Preliminary Hazard Analysis

Appendix E

Appendix E — Preliminary Hazard Analysis

E

KURRI KURRI BATTERY RECYCLING FACILITY

PRELIMINARY HAZARD ANALYSIS

EMM CONSULTING PTY LTD

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Title: **Kurri Kurri battery recycling facility** **Preliminary Hazard Analysis**	**QA verified:** H de Vries
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ABBREVIATIONS

AEGL	Acute Exposure Guideline Level
CXIS	CX Integrated System
DA	Development Application
DPE	Department Planning and Environment
EFFECTS	TNO consequence modelling software
EIS	Environmental Impact Statement
EP&A	Environmental Planning & Assessment
HAZID	Hazard Identification
HIPAP	Hazardous Industry Planning and Advisory Paper
kg	kilogram
kg/s	kilogram per second
km	kilometre
kPa	kilopascal
kW/m^2	Kilowatt per square metre
L	litre
m	metre
m/s	metre per second
MAOP	Maximum Allowable Operating Press
mg/m^3	milligrams per cubic metre
mm	millimetre
MPa	Megapascal
PHA	Preliminary Hazard Analysis
PPE	Personal Protective Equipment
ppm	Parts per million
SDS	(Material) Safety Data Sheet
SEPP	State Environmental Planning Policy
SO_2	Sulphur dioxide
SSD	State Significant Development
ULAB	Used Lead-Acid Battery

1. SUMMARY

1.1. General

Pymore Recyclers International Pty Ltd (Pymore) is proposing to construct a Used Lead-Acid Battery (ULAB) recycling facility (the project) at 129 Mitchell Avenue, Kurri Kurri (the site).

The project is designed to recycle approximately 60,000 tonnes per annum (tpa) of ULABs. The project will have four main processes – crushing, screening and separation; desulphurisation; crystallisation; and lead extraction. The entire process converts a ULAB into materials which are recycled for use in new products. Lead and plastics recovered are used in the production of new batteries. Sodium sulphate crystals, a by-product of ULAB recycling, can be readily used in other industries.

The project is a State Significant Development (SSD) which requires development consent under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). A Development Application (DA) for SSD is required to be accompanied by an Environmental Impact Statement (EIS). Based on the NSW Department of Planning and Environment (DPE) *Applying State Environmental Planning Policy (SEPP) 33* screening*,* Ref (1), a Preliminary Hazard Analysis (PHA) is required for inclusion in the EIS.

Sherpa was retained by EMM Consulting Pty Ltd (EMM) to conduct the PHA which will be appended to the EIS for the project.

1.2. Hazard Analysis

Hazard Analysis for the proposed battery recycling facility was carried out in accordance with NSW DPE Hazardous Industry Planning Advisory Paper (HIPAP) 6 *Hazard Analysis*, Ref. (2), and included the following steps:

- Identification of hazards resulting from the operations of the plant under study and identification of incidents with potential for impact offsite
- Assessment of the consequences for those scenarios that were judged to have offsite impact
- Assessment of the frequency and risk of scenarios confirmed to have an offsite impact in the consequence analysis
- Comparison of the estimated total risk resulting from the proposed facility with the appropriate criteria detailed in NSW DPE HIPAP 4 *Risk Criteria for Land Use Safety Planning*, Ref (3).

A review of design documents and Safety Data Sheets (SDSs) was undertaken to identify hazards from the storage of hazardous chemicals and the operation of the proposed facility. This resulted in identification of scenarios with the potential for offsite impact.

The resulting assessment of the scenarios identified as having an offsite impact is summarised in Table 1.1.

Table 1.1: Summary of the assessment results for potential offsite scenarios

Scenario no.	Scenario description	Assessment
INC-001	Failure of Desulphurisation process resulting in increased emissions of SO_2	Consequence modelling determined that the ground level SO_2 plume concentration would be approximately 0.01 ppm at 800 m. This is below the Acute Exposure Guideline Level (AEGL)-1 (irritation) criterion of 0.2 ppm, and hence in the context of HIPAP 6, there would be no offsite impact to people.
INC-002	Molten metal explosion in the foundry area due to contact with water	Consequence modelling determined a maximum distance to injury overpressure (7 kPa) of 13.6 m from the foundry, i.e. the overpressure remains on site. No offsite impact.
INC-003	Fuel gas release and ignition resulting in jet fire	Consequence modelling confirmed an offsite impact. Frequency and risk assessment determined that the individual fatality and injury risk as well as the escalation risk complied with the relevant criteria detailed in HIPAP 4, Ref (3).

