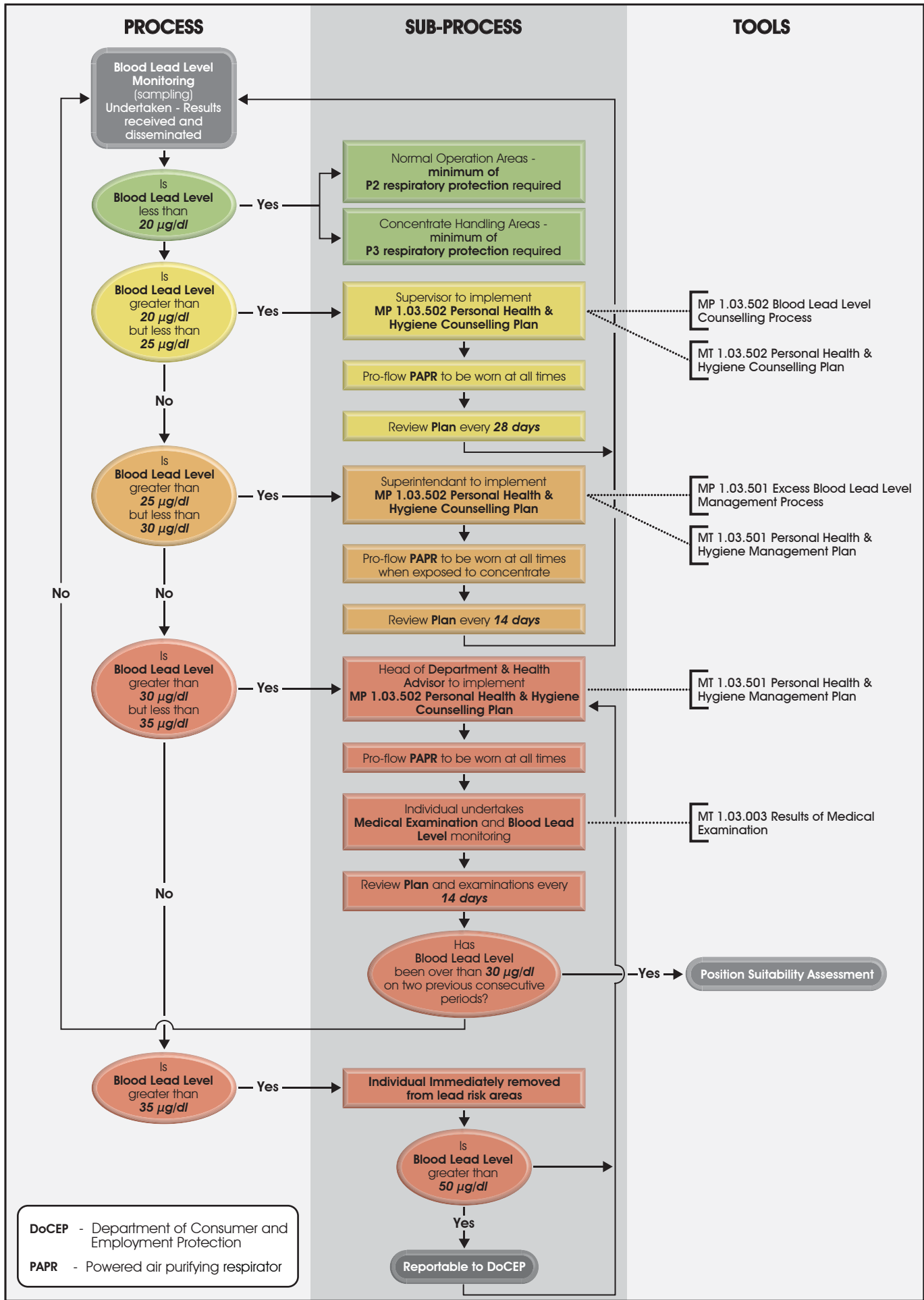
From: National Standard for the Control of Inorganic Lead at Work (NOHSC: 1012(1994))

Lead in blood concentrations will be compared to Biological Exposure Indices (BEIs), which are reference values intended as guidelines for the evaluation of potential health hazards. BEIs do not indicate a sharp distinction between hazardous and non-hazardous exposures and are primarily an index of exposure. They are not an indicator of health effects that may have been produced from exposure to a workplace chemical. A copy of Magellan's blood lead level management process is included as Figure 2.

Materials such as lead have relatively long biological half-lives and their presence in blood may not necessarily indicate current occupational exposure. For this reason, pre-employment monitoring for lead will be conducted by Magellan to detect absorption, which may have occurred from previous employment or other activities. Pre-employment tests are also useful for providing a background level against which future exposure may be compared.

One of the main benefits of biological monitoring is the assessment of individual risk. Individuals with virtually identical exposure histories can show a wide variation in response, due to subtle differences in their rates of absorption, tissue storage, or metabolism. Greater significance will be given to the variations in an individual's level from period to period rather than the variations between different individuals within a group.

The results may also be interpreted on a group basis by considering their distribution. If all the observed values are significantly below the BEI, the working conditions may be assumed to be satisfactory. If all or the majority of the results are above the BEI, the cause of the excessive values will be investigated and appropriate action taken to reduce exposure.



### 5.9 Developing Control Strategies – Hierarchy of Controls

The outcomes of air and blood lead monitoring will allow a continuous improvement program to be followed in which operational risk areas and personnel at risk will be identified and control strategies developed, implemented and reviewed in accordance with the hierarchy of controls, which are:

- Elimination.
- Substitution.
- Isolation.
- Engineering.
- Safe Work Practices.
- Administrative.
- PPE.

The primary prevention strategy is to minimise potential for exposure to lead. Biological monitoring provides an important complement to air monitoring and will be used to:

- Prevent further ingestion by identifying excessive absorption before any significant adverse health effect occur
- Evaluate the effectiveness of workplace controls, such as personal protective equipment and engineering control methods.
- Operational procedures reviewed and revised to minimise or eliminate risk identified
- Training requirements will be revised and conducted on an ongoing basis to ensure that correct operational and hygiene procedures are followed.

In the event that blood lead levels exceed the Statutory limit for *withdrawal from the usual workplace*, the individual will be reclassified and redeployed to a low lead environment where they will remain until blood lead level falls to less than 30 ug/dl and are notified (approved) to return to normal duties by an authorised medical officer.

Protocols that will be followed in the event of any individual showing indications of elevated blood lead levels from the regular blood analysis include:

- Counselling by the individual's supervisor and/or other appropriately qualified persons
- Re-induction
- Further PPE training.

Appendix 4 details the Health Management Plan

## 6 TRANSPORT OF PRODUCT

Magellan exported lead concentrates out of Esperance from commencement until the 12<sup>th</sup> of March 2007, when Esperance Port Authority was issued with a "Notice of suspension of lead operations at the Port of Esperance".

This change has forced Magellan to review its procedure for the transport of lead concentrate as well as its point of export. The plan is to transport the lead concentrate in sealed UN approved packaging inside sealed sea containers via the port of Fremantle.

The material will be packaged onsite (see sections 1.6 & 1.7) with rigorous checks and balances put in place to ensure that no other lead leaves site except inside this double barrier of protection and that any potential for off site contamination throughout the transport route is minimised. All road trains will pass through a wash down facility before exiting the site. Wash down effluent will be pumped to the tailings thickener.

The proposed transportation route of the loaded sea containers is via road haulage (on triple road trains) to Leonora where the sea containers will be transferred onto rail rolling stock. The material will then proceed by rail to the port of Fremantle where it will be unloaded by Fremantle Link Services and transported directly onto the berth ready for loading on a container vessel.

At peak production, approximately 120,000 tonnes per annum (tpa) of lead carbonate concentrate, at approximately 65% lead and 9.0% moisture, will be transported in containers to Fremantle, for export via ship.

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This practice is expected to last for the duration of the mine life or until it becomes economically viable to establish a refinery on site, then lead metal ingots can be produced and exported.

At peak production, it is planned that approximately 125 containers will be shipped from site per week.

### **6.1 Risk Assessment**

Risk assessments have been undertaken for the entire transport route and measures put in place to minimise any hazards that have been identified. Emergency plans dealing with any eventuality have also been put into place. These risk assessments can be seen in Appendix 7 (section 8.7).

The risk assessments were carried out following the risk management procedure as per the requirements of HB 203:2006 Environmental risk management – Principles and process and the Australian Standard AS/NZS 4360:2004 (Risk Management).

The purpose of the risk assessment was to:

- Identify and assess potential hazards to the public associated with transport and handling of lead carbonate concentrate.
- Identify and assess any potential hazards that may impact on the environment during transport, storage and ship loading.
- Undertake a scenario-based risk assessment, using the methods defined in HB 203:2006 Environmental risk management – Principles and process and the Australian Standard AS/NZS 4360:2004.
- Identify and rank major hazards and determine appropriate risk reduction measures.

Information on how the risk assessment was undertaken can be found in Magellan proposal to ship lead concentrate in sealed bulk bags inside sea shipping via the Port of Fremantle. The proposal titled 'Proposal and Project Conditions Review – To Facilitate the Export of Containerised Lead from the Port of Fremantle' was submitted to the EPA in September 2007.

### **6.2 Concentrate Spillage**

#### **6.2.1 Scope and Responsibility**

Once the concentrate leaves the mine site they are under the control of a number of contractors who are responsible for transporting the concentrate to Fremantle, unloading, storage and loading onto ships.

The managers of the contract companies involved in the movement of concentrates from the Mine Site to the Port of Fremantle and those involved in the operations at the Port of Fremantle will be responsible for the emergency response to any incident that occurs while the concentrates are under their control. Details of the companies responsible for the various sectors of the journey to Fremantle including handling and ship loading at Fremantle are as follows:

- Magellan will be responsible for managing the response to any incident that occurs during the loading of concentrates at the Magellan mine site and during transport to the mine site boundary
- Magellan and the road haulage contractor will be responsible for managing the response to any incident that occurs during the road transport leg from the mine site boundary to the Australian Rail Group (ARG) yard at Leonora including unloading at Leonora.
- Magellan and ARG will be responsible for managing the response to any incident that occurs during loading at Leonora, the transport by rail to Fremantle and unloading at Fremantle

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- Magellan, ARG and Fremantle Link Service will be responsible for managing the response to any incident that occurs during the movement of containers from the railhead to the stevedore company's storage areas; Patricks at berths 6-8 and Dubai Ports at berths 4 and 5
- Magellan, Patricks and Dubai Ports will be responsible for managing the response to any incident that occurs while the containers are in their storage areas or during ship loading.