1.3. Conclusions

The risk resulting from operations of the ULAB recycling facility was found to meet the relevant criteria detailed in HIPAP 4, Ref (3), for adjacent land uses.

The proposed battery facility is therefore not ‘hazardous’ as defined by the SEPP 33 guidelines, Ref (1).

1.4. Recommendations

The following recommendation was made during the risk assessment:

- An emergency 'automatic slam' shutoff valve be provided for the natural gas supply to isolate leaks.
- Review the effectiveness of the scrubbing system (reliability/redundancy) in the collection area, such that lead contaminated dust is prevented from being released to atmosphere.
- If the facility is to accept local ad-hoc deliveries then an approved collection area should be provided on- site. Options for providing a container and collection point near the front gate should be reviewed.
- Review options for fire detection in battery storage area.
- Develop a preventive maintenance schedule and procedures, especially for the scrubbing systems in order to reduce the likelihood of failure.

- Update this PHA when the design is finalised to form the Final Hazard Analysis (FHA) for the proposed development.

2. INTRODUCTION

2.1. Background

This Preliminary Hazard Analysis (PHA) has been prepared by Sherpa Consulting Pty Ltd (Sherpa) for Pymore Recyclers International Pty Ltd (Pymore) proposed Used Lead-Acid Battery (ULAB) recycling facility (the project) at 129 Mitchell Avenue, Kurri Kurri (the site).

The project is designed to recycle approximately 60,000 tonnes per annum (tpa) of ULABs. The project will have four main processes – crushing, screening and separation; desulphurisation; crystallisation; and lead extraction. The entire process converts a ULAB into materials which are recycled for use in new products. Lead and plastics recovered are used in the production of new batteries. Sodium sulphate crystals, a by-product of ULAB recycling, can be readily used in other industries.

The project is a State Significant Development (SSD) which requires development consent under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). A Development Application (DA) for SSD is required to be accompanied by an Environmental Impact Statement (EIS). Based on the NSW DPE *Applying SEPP 33* screening, Ref (1), a PHA is required for inclusion in the EIS. This PHA will be appended to the EIS for the project.

2.2. Study objectives

The high level objective of the PHA was to develop a comprehensive understanding of the hazards and risks associated with the proposed facility and of the adequacy of safeguards. This is in line with the requirements of the DPE HIPAP 6 *Hazard Analysis*, Ref (2), and Multi Level Risk Assessment, Ref (4).

2.3. Limitations and exclusions

The limitations of this PHA are as follows:

- This report contains assumptions relating to site layout and process conditions. These assumptions are identified in the report.
- The SEPP 33 screening relies on information provided by EMM and Pymore.
- Assessment of routine solid, liquid and gaseous emissions from the site is beyond the scope of the PHA, which is intended to focus on the impact of abnormal operations due to equipment failure, with associated acute effects. Normal emissions impacts are assessed in the EIS.

The exclusions of this PHA are as follows:

- Onsite risk and Occupational, Health and Safety (OHS) issues are not assessed.
- Transport of hazardous materials assessment is carried out in a separate report, which is the Route Evaluation Study, Ref (5).

3. DESCRIPTION OF DEVELOPMENT

3.1. Location and surrounds

The site is in the Cessnock local government area, approximately 40 km northwest of Newcastle (Figure 3.1). The site will occupy part (approximately 3.4 ha) of the lot on which the Weston Aluminium Dross Recycling Plant (the aluminium plant) is located within Lots 796 and 797, DP 39877.