#### 6.2.2 Notification

All incidents shall be notified as soon as practicable to the authority responsible for managing the response to incidents in the area where the incident occurred. Details including phone numbers of those who should be contacted for the various sectors of the journey from the mine site to Fremantle including handling activities at Fremantle are included in the Magellan Emergency response plan.

In addition the Manager of the company who was in control of the concentrates when the incident occurred, the General Manager Operation at Magellan Metals and the relevant government agencies shall also be notified.

#### 6.2.3 Initial Response

The initial response to the incident should be to arrange for the treatment of any injured persons, take any steps necessary to ensure public safety, secure the area, and restrict public access and to prevent the movement of any spilled concentrates from the incident site.

#### 6.2.4 Clean Up

From July 2008 WA regulation will require that the clean up of hazardous materials spilled as a result of an accident or incident will be carried out by an organisation that is approved by the regulators for that purpose. ARG are currently negotiating with a clean up provider who will be responsible for any clean up arising from incidents on the ARG network.

Magellan Metals will develop a clean up procedure for lead carbonate concentrates that is applicable to all sectors of the transport route including ship loading. The procedure will include detail on the return of any spilled concentrates and other contaminated material to the mine site for disposal. Fire and Emergency Services Australia (FESA) will be consulted during the development of the method.

Generic Procedure for cleanup of spills will be based on the following:

- Control source of spillage if possible to do so safely.
- Assess the full extent of the spillage and define the area, which is affected.
- Restrict access to the area until completion of clean-up. Cordon off and isolate the area affected by erecting physical barriers, display signs on post sentries at strategic points to ensure unauthorised persons or vehicles to not enter the area.
- If rainfall is occurring or expected, take appropriate measures to prevent the spilled material from being washed into drains or ducts or from being dispersed by rainwater until clearance can be undertaken, e.g. cover the spillage with waterproof sheeting, install temporary sandbag bunds, etc.
- Clean up spilled material immediately using appropriate PPE and using methods that will minimize dust generation (e.g. dampen material and shovel or wet sweep).
- Persons responding to an accidental release should wear coveralls or other protective clothing, gloves and a respirator. Close-fitting safety goggles may be necessary to prevent eye contact with dust. Workers should wash and change clothing following cleanup of a spill to prevent personal contamination

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- with lead-containing dust.
- Load the spilled material into suitable containers or vehicles and transport it to an appropriate location for use storage or disposal. Return uncontaminated spilled material to be reprocessed.
- Repair, make safe or cordon off any damaged or unsafe areas resulting from the spillage until repairs can be undertaken.
- Clear the area affected of all clearance equipment.

The method will be used to train the clean up provider's staff and FESA personnel.

#### **6.2.5 Incident Investigation**

Magellan Metals will carry out a investigation of any incident that occurs during the transport of concentrates from the mine site to Fremantle including storage and ship loading. The existing Magellan Metals Incident Investigation procedure will be used for this purpose. The key elements of the investigation will include:

- Details of what happened
- What were the causes of the incident
- An action plan detailing actions required to prevent a recurrence

A member of Magellan's Management will be responsible for carrying out the investigation. Copies of the report will be circulated to the following:

- Magellan Metals - Chief Operating Officer
- Magellan Metals – General Manager Operation
- The Manager of the company who were in control of the concentrates when the incident occurred.
- The relevant government agencies

#### **6.2.6 Fire Fighting Measures**

The lead concentrate is not a fire or explosion hazard.

Appendix 5 details the Transport Emergency Management Plan.

## 7 MONITORING - Environmental:

### 7.1 Introduction

Environmental monitoring involves the periodic and/or continuous sampling of environmental components to derive a quantitative estimate of the environmental exposure. Magellan has monitoring obligations for the mine site under both Ministerial Statement 559 and DEC's Licence to Operate.

The monitoring and management system component of the program involves:

- Community consultation and maintaining a community complaints register;
- Establishing performance criteria and targets
- Developing and implementing a continuous operational dust monitoring network to identify operational dust events and non-operational/external events (weather or third party activities);
- The ongoing review of dust monitoring and management technology.

### 7.2 Static Dust Monitoring

Static dust monitoring is a means to assess the potential to contribute adverse concentrations of airborne lead to the surrounding (non-occupational) environment. Elevated environmental monitoring results provide a trigger mechanism to:

- Review the procedures and hierarchical controls applicable to the activity/activities likely to be related to the elevated concentrations; and
- Review (in adverse situations) the potential environmental impacts, which may be associated with lead deposition.

In accordance with DEC Licence Condition 1, Magellan has commenced its dust deposition monitoring program. Samples of dust are collected from deposition monitors at three-monthly intervals, with the samples weighed and analysed for lead. The results of the analysis are reported in grams (total weight) and mg/kg (lead). The results of the monitoring require by Condition 1 are included in the annual environment reported which is submitted to the DEC by 31 March each year. The results will be compared to previous sampling results at the mine to determine any trends in the quantity and concentration of lead dust.

Static dust monitoring conducted in accordance with recognized technical guidance documents will enable Magellan to demonstrate that:

- procedures and hierarchical control measures are effective in preventing unacceptable occupational exposures and environmental impacts due to lead dust; and
- concentrations of airborne lead are maintained within acceptable limits.

If environmental monitoring show that airborne lead concentrations appear to be exceeding acceptable limits, Magellan's procedures and control measures will be revised to ensure that a safe working environment is maintained and that impacts to the surrounding environment continue to be minimised. The following documents provide essential guidelines and procedures for implementing an environmental lead monitoring program.

Document	Purposes
Ministerial Statement 553 (Magellan Lead Carbonate Project, Wiluna) published on 28 November 2000, as amended	Ministerial conditions prescribe the required monitoring programmes
Environmental Protection Act 1986 Licence number 7982/2 and subsequent licences	Contains specific requirements for dust and water monitoring

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Document	Purposes
National Environmental Protection (Ambient Air Quality) Measure National Environmental Protection Measure (NEPM) (as amended, July 2003) AS 2800-1985 Ambient Air – Determination of Particulate Lead – High Volume Sampler Gravimetric Collection – Flame Atomic Absorption Spectrometric Method (referenced in the Replaced by: AS/NZS 3580.9.3:2003 Methods for sampling and analysis of ambient air Method 9.3: Determination of suspended particulate matter – Total suspended particulate matter (TSP) – High volume sampler gravimetric method	National standards to establish: <ul style="list-style-type: none"> <li>• monitoring plans;</li> <li>• environmental outcomes;</li> <li>• acceptable concentrations of pollutants (lead);</li> <li>• Australian Standard methods for monitoring; and</li> <li>• frequency of monitoring</li> <li>• method for determining acid-soluble lead fraction of material collected from ambient air by a high volume sampler</li> </ul>
AS 2724.3-1984 – Determination of Total Suspended Particulates (TSP) – High Volume Sampler Gravimetric Method	Method for determining the concentration of suspended particulate matter in ambient air
AS 2922-1987 – Ambient Air - Guide for the Siting of Sampling Units To be replaced by AS/NZS 3580.1.1	General guidelines for siting of ambient air sampling units and specifies a number of siting parameters specific to lead monitoring
AS 2923-1987 – Ambient Air - Guide for Measurement of Horizontal Wind for Air Quality Applications	Guide for measurement of horizontal wind speed and direction

### 7.3 High Volume Dust Lead Monitoring

High volume dust monitoring is undertaken to assess airborne Pb particle concentrations. Results for the previous reporting period continue to indicate that Pb concentrations near the village are significantly below the National Environment Protection Measure of 0.5 µg/m<sup>3</sup>.

A high-volume air sampler will also be installed on a trailer for mobile sampling to determine the concentration of air lead levels, in accordance with Australian Standard AS 2922-1987, Ambient Air: Guide for the siting of sampling units. Samples will be taken every six days as per the requirements of the National Environmental Protection (Ambient Air Quality) Measure 2003, with the results reported as particulate matter in µg/m<sup>3</sup> of lead.

Magellan is committed to undertaking handling and transport of its product in accordance with all relevant legislation, standards and guidelines. As such, Magellan will undertake sampling in accordance with any amendments to the National Environmental Protection Measure.

For the clearing of the stockpiled concentrate, the high-volume air sampler will be located downwind of the concentrate drying pad. For routine deposition of concentrate in the concentrate storage shed stockpile the high-volume air sampler will be located downwind of the concentrate storage shed.

The results of dust monitoring are assessed under the Exposure Standards for Atmospheric Contaminants in the Occupational Environment (NOHSC: 3008 (1995) and the National Exposure Standards (OHSC: 1003 (1995)). The exposure standard for lead, inorganic dusts and fumes (as lead) is 0.15 mg/m<sup>3</sup>. This value is a time-weighted average based on a standard 8-hour day, 5 days per week.

### 7.4 Soil Monitoring

Monitoring is undertaken of lead concentration in soil at the concentrate drying pad and radially from the pad. The sampling is conducted on a quarterly basis with results reported to DoIR in parts per million (ppm) as required under tenement M53/502 Condition 26. The results will be assessed as per the soil health investigation level (1500 mg/kg) for industrial sites listed in the Contaminated Sites Management Series – Assessment levels for soil, sediment and water.

A baseline soil-sampling program will be undertaken along the transport route from Wiluna to the Port of Fremantle. The sampling will occur before the commencement of container transport along the route. The results will be reported to the DEC in the Annual Environment Report.

### 7.5 Water Monitoring

The only mechanism for personnel to ingest lead is through particulate matter most likely caused by dust. The HHEMP therefore focuses heavily on dust prevention and management. However, monitoring of both ground

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water and run-off from the waste dumps and tailings storage area is conducted. Magellan monitors all production bores on a monthly basis for volume abstracted (kL), standing water level (SWL), pH and TDS, with full chemical analysis undertaken biannually. In addition to the production bores, Magellan also undertakes monitoring of the bore field at a number of aquifer monitoring bores for SWLs on a monthly basis. All water samples are collected in accordance with the Australian Standard AS/NZS 5667.1:1998, and submitted to a NATA accredited laboratory. The results are included in the annual environmental report.

Magellan has adopted a strategy of containment for surface water generated from within the mining operational areas. Containment of surface water is essential to minimize the egress of potential contaminants from the operation's mining lease. The Surface Water and Drainage Management Plan details the surface water strategy, however, two other potential water streams need consideration:

- **Tailings Storage.** Extensive test work has shown that the potential for lead input in to the underlying aquifers is minimal with an independent risk analysis was completed in September 2004. To monitor water quality in the vicinity of ground water, monitoring bores were installed at selected sites around the TSF. The aquifer below and downstream of the TSF has been shown to be isolated from the other aquifers in the area. A seepage management plan has been developed to provide action strategies in the unlikely event that the lead content did increase to above acceptable levels.
- **Open Pit Water.** It is possible that the Magellan or Cano pits may intercept the water table as the level has been estimated at between 40m and 50m but is known to vary depending on recent rainfall events. It is known that no aquifers will be intercepted through mining activities. In the event that seepage into a pit occurs or rainwater is collected, the water will be used for in pit dust suppression with any excess being returned to the process water dam.

### 7.6 Biological Lead Monitoring

The scope of work for monitoring of lead uptake by vegetation was submitted to the Department of Environment (DoE) and the Department of Health (DoH) in July 2006, as per the requirements of commitment P11 of Ministerial Statement 559. The comments were incorporated into the report and a revised scope of work was submitted to the DEC in January 2007 and included as Appendix 23 in the AER 2006. The revised scope of work included linking sampling locations with dust deposition sampling locations for comparison.

There are seven monitoring sites located on the four compass points (N, S, E, W) and the prevailing wind direction (NE, SE and SW) surrounding the mine site. These have been established to determine if wind direction and orientation are correlated with lead uptake in vegetation (as determined by soil and vegetation sampling). Additionally, vegetation monitoring has been established adjacent to each of the dust monitoring sites (site 3, 4, 6, 7, 9, 13 and 14) as per Figure 1 of Appendix 23 in the AER 2006.

The vegetation monitoring plan has been updated following comments from DoH and DEC, and comparison of dust deposition monitoring and vegetation monitoring is being undertaken.

In addition to the DoE comments, the DoH noted that the grazing of livestock over the mining area may be the most significant public health issue following the closure of mining. Based on these comments, Magellan initiated a program of blood lead level monitoring in cattle from a nearby property as to establish a baseline to which future changes in blood lead levels could be monitored.

### 7.7 Procedures for Monitoring

Monitoring will only be carried out by a competent person who has sufficient knowledge, skills and experience in the appropriate techniques and procedures.

An environmental monitoring manual will be established and contain details such as;

- Monitoring protocols
- The sampling procedures and analytical methods to be used;
- The sites and frequency of sampling; and
- How the results are to be interpreted.
- Relevant parties and processes to report results to such.

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The results of monitoring shall be recorded in sufficient detail to determine:

- The level of lead measured and when the monitoring was done;
- What monitoring procedures were adopted, including the duration of sampling;

#### ***7.8 Developing Control Strategies – Hierarchy of Controls***

Where the results of monitoring indicate that the atmospheric lead level is routinely at or above the exposure standard, control measures should be reviewed in consultation with appropriate personnel. This review shall include, but is not limited to:

- Engineering controls,
- Safe work practices, such as wetting of surfaces.

Appendix 6 details the Environmental Monitoring Management Plan

## **8 APPENDICIES**

## Magellan Metals Pty Ltd – Lead Carbonate Project

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#### 8.1 Appendix 1 – Training System General Requirements

Requirement	Accountability
<b>Planning</b>	
Appropriate resources shall be provided to ensure relevant training to all personnel.	General Manager
Detailed training management/action plans will be developed for all training objectives and targets. The plans shall define the actions, accountabilities, timeframes and any key performance indicators required to successfully implement the plan	Area Managers/ OHSE Superintendent
Training requirements as identified using such tools as a training needs analysis, or as requested by management will be incorporated into the detailed training management/action plans.	Area Managers/ OHSE Superintendent
Determine training requirements and priorities for their employees in terms of who is to be trained and the training that is to be received.	Area Managers
<b>Risk / Change Management</b>	
The Magellan training program shall be designed to ensure mandatory competency standards are implemented and maintained for all high risk processes as identified through the Magellan risk identification and management regimen.	Area Managers/ OHSE Superintendent
Training programs and materiel shall be reviewed on a periodic basis and amended where appropriate.	Area Managers/ OHSE Superintendent
When changes are made to training programs or materials, relevant personnel are to be informed utilising the operations' change management process.	General Manager/Area Managers/ OHSE Superintendent
Training objectives and targets will be developed where new programs are required in response to managing identified significant change or risk to business, operations, and new legal or corporate requirements.	Area Managers/ OHSE Superintendent
<b>Implementation / Operation</b>	
Only persons with the appropriate knowledge, skills, and experience shall conduct and/or assess training.	OHSE Superintendent
The OHSE department will maintain all training related documentation and ensure relevant document control on those documents.	OHSE Superintendent
All company and contractor personnel shall be trained and deemed competent and correctly authorised to work in all aspects of their role.	Area Managers
Ensure that all employees receives and undergoes the necessary training	Area Managers
Provide modified training plans where required for employees that do not meet standard competency requirements	Area Managers
Records shall be kept of all attendances to training courses.	OHSE Superintendent
Define and review the training and competencies required for each position that reports to them	Area Managers
The attendance of personnel scheduled to participate in training shall be in accordance with the management / action plan	Area Managers
All non-attendances to training courses shall be investigated and disciplinary action taken where required. Rescheduled to be undertaken at Area Managers discretion.	Area Managers
Attendances to all training shall be recorded and forwarded to the OHSE Superintendent and relevant Area Managers	Training Provider
Provide training course assessments and/or feedback as required	All
<b>Monitoring, Review, &amp; Improvement</b>	
The training and competency program shall be reviewed annually	Area Managers/ OHSE Superintendent/ GM
Training plans shall be monitored to compare actual performance against expected performance, validated, and then used to identify improvement opportunities and successes	Area Managers
Training and competency will be audited as part of the annual audit schedule. Additional effectiveness audits can be instigated at any time by management	OHSE Superintendent/ Training Provider
Evaluate employee's performance (via performance review) and identify training needed to improve their performance	All supervisors

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Personnel shall be given the opportunity to assess training courses, suggest improvements, or provide feedback to the training and competency system.  
This information shall be used in order to identify improvement opportunities

All

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### 8.2 Appendix 2 - Training and Competency Management Plan

Activity / Actions	Accountability	Completion Date
Review the Magellan Safety, Health and Environmental Management System, Strategy and Framework	OHSE Superintendent/ Area Managers	Ongoing / Prior to restart
Review and amend where required the Magellan Training and Competency strategy within the Magellan Safety, Health and Environmental Management System strategy and framework	OHSE Superintendent/ Area Managers	Ongoing / Prior to restart
Gain management approval on reviewed & amended strategies	General Manager	Ongoing / Prior to restart
Select Training provider (where required)	OHSE Superintendent	Ongoing / Prior to restart
Review and amend where required the Magellan Lead Induction Package	OHSE Superintendent	Ongoing / Prior to restart
Review and amend where required the Magellan General Site OHS&E Induction Package	OHSE Superintendent/ Area Managers	Ongoing / Prior to restart
Review and amend where required the Magellan Area Specific Induction Packages	Area Managers	Ongoing / Prior to restart
Review and amend where required the Magellan risk management and training strategies/ packages	OHSE Superintendent/ Area Managers	Ongoing / Prior to restart
Review and amend where required the Magellan PPE Specific training packages	OHSE Superintendent	Ongoing / Prior to restart
Review and amend where required the Magellan OHS Risk Assessment relating to lead exposure – by position	OHSE Superintendent/ Area Managers	Ongoing / Prior to restart
Schedule training	OHSE Superintendent	Ongoing / Prior to restart
Develop Task observation process / tools etc	OHSE Superintendent	Prior to restart
Implement Task Observation Process	OHSE Superintendent/ Area Managers	Prior to restart
Review and improve training plan using data from Task Observation Process	OHSE Superintendent	Once developed
Undertake periodic review & amendments where required of training strategy	OHSE Superintendent/ Area Managers	Ongoing

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### 8.3 Appendix 3 – Work Method Control Management Plan

Activity / Actions	Accountability	Completion Date
Develop the Magellan Safety, Health and Environment Management System	OHSE Superintendent	complete
Review and amend where required the Magellan Work Method Control strategy within the Magellan Safety, Health and Environmental Management System strategy and framework	OHSE Superintendent	ongoing
Gain management approval on reviewed and amended strategies	General Manager	ongoing
Identify key tasks by position	Area Managers	completed
Identify key risks requiring work method controls per position	OHSE Superintendent/ Area Managers	ongoing
Schedule development of work method controls depending upon risk rating, urgency, and potential usage	OHSE Superintendent	ongoing
Develop work method controls (procedures)	OHSE Superintendent/ Area Managers	ongoing
Develop training materials and tools related to each work method control as required	OHSE Superintendent	ongoing
Develop implementation schedules for work method controls	OHSE Superintendent	ongoing
Implement work method controls as required	OHSE Superintendent	ongoing
Develop Task observation process / tools etc	OHSE Superintendent	Prior to restart
Implement Task Observation Process	OHSE Superintendent/ Area Managers	Prior to restart
Collect Task Observation Data	All	ongoing
Review and improve work method controls using data from Task Observation Process	OHSE Superintendent	Prior to restart
Undertake periodic review & amendments where required of work method control strategies	OHSE Superintendent	ongoing

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#### 8.4 Appendix 4 – Health Management Plan