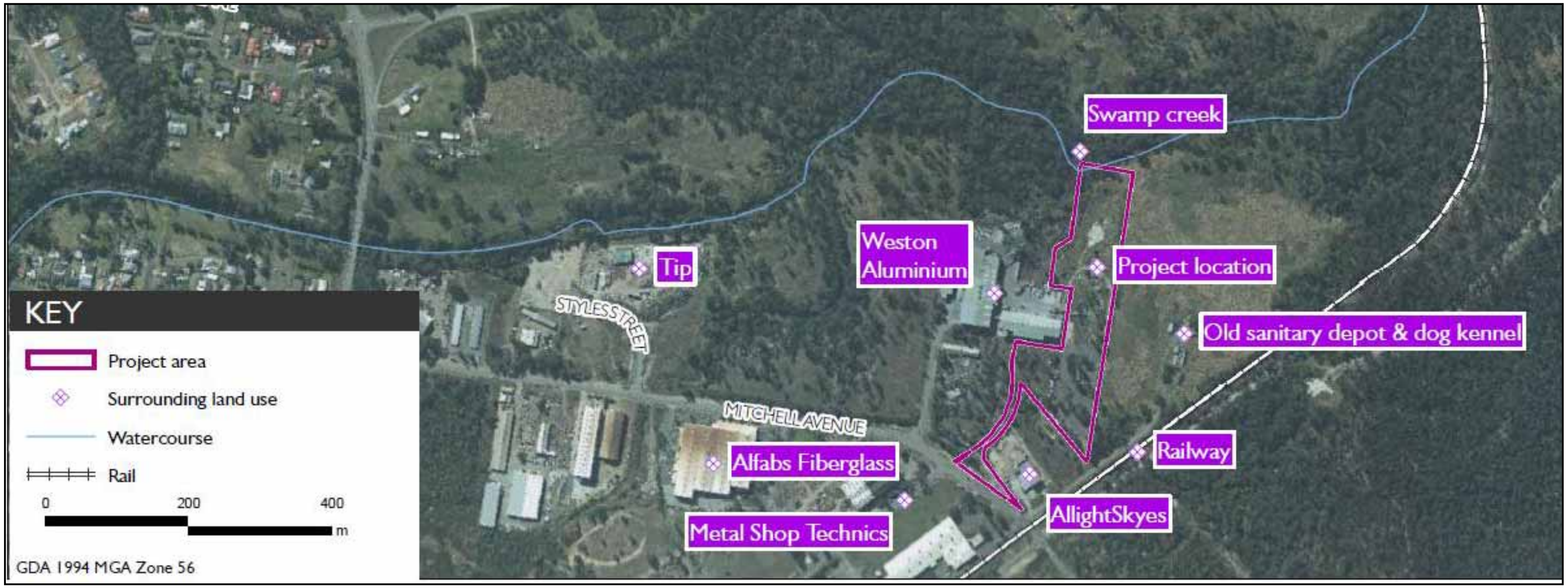
The site currently comprises undeveloped land used for the storage of unused industrial equipment for the aluminium plant. Some remnant native vegetation occurs in the southern portion of the site.

Surrounding land uses are primarily industrial as shown in Figure 3.2, including the aluminium plant, a waste-water treatment facility 750 m to the east, and the Hydro Aluminium Kurri Kurri smelter 1.3 km to the north. The residential areas of Kurri Kurri and Weston are approximately 650 m to the south-east and 1,000 m to the west of the site, respectively. The Hunter Expressway is approximately 550 m to the north-east. Swamp Creek is approximately 70 m to the north.

The site is zoned IN3 Heavy Industrial under the Cessnock Local Environmental Plan 2011 (Cessnock LEP).

Figure 3.1: Site location

Figure 3.2: Surrounding land use



3.2. Process design

The battery recycling facility will process ULABs using the CX Integrated System (CXIS) supplied by Engitec Technologies S.p.A (Engitec). The CXIS uses a combination of hydro-metallurgical and pyro-metallurgical process for the recovery of lead and associated by-products. This technology is used in over 60 plants worldwide to treat ULABs and is used in a facility located in Wagga Wagga.

The ULAB recycling plant would have four main processes – crushing, screening and separation; desulphurisation; crystallisation; and lead recovery – which are described further below. The entire recycling process converts a ULAB into materials which are recycled for use in new products. Lead and plastics recovered are used in the production of new batteries. Sodium sulphate crystals are a by-product of ULAB recycling which are readily used in other industries.

The detailed process flow, with production values is provided in APPENDIX B.

3.2.1. Crushing, screening and separation

The ULABs are sent through an automatic de-palletiser, into a vibrating feed hopper, and transported on a belt conveyor into a crushing mill. To protect the crusher a metal detector is installed to remove iron and other unwanted metallic objects while the batteries are still on the belt conveyor. The batteries are crushed to 50 – 80 mm in size. The crushing mill is fully enclosed in an acoustic chamber to mitigate noise as well as prevent dust emissions.

The crushed materials pass through a rotating screen and are wetted down with high pressure water sprayers using recycled water. The screen separates the solid and liquid components of the batteries. These materials include:

- lead metals such as battery posts (or poles) and battery plates (grids); and
- crushed polypropylene plastic from the battery casing and cover; and
- a slurry solution composed mainly of lead pastes from the battery plates and the electrolyte in the battery.

The solid components (lead metals and plastics) go through a further hydrodynamic separation process using controlled flow of recycled water, which naturally separates the materials due to their differences in density. The solid metals are collected and fed into the rotary furnace, while the plastics (polypropylene) are washed, cleaned and sent to battery production facilities where they are pelletized and reused as battery casings and covers.

3.2.2. Desulphurisation and crystallisation

The slurry solution of lead sulphates, lead oxides and sulphuric acid goes through a desulphurisation process which effectively removes the sulphur from lead sulphates and sulphuric acid. This is an important step in minimising sulphur (sulphur dioxide and sulphur trioxide) emissions by eventually converting them to a solid form instead of gases emitted from the furnace. Removal of the sulphur prior to feeding the material to the furnace significantly improves recovery efficiency.

Desulphurization involves mixing the slurry solution with soda ash to produce sodium sulphate. The resulting solution is further processed in a filter press which separates the desulphurised lead paste from the sodium sulphate solution.

The liquid sodium sulphate is processed further through crystallization which removes water, purifies, and converts the solution to sodium sulphate crystals. Sodium sulphate crystals are packed and sold commercially to glass and detergent manufacturers.

3.2.3. Lead recovery

The lead recovery process uses a furnace to melt the lead metals and lead oxide from the lead paste, subjecting them to high temperatures to recover the lead and produce lead bullion.

Desulphurised lead paste is fed into a rotary furnace, mixed with the solid metals and some fluxing agents, and processed under high temperatures into lead bullion. The rotary furnace will be completely enclosed to prevent release of fugitive emissions. Dust and smoke suction chambers and closed ducting systems convey the dust and smoke to a series of filters inside a filter bag house to ensure that air emissions are clean and free from lead particulates. The lead bullion is sent to battery production facilities for production of new batteries.

3.3. Site layout

The site layout is shown in Figure 3.3. The main plant areas are located within the enclosed process building (Building 5) with the main process flow proceeding along the major length of the building. Building 5 is located about 165 m from the main entrance on Mitchell Avenue, and comprises:

- The truck unloading area
- The CXIS plant area (battery breaking and separation)
- The processing area (desulphurisation and crystallisation)
- The furnace preparation area
- The furnace area
- Scrubbing unit.

Attached to or near the plant building are the following:

- The sodium sulphate crystallisation area
- Bag houses
- Slag demolition area.

Also located on site are the following:

- Workshop, warehousing and amenities located in a building near the main plant building
- Offices and weighbridge located near the main entrance
- Effluent treatment located near the western boundary
- A truck wash area beside the foundry area adjacent to Building 5.