Activity / Actions	Accountability	Completion Date
Review and amend where required the Magellan Health Management strategy within the Magellan Safety, Health and Environmental Management System strategy and framework	OHSE Superintendent	ongoing
Gain management approval on amended strategies	General Manager	ongoing
Identify key tasks by position	OHSE Superintendent	completed
Identify key risks per position	OHSE Superintendent	ongoing
Coordinate Biological/ occ health monitoring testing facilities and services	OHSE Health Advisor/ Ventilation Officer	ongoing
Develop Pre-employment and Post employment medical requirements, including biological monitoring and helath assessments	OHSE Superintendent	ongoing
Develop Occupational Helath Dust Monitoring program & schedules	OHSE Ventilation officer	Ongoing / Prior to restart
Review Biological Monitoring Program & schedules	OHSE Health Advisor	ongoing
Review training and awareness materials	OHSE Health Advisor/ Ventilation Officer	ongoing
Review and evaluate monitoring results	OHSE Health Advisor/ Ventilation Officer/ OHSE Superintendent	ongoing
Develop control strategies where required	OHSE Health Advisor/ Ventilation Officer/ OHSE Superintendent	ongoing
Undertake periodic review & amendments where required of health management plan and strategies	OHSE Superintendent	ongoing

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### 8.5 Appendix 5 – Transport Emergency Management Plan

Activity / Actions	By Whom	By When
Review and amend where required the Magellan transport emergency management plan within the Magellan Safety, Health and Environmental Management System strategy and framework	OHSE Superintendent / Area Managers	completed
Gain management approval on amended strategies	General Manager	ongoing
Undertake emergency response exercise to test relevant procedures	OHSE Superintendent/ Transport Providers	Prior to commencement
Undertake periodic review & amendments where required of transport emergency plan and strategies	OHSE Superintendent/ Transport Providers	ongoing

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### 8.6 Appendix 6 – Environmental Monitoring Management Plan

Activity / Actions	By Whom	By When
Review and amend where required all Environmental Management programs and plans within the Magellan Safety, Health and Environmental Management System strategy and framework	OHSE Superintendent	ongoing
Gain management approval on amended strategies	General Manager	ongoing
Review and amend where required environmental monitoring Procedures/policies	OHSE Superintendent	ongoing
Implement Monitoring Schedules	OHSE Superintendent	ongoing
Develop training and awareness materials	Environmental Officer	ongoing
Review and evaluate monitoring results	Environmental Officer	ongoing
Develop management strategies where required	OHSE Superintendent	Ongoing / as needed
Review monitoring schedules and modify where required	OHSE Superintendent	ongoing
Undertake periodic review & amendments where required of environmental monitoring programs and management plans	OHSE Team	ongoing

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**8.7 Appendix 7 Risk Assessments on Bagging and Transportation of Product**

Table 1 Risk Register: Bagging and containerising concentrate

Ref No.	Date Reviewed	Risk Scenario	Key Causes	Possible Consequences	Existing Controls	Inherent Risk			Proposed Treatments	Residual Risk			Comments
						Consequences	Likelihood	Risk Rating		Consequences	Likelihood	Risk Rating	
1	16/5/2007	Dust in atmosphere.	<ul style="list-style-type: none"> <li>Loader turning concentrate pile and loading transfer hopper.</li> </ul>	<ul style="list-style-type: none"> <li>Lead contamination of environment and lead exposure of workers.</li> </ul>	<ul style="list-style-type: none"> <li>Existing site dust minimisation procedures.</li> <li>Sprinkler system used for dust suppression on pad.</li> <li>Water truck and cannon used for localised dust suppression.</li> <li>Use of respirators and other PPE.</li> <li>Vehicles used onsite are pressurised to minimise dust ingress.</li> </ul>	1	2	3		1	2	3	
2	16/5/2007	Heat exhaustion during the summer months.	<ul style="list-style-type: none"> <li>Working in the open at the concentrate drying pad.</li> </ul>	<ul style="list-style-type: none"> <li>Dehydration and fatigue.</li> </ul>	<ul style="list-style-type: none"> <li>Return to crib room (after appropriate decontamination procedure) for drinks and cooling off in the shade.</li> <li>Use of rehydrating solutions and icy poles as medics direct.</li> </ul>	2	6	7	<ul style="list-style-type: none"> <li>Lean-to or roof for the concentrate bag preparation activity.</li> <li>Rotation of plant operators to minimise individual exposure.</li> </ul>	1	3	4	
3	16/5/2007	Poor visibility during night shift.	<ul style="list-style-type: none"> <li>Inadequate lighting.</li> </ul>	<ul style="list-style-type: none"> <li>Collisions and danger of injury and/or property damage.</li> </ul>	<ul style="list-style-type: none"> <li>Mobile lighting tower used for after dark operations.</li> <li>Site vehicles equipped with reversing sirens and beacons.</li> </ul>	3	3	6	<ul style="list-style-type: none"> <li>Add additional lighting towers.</li> <li>Demarcate areas for different equipment.</li> </ul>	3	1	4	
4	16/5/2007	Collisions between the loader and forklift.	<ul style="list-style-type: none"> <li>High vehicle movement in close proximity with one another.</li> </ul>	<ul style="list-style-type: none"> <li>Fatality or injury and/or major property damage.</li> </ul>	<ul style="list-style-type: none"> <li>Site vehicles equipped with reversing sirens and beacons.</li> </ul>	4	2	6	<ul style="list-style-type: none"> <li>Demarcate areas for different equipment.</li> <li>Operating procedures for filling procedure to be implemented.</li> </ul>	4	1	5	
5	16/5/2007	Bag rupture when transporting full bag from Bulkafil to storage and/or container.	<ul style="list-style-type: none"> <li>Collision of bag with loading hopper and/or loader.</li> <li>Forklift tyre put through bag.</li> </ul>	<ul style="list-style-type: none"> <li>Dust generation: lead contamination of environment and lead exposure of workers.</li> </ul>	<ul style="list-style-type: none"> <li>Prestart equipment checks on equipment and maintenance program.</li> <li>Equipment driver training and procedures.</li> <li>Bag removed from Bulkafill machine on pallet.</li> <li>Equipment cab pressurised.</li> <li>Operators to wear appropriate PPE for area.</li> </ul>	1	4	5	<ul style="list-style-type: none"> <li>Demarcate loading routes for all vehicles on pad.</li> </ul>	1	3	4	

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Table 1 Risk Register: Bagging and containerising concentrate cont'd

Ref No.	Date Reviewed	Risk Scenario	Key Causes	Possible Consequences	Existing Controls	Inherent Risk			Proposed Treatments	Residual Risk			Comments
						Consequences	Likelihood	Risk Rating		Consequences	Likelihood	Risk Rating	
6	16/5/2007	Overfilled bag.	<ul style="list-style-type: none"> <li>Operator error.</li> <li>Loading system malfunction.</li> </ul>	<ul style="list-style-type: none"> <li>Dust generation: lead contamination of environment and lead exposure of workers.</li> </ul>	<ul style="list-style-type: none"> <li>Workers wear appropriate PPE.</li> </ul>	2	2	4	<ul style="list-style-type: none"> <li>Preventative maintenance program for bagging machine.</li> <li>Procedure to cease loading operations in this instance.</li> </ul>	1	2	4	Bagging machine will be fitted with load cells that, when functioning correctly, provide accurate weight to prevent overflow
7	16/5/2007	Vehicle runs over plant operator.	<ul style="list-style-type: none"> <li>Loader or forklift.</li> </ul>	<ul style="list-style-type: none"> <li>Fatality or injury.</li> </ul>	<ul style="list-style-type: none"> <li>Use of two-way radios for communication.</li> </ul>	4	2	6	<ul style="list-style-type: none"> <li>Use of high visibility vests by all personnel in area.</li> <li>Clear demarcation and separation of vehicle and operator activities.</li> </ul>	4	1	5	
8	16/5/2007	Forklift roll over.	<ul style="list-style-type: none"> <li>Uneven ground or uneven load on forks.</li> </ul>	<ul style="list-style-type: none"> <li>Fatality or injury and/or ruptured bag and damaged forklift.</li> </ul>	<ul style="list-style-type: none"> <li>Grader to level ground in area of forklift operation.</li> </ul>	4	2	6	<ul style="list-style-type: none"> <li>Daily inspection of condition of working area.</li> <li>Procedures and training to ensure that load is evenly supported.</li> </ul>	4	1	5	
9	16/5/2007	Rupture of container by forklift forks.	<ul style="list-style-type: none"> <li>Forklift mechanical failure.</li> <li>Operator error.</li> <li>Operator fatigue.</li> </ul>	<ul style="list-style-type: none"> <li>Container damages.</li> <li>Dust generation: lead contamination of environment and lead exposure of workers.</li> </ul>	<ul style="list-style-type: none"> <li>Pre-start equipment checks on equipment and maintenance program.</li> <li>Equipment driver training and procedures.</li> <li>Equipment cab pressurised.</li> <li>Operators to wear appropriate PPE for area.</li> </ul>	3	2	5	<ul style="list-style-type: none"> <li>Procedure for new tasks.</li> <li>Operator rotation.</li> <li>Procedure for removal and cleaning of damaged containers.</li> </ul>	3	1	4	
10	16/5/2007	Forklift collision with container.	<ul style="list-style-type: none"> <li>Forklift mechanical failure.</li> <li>Operator error.</li> <li>Operator fatigue.</li> </ul>	<ul style="list-style-type: none"> <li>Container damage.</li> <li>Dust generation: lead contamination of environment and lead exposure of workers.</li> </ul>	<ul style="list-style-type: none"> <li>Prestart equipment checks on equipment and maintenance program.</li> <li>Equipment driver training and procedures.</li> <li>Equipment cab pressurised.</li> <li>Operators to wear appropriate PPE for area.</li> </ul>	3	2	5	<ul style="list-style-type: none"> <li>Procedure for new tasks.</li> <li>Operator rotation.</li> <li>Procedure for removal and cleaning of damaged containers.</li> </ul>	3	1	4	
11	16/5/2007	Pinch points at container doors.	<ul style="list-style-type: none"> <li>Opening and closing container doors.</li> </ul>	<ul style="list-style-type: none"> <li>Injury.</li> </ul>	<ul style="list-style-type: none"> <li>Use of correct PPE (gloves).</li> </ul>	2	4	6	<ul style="list-style-type: none"> <li>Procedures to be developed for door closing and sealing.</li> </ul>	2	2	4	

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Table 1 Risk Register: Bagging and containerising concentrate cont'd

Ref No.	Date Reviewed	Risk Scenario	Key Causes	Possible Consequences	Existing Controls	Inherent Risk			Proposed Treatments	Residual Risk			Comments
						Consequences	Likelihood	Risk Rating		Consequences	Likelihood	Risk Rating	
12	16/5/2007	Contaminated container despatched by mistake.	<ul style="list-style-type: none"> <li>Operator error.</li> </ul>	<ul style="list-style-type: none"> <li>Lead contamination across shipment route and/or port.</li> <li>Exposure of public.</li> </ul>	<ul style="list-style-type: none"> <li>Washing procedures for all containers prior to dispatch truck wash.</li> </ul>	3	2	5	<ul style="list-style-type: none"> <li>Checklists and precartage approvals.</li> <li>Regular inspection of cleaned containers.</li> </ul>	2	1	3	
13	17/5/2007	Loader / bobcat leaving pad with concentrate on tyres.	<ul style="list-style-type: none"> <li>Operator error.</li> </ul>	<ul style="list-style-type: none"> <li>Lead contamination of environment and lead exposure of workers.</li> </ul>	<ul style="list-style-type: none"> <li>Washdown facilities at concentrate drying pad and procedures.</li> <li>Equipment cab pressurised.</li> <li>Operators to wear appropriate PPE for area.</li> </ul>	2	1	3		2	1	3	

## Magellan Metals Pty Ltd – Wiluna Lead Project

### Health, Hygiene, and Environmental Management Program

Table 2 Treatment Plan: Bagging and containerising concentrate at the concentrate drying pad

Ref No.	Date Reviewed	Risk Scenario	Proposed Treatments	Risk Rating after Treatment	Result of Cost-Benefit Analysis	Person Responsible	Timetable for Implementation	Details of Monitoring
1	16/5/2007	Dust in atmosphere.		3	NA	NA	NA	NA
2	16/5/2007	Heat exhaustion during the summer months.	<ul style="list-style-type: none"> <li>Lean-to or roof for the concentrate bag preparation activity.</li> <li>Rotation of plant operators to minimise individual exposure.</li> </ul>	4	To be reviewed Accept	Manager Metallurgy - Magellan.	Prior to commencement.	NA
3	16/5/2007	Poor visibility during night shift.	<ul style="list-style-type: none"> <li>Add additional lighting towers.</li> <li>Demarcate areas for different equipment.</li> </ul>	4	Accept all	Manager Metallurgy - Magellan.	Prior to commencement.	NA
4	16/5/2007	Collisions between the loader and forklift.	<ul style="list-style-type: none"> <li>Demarcate areas for different equipment.</li> <li>Operating procedures for filling procedure to be implemented.</li> </ul>	5	Accept all	Manager Metallurgy - Magellan.	Prior to commencement.	NA
5	16/5/2007	Bag rupture when transporting full bag from Bulkafil to storage and/or container.	<ul style="list-style-type: none"> <li>Demarcate loading routes for all vehicles on pad.</li> </ul>	4	Accept all	Manager Metallurgy - Magellan.	Prior to commencement.	NA
6	16/5/2007	Overfilled bag.	<ul style="list-style-type: none"> <li>Preventative maintenance program for bagging machine.</li> <li>Procedure to cease loading operations in this instance.</li> </ul>	4	Accept all	Manager Metallurgy - Magellan.	Prior to commencement.	NA
7	16/5/2007	Vehicle runs over plant operator.	<ul style="list-style-type: none"> <li>Use of high visibility vests by all personnel in area.</li> <li>Clear demarcation and separation of vehicle and operator activities.</li> </ul>	5	Accept all	Manager Metallurgy - Magellan.	Prior to commencement.	NA
8	16/5/2007	Forklift roll over.	<ul style="list-style-type: none"> <li>Daily inspection of condition of working area.</li> <li>Procedures and training to ensure that load is evenly supported.</li> </ul>	5	Accept all	Manager Metallurgy - Magellan.	Prior to commencement.	NA
9	16/5/2007	Rupture of container by forklift forks.	<ul style="list-style-type: none"> <li>Procedure for new tasks.</li> <li>Operator rotation.</li> <li>Procedure for removal and cleaning of damaged containers.</li> </ul>	4	NA	NA	Prior to commencement.	NA

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Health, Hygiene, and Environmental Management Program

Table 2 Treatment Plan: Bagging and containerising concentrate at the concentrate drying pad (cont'd)

Ref No.	Date Reviewed	Risk Scenario	Proposed Treatments	Risk Rating after Treatment	Result of Cost-Benefit Analysis	Person Responsible	Timetable for Implementation	Details of Monitoring
10	16/5/2007	Forklift collision with container.	<ul style="list-style-type: none"> <li>• Procedure for new tasks.</li> <li>• Operator rotation.</li> <li>• Procedure for removal and cleaning of damaged containers.</li> </ul>	4	Accept all	Manager Metallurgy - Magellan.	Prior to commencement.	NA
11	16/5/2007	Pinch points at container doors.	<ul style="list-style-type: none"> <li>• Procedures to be developed for door closing and sealing.</li> </ul>	4		Manager Metallurgy - Magellan.	Prior to commencement.	NA
12	16/5/2007	Contaminated container despatched by mistake.	<ul style="list-style-type: none"> <li>• Checklists and precartage approvals.</li> <li>• Regular inspection of cleaned containers.</li> </ul>	3		Manager Metallurgy - Magellan. BIS.	Prior to commencement.	NA
13	17/5/2007	Loader / bobcat leaving pad with concentrate on tyres.		3	NA	NA	NA	NA

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Health, Hygiene, and Environmental Management Program

Table 3 Risk Register: Transporting containerised concentrate from Magellan mine to Leonora by road

Ref No.	Date Reviewed	Risk Scenario	Key Causes	Possible Consequences	Existing Controls	Inherent Risk			Proposed Treatments	Residual Risk			Comments
						Consequences	Likelihood	Risk Rating		Consequences	Likelihood	Risk Rating	
1	16/5/07	Traffic accident without release of product.	<ul style="list-style-type: none"> <li>• Driver error.</li> <li>• Poor road surface.</li> <li>• Flooding/washaways.</li> <li>• Mechanical failure.</li> <li>• Driver fatigue.</li> </ul>	<ul style="list-style-type: none"> <li>• Damage to truck and trailer.</li> <li>• Damage to container.</li> <li>• Fatality or Injury to driver or general public.</li> </ul>	<ul style="list-style-type: none"> <li>• Driver fatigue management.</li> <li>• Driver training and licensing.</li> <li>• Driving to road conditions.</li> <li>• Awareness of road closure notices.</li> <li>• Pre-use vehicle inspection (BIS).</li> <li>• Regular vehicle maintenance.</li> </ul>	4	3	7	Covered by existing controls.	3	3	6	
2	16/5/07	Traffic accident with release of product.	<ul style="list-style-type: none"> <li>• Driver error.</li> <li>• Poor road surface.</li> <li>• Flooding/washaways.</li> <li>• Mechanical failure.</li> <li>• Driver fatigue.</li> </ul>	<ul style="list-style-type: none"> <li>• Damage to containers.</li> <li>• Loss of product.</li> <li>• Potential for environmental contamination.</li> <li>• Exposure of personnel and public to the concentrates.</li> </ul>	<ul style="list-style-type: none"> <li>• Driver fatigue management.</li> <li>• Driver training and licensing.</li> <li>• Driving to road conditions.</li> <li>• Awareness of road closure notices.</li> <li>• Pre-use vehicle inspection (BIS).</li> <li>• Regular vehicle maintenance.</li> <li>• Container has full length rods at either end to prevent bursting open in a crash.</li> </ul>		2	5	Emergency containment and cleanup procedure.	1	2	3	
3	16/5/07	Traffic accident with container damaged but no product released.	<ul style="list-style-type: none"> <li>• Driver error.</li> <li>• Poor road surface.</li> <li>• Flooding/washaways.</li> <li>• Mechanical failure.</li> <li>• Driver fatigue.</li> </ul>	<ul style="list-style-type: none"> <li>• Container unsuitable for carriage.</li> </ul>	<ul style="list-style-type: none"> <li>• Driver fatigue management.</li> <li>• Driver training and licensing.</li> <li>• Driving to road conditions.</li> <li>• Awareness of road closure notices.</li> <li>• Pre-use vehicle inspection (BIS).</li> <li>• Regular vehicle maintenance.</li> </ul>	1	3	4	Develop procedure for returning damaged containers to the site.	1	3	4	
4	16/5/07	Truck breakdown.	<ul style="list-style-type: none"> <li>• Mechanical failure.</li> </ul>	<ul style="list-style-type: none"> <li>• Container damaged or ruptured by vandalism.</li> <li>• Release of product.</li> </ul>	<ul style="list-style-type: none"> <li>• Vehicle inspection and maintenance practices.</li> </ul>	3	2	5	(a) Bolt-sealed container. (b) Procedures to require driver to remain with the vehicle.	3	1	4	
5	16/5/07	Public concern about exposure to lead in their community.	<ul style="list-style-type: none"> <li>• Existing community perception.</li> <li>• Lack of provision of balanced information.</li> </ul>	<ul style="list-style-type: none"> <li>• Unnecessary community concern.</li> <li>• Loss of business: i.e., mine remains closed.</li> <li>• Negative impact on company reputation.</li> </ul>	<ul style="list-style-type: none"> <li>• None.</li> </ul>	3	5	8	Develop a road show to raise awareness and allay community concerns in communities through which the concentrate will be transported.	2	4	6	

## Magellan Metals Pty Ltd – Wiluna Lead Project

Health, Hygiene, and Environmental Management Program

Table 3 Treatment Plan: Transporting containerised concentrate from Magellan mine to Leonora by road