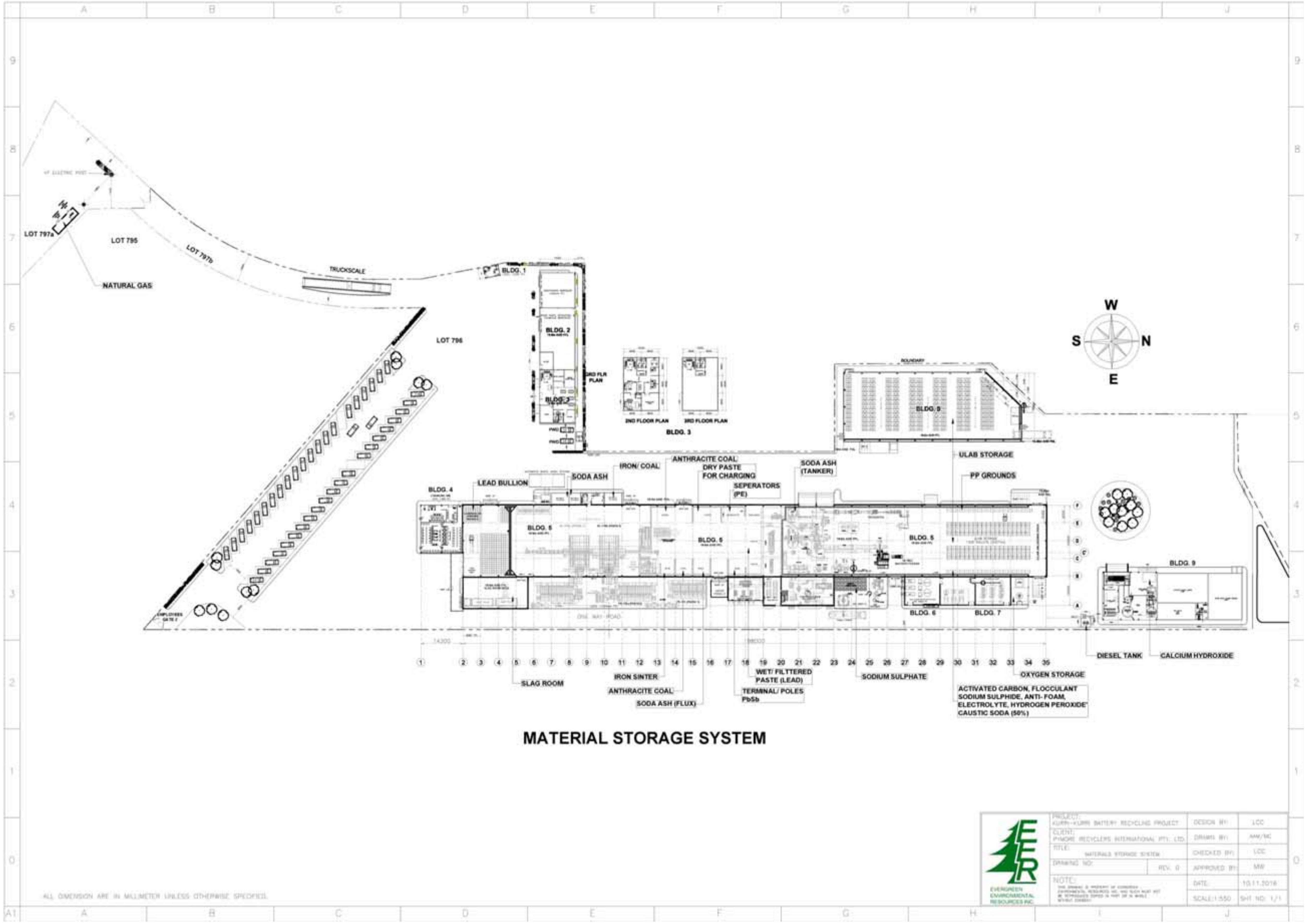
3.4. Transportation of goods

Shipment of ULABs to the site and distribution of finished products as well as waste removal will be by road. Proposed total commercial vehicle movements will average a total of 97 vehicles per week (in and out). These commercial vehicles include B-double road tankers, semi-trailers, small and large trucks and couriers.

3.5. Hours of operation

When the facility is operating to its full capacity, it will run for 20 hours per day and 310 days per year. Approximately 60 full time operational staff and 13 contractors would be employed at the proposed facility. Workforce shift operations typically result in three shifts on weekdays for the majority (63 persons) of the site workforce. Ten administration staff would typically work normal business hours.

Figure 3.3: Site layout



3.6. Hazardous chemicals

3.6.1. Safety data sheets

Hazardous chemicals will be stored at the proposed facility for use in the ULAB recycling process. A summary of the chemical storage is provided in APPENDIX D, based on SDSs provided in APPENDIX C. Approximate locations of the storage areas are provided in Figure 3.3.

In addition, the proposed facility would also have a number of hazardous chemicals produced by the process which could have potential off site impacts. These are reviewed in the hazard identification in Section 5.

3.6.2. SEPP 33 screening

To determine whether a proposed development is potentially hazardous and hence requires a PHA, the risk screening process in the NSW DPE Applying SEPP33 guideline Ref. (1) considers the type and quantity of hazardous materials to be stored on the site and the distance of the storage area to the nearest site boundary, as well as the expected number of transport movements.

From the information in APPENDIX D, the assessment in Table 3.1 was constructed. As the quantity of hazardous chemicals will exceed the SEPP 33 screening threshold, the proposed facility is classified as 'potentially hazardous'.