Ref No.	Date Reviewed	Risk Scenario	Proposed Treatments	Risk Rating after Treatment	Result of Cost-Benefit Analysis	Person Responsible	Timetable for Implementation	Details of Monitoring
1	16/5/07	Traffic accident without release of product.	Covered by existing controls.	6	NA	NA	NA	NA
2	16/5/07	Traffic accident with release of product.	Emergency containment and cleanup procedure.	3	Accept	Environmental and Safety Superintendent - Magellan.	<ul style="list-style-type: none"> <li>Draft procedure by 31-May-07.</li> <li>Final procedure prior to commencement.</li> </ul>	Annual review.
3	16/5/07	Traffic accident with container damaged but no product released.	Develop procedure for returning damaged containers to the site.	4	Accept	Environmental and Safety Superintendent - Magellan.	<ul style="list-style-type: none"> <li>Draft procedure by 31-May-07.</li> <li>Final procedure prior to commencement.</li> </ul>	NA
4	16/5/07	Truck breakdown.	(a) Bolt-sealed container. (b) Procedures to require driver to remain with the vehicle.	4	(a) Accept (b) Accept	(a) Manager Metallurgy - Magellan. (b) BIS.	(a) 31-May-07. (b) 30-Jun-07.	NA
5	16/5/07	Public concern about exposure to lead in their community.	Develop a road show to raise awareness and allay community concerns in communities through which the concentrate will be transported.	6	(a) Accept (b) Accept	(a) General Manager Operations - Magellan. (b) BIS.	30-Jun-07.	NA

**Magellan Metals Pty Ltd – Wiluna Lead Project**

Health, Hygiene, and Environmental Management Program

Table 4 Risk Register: Loading containerised concentrate at Leonora

Ref No.	Date Reviewed	Risk Scenario	Key Causes	Possible Consequences	Existing Controls	Inherent Risk			Proposed Treatments	Residual Risk			Comments
						Consequences	Likelihood	Risk Rating		Consequences	Likelihood	Risk Rating	
1	10/5/07	Dropping full containers.	<ul style="list-style-type: none"> <li>Mechanical failure on forklift (e.g., metal fatigue, hydraulic hose break).</li> <li>Driver leaving container forward of centre tipping forklift.</li> <li>Uneven loading of container to one end.</li> </ul>	<ul style="list-style-type: none"> <li>Container rupture or damage.</li> <li>Release of product exposure to personnel.</li> <li>Container not suitable for transport.</li> <li>Serious injury or death to personnel due to crushing.</li> </ul>	<ul style="list-style-type: none"> <li>Regular maintenance programs of forklift.</li> <li>Container inspection by shipping line.</li> <li>Forklift driver training and qualifications and procedures.</li> <li>Certification at site that containers have been loaded evenly.</li> <li>Container has full length rods at either end to prevent bursting open in a crash.</li> </ul>	4	2	6	<ul style="list-style-type: none"> <li>(a) Develop a procedure for loading product into containers.</li> <li>(b) Train the operators loading product into containers.</li> <li>(c) Develop emergency containment and cleanup procedure for Leonora.</li> <li>(d) Develop a procedure to return damaged container to site.</li> </ul>	3	1	4	
2	10/5/07	Rupturing container with forklift.	<ul style="list-style-type: none"> <li>Driver negligence.</li> </ul>	<ul style="list-style-type: none"> <li>Container rupture or damage.</li> <li>Release of product exposure to personnel.</li> <li>Container not suitable for transport.</li> </ul>	<ul style="list-style-type: none"> <li>N/A.</li> </ul>	4	2	6	<ul style="list-style-type: none"> <li>Use only container handling machines (no tyne, top lift only)</li> </ul>	1	1	2	
3	10/5/07	Willful damage or vandalism to container releasing product.	<ul style="list-style-type: none"> <li>Access to containers by general public.</li> </ul>	<ul style="list-style-type: none"> <li>Container rupture or damage.</li> <li>Release of product exposure to personnel.</li> <li>Container not suitable for transport.</li> </ul>	<ul style="list-style-type: none"> <li>Authorised personnel on site during work hours (which is almost 24 hours).</li> </ul>	2	1	3	<ul style="list-style-type: none"> <li>(a) Investigate requirement to install secured fenced area to restrict access.</li> <li>(b) Bolt-sealed containers.</li> </ul>	2	1	3	
4	10/5/07	Transfer of lead contamination on outside of container to atmosphere.	<ul style="list-style-type: none"> <li>Lead dust on the outside of containers because they haven't been washed down.</li> </ul>	<ul style="list-style-type: none"> <li>Release of product exposure to personnel.</li> </ul>	<ul style="list-style-type: none"> <li>Existing procedure and vehicle washdown facility to wash down container and trailer.</li> <li>Strong existing culture of washdown procedure.</li> </ul>	2	5	7	<ul style="list-style-type: none"> <li>(a) Amendment of current procedure and equipment to handle new height of containers.</li> </ul>	1	4	5	
5	10/5/07	Derailing wagons while loading containers.	<ul style="list-style-type: none"> <li>Incorrect driving by forklift driver.</li> <li>Rolling stock moving during container loading.</li> </ul>	<ul style="list-style-type: none"> <li>Broken or damaged container.</li> <li>Release of product.</li> <li>Damage to rolling stock.</li> <li>Delay to operations.</li> <li>Injury to personnel.</li> </ul>	<ul style="list-style-type: none"> <li>Shunt procedures and guidelines</li> <li>Three Step Protection.</li> <li>Derailer.</li> <li>Container has full length rods at either end to prevent bursting open in a crash.</li> </ul>	4	2	6	<ul style="list-style-type: none"> <li>(a) Development of Interface Coordination Plan between Brambles and ARG.</li> </ul>	4	1	5	

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Table 4 Risk Register: Loading containerised concentrate at Leonora (cont'd)

Ref No.	Date Reviewed	Risk Scenario	Key Causes	Possible Consequences	Existing Controls	Inherent Risk			Proposed Treatments	Residual Risk			Comments
						Consequences	Likelihood	Risk Rating		Consequences	Likelihood	Risk Rating	
6	10/5/07	Locomotive movement while loading wagons.	<ul style="list-style-type: none"> <li>Failure to put down derailer.</li> <li>Poor communication between loco driver and forklift operator.</li> </ul>	<ul style="list-style-type: none"> <li>Broken or damaged container.</li> <li>Release of product.</li> <li>Damage to rolling stock and container-handling equipment.</li> <li>Delay to operations.</li> <li>Injury to personnel.</li> </ul>	<ul style="list-style-type: none"> <li>Shunt procedures and guidelines</li> <li>Derailer.</li> <li>Communication protocols in current Interface Coordination Plan for that site.</li> </ul>	4	2	6	Development of new Interface Coordination Plan between Brambles and ARG.	4	1	5	
7	10/5/07	Unsecure container on wagon.	<ul style="list-style-type: none"> <li>Twist locks not being applied correctly.</li> </ul>	<ul style="list-style-type: none"> <li>Container coming off wagon.</li> <li>Damage to rolling stock, perway.</li> <li>Serious injury or death.</li> </ul>	<ul style="list-style-type: none"> <li>Train examination procedure prior to departure of services.</li> </ul>	4	1	5	No treatments in addition to existing procedures.	4	1	5	

**Magellan Metals Pty Ltd – Wiluna Lead Project**

Health, Hygiene, and Environmental Management Program

Table 5 Treatment Plan: Loading containerised concentrate at Leonora

Ref No.	Date Reviewed	Risk Scenario	Proposed Treatments	Risk Rating after Treatment	Result of Cost-Benefit Analysis	Person Responsible	Timetable for Implementation	Details of Monitoring
1	10/5/07	Dropping full containers.	(a) Develop a procedure for loading product into containers. (b) Train the operators loading product into containers. (c) Develop emergency containment and cleanup procedure for Leonora. (d) Develop a procedure to return damaged container to site.	4	Accept	(a) Manager Metallurgy – Magellan. (b) Manager Metallurgy – Magellan. (c) Environmental and Safety Superintendent – Magellan. (d) Environmental and Safety Superintendent – Magellan.	Develop draft procedures and training programs by 31 May 2007 with final prior to commencement.	Review procedures and training as soon as practicable after commencement with annual reviews thereafter.
2	10/5/07	Rupturing container with forklift.	Use only container handling machines (no tyne, top lift only)	2	TBC between Brambles and Magellan.	General Manager Operations – Magellan.	31-May-07	
3	10/5/07	Willful damage or vandalism to container releasing product.	(a) Investigate requirement to install secured fenced area to restrict access. (b) Bolt sealed containers.	3	(a) TBC (b) Accept	(a) Train Management Manager – ARG. (b) Manager Metallurgy – Magellan.	31-May-07	
4	10/5/07	Transfer of lead contamination on outside of container to atmosphere.	(a) Amendment of current procedure and equipment to handle new height of containers.	6	Accept	Manager Metallurgy – Magellan.	Procedure by 31 May 2007. Modification to washdown facility prior to start.	
5	10/5/07	Derailing wagons while loading containers.	(a) Development of Interface Coordination Plan between Brambles and ARG.	5	Accept	Transportation Manager Goldfields – ARG.	1-Aug-07	
6	10/5/07	Locomotive movement while loading wagons.	Development of new Interface Coordination Plan between Brambles and ARG.	5	Accept	Transportation Manager Goldfields – ARG.	1-Aug-07	
7	10/5/07	Unsecure container on wagon.	No treatments in addition to existing procedures.	NA	NA	NA	NA	

**Magellan Metals Pty Ltd – Wiluna Lead Project**

Health, Hygiene, and Environmental Management Program

Table 6 Risk Register: Transporting containerised concentrate by rail from Leonora to Fremantle