Table 3.1: Site SEPP 33 screening

			Quantities in tonnes		
Class	**Sub**	**PG**	**Stored**	**Threshold in SEPP 33, Ref (1)**	**Potentially hazardous?**
2.2	5.1	-	25	N/A [(a)]	No
5.1	8	II	21	5	Yes
8[(b)]	-	II	1096	25	Yes

(a) Non-flammable, non-toxic gases and are not considered to be potentially hazardous with respect to off-site risk.
(b) Predominantly sulphuric acid within the ULABs.

4. HAZARD ANALYSIS METHODOLOGY

4.1. Overview

The PHA for the proposed battery recycling facility was carried out in accordance with HIPAP 6, Ref. (2), and included the following steps:

- Identification of hazards resulting from the operations of the plant under study and identification of incidents with potential for impact offsite
- Assessment of the consequences for those scenarios that were judged to have offsite impact
- Assessment of the frequency and risk of scenarios confirmed to have an off site impact in the consequence analysis
- Comparison of the estimated total risk resulting from the proposed facility with the appropriate criteria for acceptable risk.

Multi Level Risk Assessment, Ref (4), sets out three levels of risk assessment that may be appropriate for a PHA, as shown in Table 4.1. This document was consulted to identify the level of assessment required in this study.

Table 4.1: Level of Analysis

Level	Type of analysis	Appropriate if:
1	Qualitative	No major offsite consequences and societal risk is negligible
2	Partially Quantitative	Offsite consequences but with a low frequency of occurrence
3	Quantitative	Where level 1 and 2 are exceeded

4.2. Criteria

4.2.1. Consequence criteria

Criteria are provided in HIPAP 4, Ref (3), for consequences. Criteria are reproduced below for overpressure and fire consequences. The criteria adopted for toxic impact for specific chemicals are also provided.

Table 4.2: Overpressure consequence criteria

Overpressure (kPa)	Definition extract from HIPAP 4	Definition in this report
35	50% chance of fatality for a person in a building	-
21	20% chance of fatality for a person in a building Damage to reinforced structures	-
14	Severe damage to residences	Fatality
7	10% chance of injury	Injury
4	90% glass breakage - Very Low probability of injury	-

Table 4.3: Fire consequence criteria

Thermal radiation (kW/m^2)	Definition extract from HIPAP 4	Definition in this report
4.7	Will cause pain in 1 5-20 seconds and injury after 30 seconds' exposure (at least second degree burns will occur)	Injury
12.6	Significant chance of fatality for extended exposure.	Fatality
23	Spontaneous ignition of wood after long exposure Unprotected steel will reach thermal stress temperatures which can cause failure	Escalation/ structural damage

Table 4.4: Toxic consequence criteria for SO_2

Value (30 min exposure)	Source [(a)]	Definition in this report
0.2 ppm (0.5 mg/m^3)	Acute Exposure Guideline Level 1	Irritation
0.75 ppm (2 mg/m^3)	Acute Exposure Guideline Level 2	Injury
30 ppm (79 mg/m^3)	Acute Exposure Guideline Level 3	Fatality
(a) HIPAP 4, Ref (3) states that toxic impacts should be specified in terms of irritation, injury and fatality. For this study, AEGL values were used as the most appropriate source (https://cameochemicals.noaa.gov/chemical/1554).		

4.2.2. Risk criteria

Criteria are provided in HIPAP 4, Ref (3), for risk. Criteria are reproduced below for fatality, injury and accident propagation/escalation.

Table 4.5: NSW individual fatality risk criteria

Criteria (risk in a million per year)	Land-Use
0.5	Hospitals, child-care facilities and old age housing developments
1	Residential developments and places of continuous occupancy such as hotels and tourist resorts
5	Commercial developments, including offices, retail centres, warehouses with showrooms, restaurants and entertainment centres
10	Sporting complexes and active open space areas
50	Industrial – must not be exceeded any boundary adjacent to another industrial facility

Table 4.6: NSW individual injury risk criteria

Criteria (risk in a million per year)	Land-Use
50	Residential areas – 4.7 kW/m^2 heat flux radiation
50	Residential areas – 7 kPa explosion overpressure
10	Residential areas – injurious toxic concentrations
50	Residential areas – toxic concentrations causing irritation

Table 4.7: NSW accident propagation/escalation risk criteria

Criteria (risk in a million per year)	Land-Use
50	Potentially hazardous installations – 23 kW/m^2 heat flux radiation (flame impingement)
50	Potentially hazardous installations – 14 kPa explosion overpressure

5. HAZARD IDENTIFICATION

5.1. Overview

The hazard identification exercise comprised:

- A review of hazards implicit in the chemicals and materials handled at site (refer to APPENDIX D)
- A review of significant incidents in the battery recycling industry
- A hazard identification review by Sherpa, based on:
  - available information, and previous reviews of sites with the same process
  - a Basel Convention document, Ref. (6), which provided guidelines for managing the safety impacts of battery recycling facilities.

The identified hazards were then extended and developed into hazardous scenarios which could be carried forward for further analysis.

5.2. Review of significant incidents

A review of past incidents at similar facilities was undertaken, using:

- The Australian Government Emergency Management Australia Disasters Database Ref (7)
- Japan Science and Technology Agency Failure Knowledge Database Ref (8)
- European Major Accident Reporting System Ref (9).

No incidents were found that directly related to a battery recycling facility, except for one incident related to mechanical handling.

Several incidents were found relating to hydrogen peroxide and the class 8 substances that will be stored at the proposed facility. However, these involved bulk storage of chemicals and inadequate separation of incompatible substances.

From the review, no significant incidents were found and so no information could be used to inform the hazard identification (HAZID).

5.3. Hazard identification word diagram

Table A.1 in APPENDIX A shows the HAZID table for the proposed facility, and was reviewed by EMM and Pymore. The table identifies the following for each scenario:

- The hazardous event
- The consequence of the event
- The initiating causes of the event.

The safeguards proposed which will either reduce the likelihood of the event occurring or minimise the consequences of the event if it should occur. Safeguards can be classified as:

- Prevention
- Detection
- Mitigation
- Any recommendations for additional safeguards or actions
- Whether the scenario has a potential offsite impact. (Scenarios identified to have an offsite impact were coded, e.g. INC-001).

5.4. Potentially hazardous scenarios

From Table A.1, a summary of hazardous events with the potential for offsite impact was derived. This is presented in Table 5.1.

Table 5.1: Summary of incidents assessed to have potential offsite impacts

Scenario No.	HAZID Minute	Scenario Description	Safeguards
INC-001	16	Failure of desulphurisation process resulting in increased emissions of SO_2	Monitoring of plant operation (flows, pH) Shutdown and repair plant Untreated paste not passed onto foundry Stock pile of desulphurised paste will allow recovery operations to proceed
INC-002	24	Molten metal explosion in the foundry area due to contact with water	Preheating of crucibles Control of water sources Separation distance to other plant areas. Wet paste not passed onto furnace.
INC-003	25	Fuel gas release and ignition resulting in fire	Inspection/maintenance of systems

6. CONSEQUENCE ANALYSIS

6.1. Release scenarios

The consequences of the hazards which were identified for further quantitative assessment in Table 5.1 are described in the following sections.

6.2. Failure of desulphurisation process (INC-001)

In the unlikely event of desulphurisation failure, the lead paste output from the plant would have residual levels of electrolyte (H_2SO_4) and lead sulphate. The electrolyte solution would be removed in the neutralisation process and then transferred to Crystallization for conversion to Sodium Sulphate crystals and therefore will not be carried over with the lead paste. It was conservatively assumed that in the worst case, the residual lead sulphate will be carried over with the dewatered lead paste and then to the furnace where the sulphate will be oxidised and will result in an increased rate of emission of SO_2.

The rate of SO_2 emission was taken from the tests conducted on a battery recycling facility of the same capacity as the proposed facility in Canada. This is described in Section 10.2 of Ref (10) and estimates a sulphur content of the paste of 5.5%. This is higher than the process flow charts in APPENDIX B, which estimate 3.5% sulphur, so the SO_2 emission rate can be seen as conservative.

The worst case rate of emission of SO_2 from the furnace was measured as 45.5 g/s for the sulphurised case (this compares with 7 g/s for the desulphurised case).

The calculated emission rate is conservative as it assumes complete failure of the desulphurisation process and the plant is not shut down. For the scenario to occur, a number of simultaneous failures would have to take place. The increased emission rate will also be of a short duration while the plant is shutdown, and there will be no long term offsite impacts.