Ref No.	Date Reviewed	Risk Scenario	Key Causes	Possible Consequences	Existing Controls	Inherent Risk			Proposed Treatments	Residual Risk			Comments
						Consequences	Likelihood	Risk Rating		Consequences	Likelihood	Risk Rating	
1	10/5/07	Derailment enroute without release of product.	<ul style="list-style-type: none"> <li>Incorrectly set points.</li> <li>Broken rail.</li> <li>Collision with road vehicles or other rolling stock.</li> <li>Wagon faults.</li> <li>Vandalism of track and rail infrastructure.</li> </ul>	<ul style="list-style-type: none"> <li>Damage to rolling stock.</li> <li>Damage to containers.</li> <li>Loss of product.</li> <li>Environmental contamination.</li> <li>Exposure of product to personnel and public.</li> <li>Injury or death due to crushing.</li> </ul>	<ul style="list-style-type: none"> <li>ARG Rules / Policies/ Procedures.</li> <li>Efficiency testing of personnel.</li> <li>Track inspections by Westnet.</li> <li>Regular rolling stock maintenance.</li> <li>Roll-by inspections.</li> </ul>	4	2	6	No treatments in addition to existing procedures.	3	1	4	
2	10/5/07	Derailment enroute damaging containers, exposing or releasing the product (no injury to personnel and minimal damage to rolling stock and operations).	<ul style="list-style-type: none"> <li>Incorrectly set points.</li> <li>Broken rail.</li> <li>Collision with road vehicles or other rolling stock.</li> <li>Wagon faults.</li> <li>Vandalism of track and rail infrastructure.</li> </ul>	<ul style="list-style-type: none"> <li>Damage to containers. Loss of product.</li> <li>Environmental contamination.</li> <li>Exposure of product to personnel and public.</li> </ul>	<ul style="list-style-type: none"> <li>ARG Rules / Policies/ Procedures.</li> <li>Efficiency testing of personnel.</li> <li>Track inspections by Westnet.</li> <li>Regular rolling stock maintenance.</li> <li>Roll-by inspections.</li> <li>Container has full length rods at either end to prevent bursting open in a crash.</li> </ul>	4	1	5	Develop emergency containment and cleanup procedure for transport route.	1	1	2	
3	10/5/07	Container damaged but no product released.	<ul style="list-style-type: none"> <li>Derailment of wagon.</li> </ul>	<ul style="list-style-type: none"> <li>Container unsuitable for carriage.</li> </ul>	<ul style="list-style-type: none"> <li>NA.</li> </ul>	1	2	3	Develop a procedure to return damaged container to site.	2	1	3	
4	10/5/07	Damage or vandalism to container during transportation or staging.	<ul style="list-style-type: none"> <li>Access to containers by general public.</li> </ul>	<ul style="list-style-type: none"> <li>Container rupture or damage.</li> <li>Release of product exposure to personnel.</li> <li>Container not suitable for transport.</li> </ul>	<ul style="list-style-type: none"> <li>Under constant supervision enroute and staged at 24-hour yards.</li> </ul>	2	1	3	Bolt-sealed containers.	1	4	5	
5	10/5/07	Public concern about exposure to lead in their community.	<ul style="list-style-type: none"> <li>Existing community perception.</li> <li>Lack of balanced information.</li> </ul>	<ul style="list-style-type: none"> <li>Unnecessary community concern.</li> <li>Loss of business.</li> <li>Impact on company reputations.</li> </ul>	<ul style="list-style-type: none"> <li>None.</li> </ul>	3	5	8	Develop a road show to raise awareness and allay community concerns in communities through which the concentrate will be transported.	4	1	5	

## Magellan Metals Pty Ltd – Wiluna Lead Project

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Table 7 Treatment Plan: Transporting containerised concentrate by rail from Leonora to Fremantle

Ref No.	Date Reviewed	Risk Scenario	Proposed Treatments	Risk Rating after Treatment	Result of Cost-Benefit Analysis	Person Responsible	Timetable for Implementation	Details of Monitoring
1	10/5/07	Derailment enroute without release of product.	No treatments in addition to existing procedures.	NA	NA	NA	NA	NA
2	10/5/07	Derailment enroute damaging containers exposing or releasing the product (no injury to personnel and minimal damage to rolling stock and operations).	Develop emergency containment and cleanup procedure for transport route.	4	Accept	Environmental and Safety Superintendent - Magellan	Develop draft procedures by 31 May 2007 with final prior to commencement.	Annual review.
3	10/5/07	Container damaged but no product released.	Develop a procedure to return damaged container to site.	3	Accept	Environmental and Safety Superintendent - Magellan	Develop draft procedures by 31 May 2007 with final prior to commencement.	NA
4	10/5/07	Damage or vandalism to container during transportation or staging.	Bolt-sealed containers.	3	Accept	Manager Metallurgy - Magellan	31-May-07	NA
5	10/5/07	Public concern about exposure to lead in their community.	Develop a road show to raise awareness and allay community concerns in communities through which the concentrate will be transported.	6	Accept	<ul style="list-style-type: none"> <li>• General Manager Operations – Magellan.</li> <li>• Marketing Manager Goldfields – ARG.</li> </ul>	30-Jun-07	NA

**Magellan Metals Pty Ltd – Wiluna Lead Project**

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Table 8 Risk Register: Unloading containerised concentrate at the Port of Fremantle

Ref No.	Date Reviewed	Risk Scenario	Key Causes	Possible Consequences	Existing Controls	Inherent Risk			Proposed Treatments	Residual Risk			Comments
						Consequences	Likelihood	Risk Rating		Consequences	Likelihood	Risk Rating	
1	10/5/07	Dropping full containers.	<ul style="list-style-type: none"> <li>Mechanical failure on forklift (e.g., metal fatigue, hydraulic hose break).</li> <li>Driver leaving container forward of centre tipping forklift.</li> <li>Uneven loading of container to one end.</li> </ul>	<ul style="list-style-type: none"> <li>Container rupture or damage.</li> <li>Release of product exposure to personnel.</li> <li>Container not suitable for transport.</li> <li>Serious injury or death to personnel due to crushing.</li> </ul>	<ul style="list-style-type: none"> <li>Regular maintenance programs of forklift.</li> <li>Container inspection by shipping line.</li> <li>Forklift driver training and qualifications and procedures.</li> <li>Certification at site that containers have been loaded evenly.</li> <li>Container has full length rods at either end to prevent bursting open in a crash.</li> </ul>	4	3	7	<ul style="list-style-type: none"> <li>(a) Develop a procedure for loading product into containers.</li> <li>(b) Train the operators loading product into containers.</li> <li>(c) Develop emergency containment and cleanup procedure for the rail/terminal operator and the selected stevedore.</li> <li>(d) Develop a procedure to return damaged container to site.</li> </ul>	3	1	4	
2	10/5/07	Willful damage or vandalism to container releasing product.	<ul style="list-style-type: none"> <li>Access to containers by general public.</li> </ul>	<ul style="list-style-type: none"> <li>Container rupture or damage.</li> <li>Release of product exposure to personnel.</li> <li>Container not suitable for transport.</li> </ul>	<ul style="list-style-type: none"> <li>Maritime Security Area with security restricted access, cameras etc.</li> <li>Bolt-sealed containers.</li> </ul>	2	1	3	No additional treatments in addition to existing.	2	1	3	
3	10/5/07	Derailing wagons while unloading containers.	<ul style="list-style-type: none"> <li>Incorrect driving by forklift driver.</li> <li>Rolling stock moving during container unloading.</li> </ul>	<ul style="list-style-type: none"> <li>Broken or damaged container.</li> <li>Release of product.</li> <li>Damage to rolling stock.</li> <li>Delay to operations.</li> <li>Injury to personnel.</li> </ul>	<ul style="list-style-type: none"> <li>Shunt procedures and guidelines</li> <li>Three Step Protection.</li> <li>Interface Coordination Plan covering handling of containers at port.</li> <li>Signals out.</li> <li>Container has full length rods at either end to prevent bursting open in a crash.</li> </ul>	4	2	6	No additional treatments in addition to existing.	4	1	5	

**Magellan Metals Pty Ltd – Wiluna Lead Project**

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Table 9 Treatment Plan: Unloading containerised concentrate at the Port of Fremantle

Ref No.	Date Reviewed	Risk Scenario	Proposed Treatments	Risk Rating after Treatment	Result of Cost-Benefit Analysis	Person Responsible	Timetable for Implementation	Details of Monitoring
1	10/5/07	Dropping full containers.	(a) Develop a procedure for loading product into containers. (b) Train the operators loading product into containers. (c) Develop emergency containment and cleanup procedure for the Port of Fremantle with Fremantle Ports. (d) Develop a procedure to return damaged container to site.	4	Accept	(a) Manager Metallurgy – Magellan. (b) Manager Metallurgy – Magellan. (c) General Manager Operations – Magellan. (d) Environmental and Safety Superintendent – Magellan.	(a), (b) & (d) Develop draft procedures and training programs by 31 May 2007 with final prior to commencement. (c) 30 June 2007.	Review procedures and training as soon as practicable after commencement with annual reviews thereafter.
2	10/5/07	Willful damage or vandalism to container releasing product.	No additional treatments in addition to existing.	NA	NA	NA	NA	NA
3	10/5/07	Derailing wagons while loading containers.	No additional treatments in addition to existing.	NA	NA	NA	NA	NA

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Table 10 Risk Register: Storage and loading containerised concentrate at the Port of Fremantle

Ref No.	Date Reviewed	Risk Scenario	Key Causes	Possible Consequences	Existing Controls	Inherent Risk			Proposed Treatments	Residual Risk			Comments
						Consequences	Likelihood	Risk Rating		Consequences	Likelihood	Risk Rating	
1	25/5/07	Dropping full containers.	<ul style="list-style-type: none"> <li>Mechanical failure on forklift (e.g., metal fatigue, hydraulic hose break).</li> <li>Driver leaving container forward of centre tipping forklift.</li> <li>Uneven loading of container to one end.</li> <li>Traffic accident while moving container to Berths 4 and 5.</li> <li>Mechanical failure on wharf crane. Operator error on wharf crane. Operator fatigue.</li> </ul>	<ul style="list-style-type: none"> <li>Container rupture or damage.</li> <li>Release of product exposure to personnel.</li> <li>Container not suitable for transport.</li> <li>Serious injury / death to personnel due to crushing.</li> </ul>	<ul style="list-style-type: none"> <li>Regular maintenance programs of forklift and wharf crane.</li> <li>Container inspection by shipping line.</li> <li>Forklift and truck driver training and qualifications / procedures.</li> <li>Crane operator training and qualifications /procedures.</li> <li>Procedures to minimise fatigue.</li> <li>Road transport from railhead to Berths 4 and 5 done when other traffic is minimal..</li> <li>Container has full length rods at either end to prevent bursting open in a crash.</li> </ul>	4	2	6	<ol style="list-style-type: none"> <li>Develop a procedure for loading product into containers.</li> <li>Train the operators loading product into containers.</li> <li>Develop emergency containment and cleanup procedure for the rail/terminal operator and the selected stevedore.</li> <li>Develop a procedure to return damaged container to site.</li> </ol>	3	1	4	
2	25/5/07	Rupturing container with forklift.	<ul style="list-style-type: none"> <li>Operator error.</li> <li>Fatigue.</li> <li>Use of forklift with tynes rather than top lifting container handling machine.</li> </ul>	<ul style="list-style-type: none"> <li>Container rupture or damage.</li> <li>Release of product exposure to personnel.</li> <li>Container not suitable for transport.</li> </ul>	<ul style="list-style-type: none"> <li>Forklift driver training and qualifications / procedures.</li> <li>Procedures to minimise fatigue.</li> </ul>	3	2	5	Maximise the use of container handling machines (no tyne, top lift only).	1	1	2	
3	25/5/07	Willful damage / vandalism to container releasing product.	<ul style="list-style-type: none"> <li>General public gain access to container hardstand storage areas.</li> </ul>	<ul style="list-style-type: none"> <li>Container rupture or damage.</li> <li>Release of product exposure to personnel.</li> <li>Container not suitable for transport.</li> </ul>	<ul style="list-style-type: none"> <li>Hardstand storage areas are in an area where public access is restricted.</li> <li>Security patrols are in place.</li> <li>24/7 operation deters public access.</li> </ul>	2	1	3	Bolt sealed containers.	2	1	3	
4	10/5/07	Lead contamination of hardstand and surrounding areas.	<ul style="list-style-type: none"> <li>Lead dust on the outside of containers because they haven't been washed down.</li> </ul>	<ul style="list-style-type: none"> <li>Contamination of soil and potential exposure of personnel.</li> </ul>	<ul style="list-style-type: none"> <li>Existing procedure and truck wash facility to wash down kibbles and trailer.</li> <li>Strong existing culture of washdown procedure.</li> </ul>	2	1	3	Amendment of current procedure and equipment to handle new height of containers.	2	1	3	

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Table 11 Treatment Plan: Storage and loading containerised concentrate at the Port of Fremantle

Ref No.	Date Reviewed	Risk Scenario	Proposed Treatments	Risk Rating after Treatment	Result of Cost-Benefit Analysis	Person Responsible	Timetable for Implementation	Details of Monitoring
1	25/5/07	Dropping full containers.	<ol style="list-style-type: none"> <li>1. Develop a procedure for loading product into containers.</li> <li>2. Train the operators loading product into containers.</li> <li>3. Develop emergency containment and cleanup procedure for Fremantle.</li> <li>4. Develop a procedure to return damaged container to site.</li> </ol>	4	Accept	<ol style="list-style-type: none"> <li>1. Manager Metallurgy – Magellan.</li> <li>2. Manager Metallurgy – Magellan.</li> <li>3. Environmental and Safety Superintendent – Magellan.</li> <li>4. Environmental and Safety Superintendent – Magellan.</li> </ol>	Develop draft procedures and training programs by 15 June 2007 with final prior to commencement.	Review procedures and training as soon as practicable after commencement with annual reviews thereafter.
2	25/5/07	Rupturing container with forklift.	Maximise the use of container handling machines (no tyne, top lift only).	2	TBC between Fremantle Link Services and Magellan.	General Manager Operations - Magellan	15-Jun-07	
3	25/5/07	Willful damage / vandalism to container releasing product.	Bolt sealed containers.	3	Accept	Manager Metallurgy - Magellan	15-Jun-07	
4	25/5/07	Lead contamination of hardstand and surrounding areas.	Amendment of current procedure and equipment to handle new height of containers.	3	Accept	Manager Metallurgy - Magellan	<ul style="list-style-type: none"> <li>• Procedure by 15 June 2007.</li> <li>• Modification to washdown equipment prior to start.</li> </ul>	

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**8.8 APPENDIX 8: SOLAR DRYING PAD DECOMMISSIONING PLAN**

## Memorandum

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To : Peter Drygala (DOCEP)  
Cc : Andrew Wallace (DOIR), David Pickles (DEC), Mike Rowe (DOCEP)  
Date : 16<sup>th</sup> June 2007  
From : Paul Cullen & Ben Murphy  
Subject : Removal of Lead Concentrate Drying Pad

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### Background

Magellan Metals currently has lead concentrate stored (approximately 18,000dmt) on the operation's concentrate drying pad. The license for the use of this facility expires on the 20<sup>th</sup> of June 2007. With the commissioning of the new pressure filter in early April which is designed to achieve the correct moisture for concentrate shipment the drying pad would not have been required. However, the suspension of shipments in March 2007 and placement of the operation in care & maintenance on the 7<sup>th</sup> April has seen the material stranded on the pad.

An application is presently residing with DOIR to grant and extension for use of the pad until the 1<sup>st</sup> January 2008.

Future shipping plan's and arrangements are detailed in Magellan's Proposed Action Plan for the movement of lead concentrate in sealed containers via the Fremantle Port, scheduled for DEC submission in July 2007.

One component of this project submission is the requirement for a licensed area to be established for storage of FIBC's containing lead concentrate. An amendment to the operation's current dangerous good license was submitted to the Dangerous Goods branch of DOCEP on the 11<sup>th</sup> June 2007. Feedback from the Department, Peter Drygala, requested that a plan for the removal of the lead pad also be submitted.

### Timing

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At this point no fixed date can be given for the decommissioning and removal of the lead pad as this activity is dependent on the granting of the necessary approvals for recommencement of transport operations. As previously indicated, a request for an extension of use of the pad has been requested to the 1<sup>st</sup> January 2008.

It is anticipated that material on the pad will take approximately three months to remove once approvals to operate are obtained and the necessary infrastructure and equipment is in place to commence bagging operations and shipping of material. It is estimated that a total of five months will be required to decommission the pad.

Hence, a further extension for use of the concentrate pad may be required after the 1<sup>st</sup> January 2008 if the relevant approval processes are delayed.

### **Plan for Removal of Lead Pad**

*Resumption of Operation* - It is expected to take three months to remove the 18,000dmt of lead concentrate stored on the pad post the commencement of transportation. This material will be packaged and removed via one of the options detailed in the Magellan Fremantle Action Plan Proposal.

*After Three Months* - After three months of packaging and shipping the lead concentrate will have been removed from the pad. At this point the shed on the lead pad will be disassembled and cleaned. The materials utilised in the shed will be stored in a site lay down area for reuse in the plant.

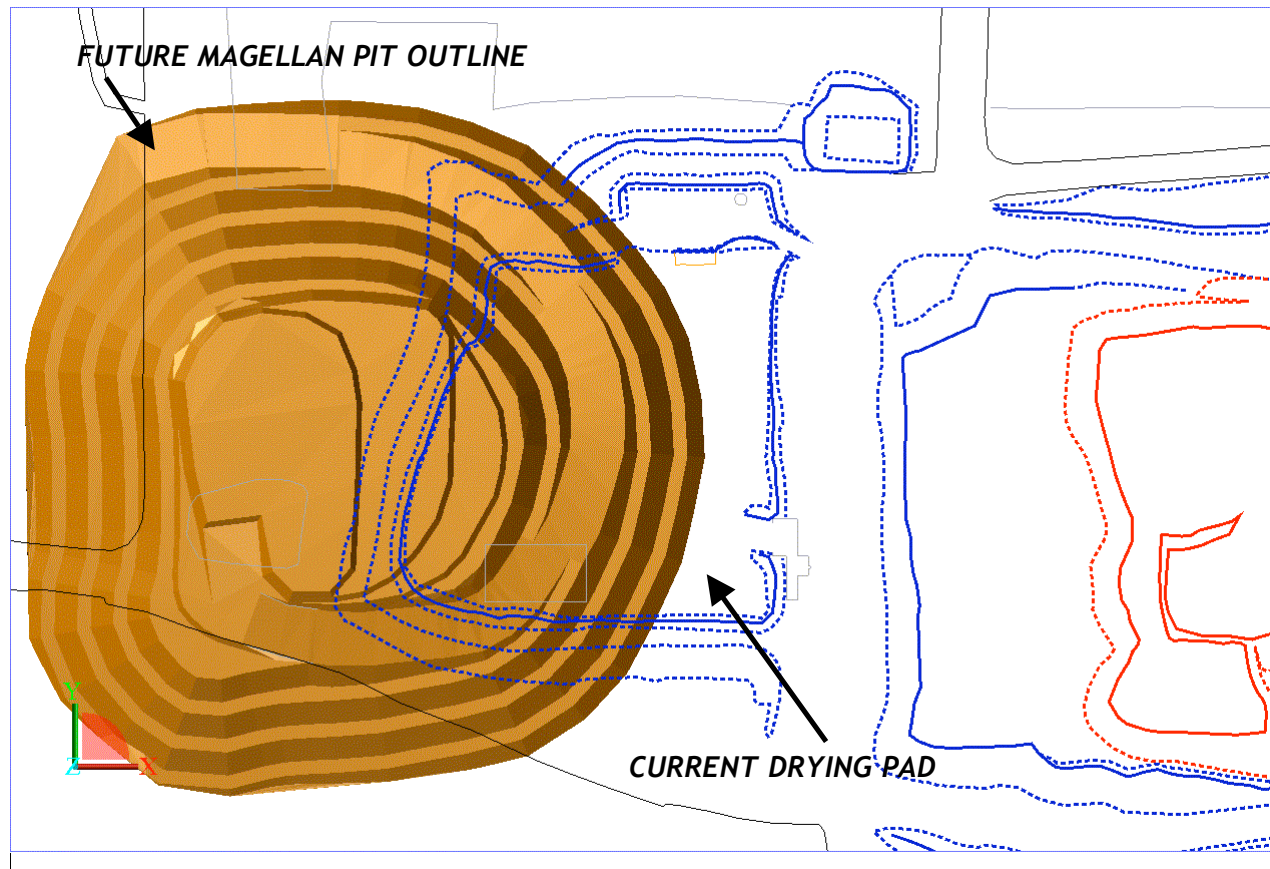
*After Four Months* - The remaining pad material, primarily consisting of mineralised waste (~1.5% Pb) will be removed and placed on the ROM pad for blending into processing plant feed.

*After Five Months* - Following the removal of the pad, the resultant area will be managed to minimise dust generation using the site water cart, as per the standard operating procedure for site hardstand operational areas.

~ 2011 - Based on the current mining plan, the majority of the drying pad will become part of Magellan pit (see Figure 1), with the remaining sections not directly enveloped by the Magellan pit to become part of the outer pit boundary. The timeframe and pit size and shape area are based on current mine planning and may change due to many other external factors such as metal price.

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*Figure 1: Plan view of future extension of Magellan pit in relation to current lead pad.*

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