Modelling described in Section 10.2 of Ref (10) resulted in a maximum half hour averaged point of impingement concentration of 0.23 mg/m^3 at a distance of 690 m from the release point. However, the model input parameters were not apparent and so DNV-PHAST v7.11 was used to model the scenario. From this modelling, the ground level concentration was determined to be approximately 0.01 ppm at 800 m, thus meeting the AEGL-1 criteria of 0.2 ppm (irritation), AEGL-2 criteria of 0.75 ppm (injury) and AEGL-3 criteria of 30 ppm (fatality) (refer to Section 4.2). In the context of HIPAP 6, Ref (2), there would be no offsite impact to people from this scenario.

6.3. Molten metal explosion in the foundry area (INC-002)

The process of molten metal explosions is complex and is understood to result from the rapid expansion of steam generated as water comes into contact with the molten metal. The contact results in a rapid increase in thermal energy as follows:

- the sensible heat of the increasing temperature of the water from ambient to the boiling point of water
- the latent heat of vaporisation at the phase change as the water boils at atmospheric pressure
- the sensible heat of the increase of temperature of the water from the boiling point to the equilibrium temperature of the molten metal/water mixture.

The explosive impact results from the superheating of water above the atmospheric boiling point of water. The increase in thermal energy and superheating results in a rapid expansion of steam which in turn results in the molten metal explosion impact.

For the assessment, a 1 kg mass of water (e.g. a full water bottle) was assumed to inadvertently come into contact with the molten metal as greater quantities would likely be detected. The thermal energy release was then converted to an equivalent mass of TNT assuming that all the thermal energy is converted to the explosion impact. The effect is determined by the temperature of the molten metal (assumed to be the maximum temperature of the furnace, 1100°C).

The consequence assessment of the impact of molten metal explosions has been undertaken in APPENDIX E. The results of the analysis are summarised in Table 6.1, which shows the distance to overpressure criteria defined in Section 4.2. The results show that the impact distance is relatively small and, as the foundry is approximately 20 m from the site boundary, overpressure causing injury would not extend offsite.

Table 6.1 Distance to explosion overpressure (molten metal explosion in foundry)

Overpressure (kPa)	Criteria	Distance to overpressure impact (m)	Distance to site boundary (m)
14	Fatality	8.7	20
7	Injury	13.6	20

6.4. Fuel gas release and fire (INC-003)

The fuel gas for the furnace will be provided by a natural gas supply taken from a distribution pipeline. The gas supply will be let down by a gas regulator station, which is assumed to be located at the gas metering skid located adjacent to the site entrance (refer to Figure 3.3). The pipe line will be buried from the outlet of the metering station up to the first column of Building 5, beside Building 4. A pipe riser will then go to the pipe racks near the roof of Building 5 roof and run to the point-of-use.

An analysis was undertaken to determine the consequences of ignited gas release. The following assumptions were made in the assessment:

- The impact of releases from the main gas pipeline was not assessed as this is an existing line.

- Gas releases could occur from natural gas pipeline and equipment both upstream and downstream of the regulator station. The Maximum Allowable Operating Pressure (MAOP) of the distribution side of the regulator was taken as 2 MPa gauge and the downstream side of the regulator was assumed to be 100 kPa gauge which is further reduced to the required burner pressure.
- The regulator station would be provided with bollards to prevent vehicle impact damage to the station.
- Gas releases could occur from holed pipework, flange leaks and valve leaks, but were assessed to occur at the metering station which was observed to have multiple valves and flanged connections. Hole sizes of 10 mm, 25 mm and 50 mm were used, which correspond to small, medium and full bore rupture.
- The gas releases were modelled as horizontal releases as this has the longest impact distance to heat radiation levels of interest.

The assessment of the impact of a fire due to a fuel gas leak is given in APPENDIX E, and was undertaken using TNO Effects v9.

The results of the analysis are summarised in Table 6.2, which compares the impact distances against criteria defined in Section 4.2.

From the site layout, the metering skid was observed to be approximately 1 m from the site boundary and thus the jet fires would impact offsite locations.

Depending on the routing of the pipework downstream of the metering station (ie to the foundry), fires could result in plant damage and injury to workers in the vicinity of the leak. It is therefore recommended that a remotely operated shutoff valve be provided for the fuel gas supply to ensure that leaks can be isolated.

Table 6.2: Fuel gas release and fire results

Hole Diameter (mm)	Release Rate (kg/s)	Flame Length (m)	Distance to Heat Radiation Levels of Interest (m)			Distance to site boundary (m)
			$23kW/m^2$	$12.6kW/m^2$	$4.7kW/m^2$	
Upstream Releases (2MPa gauge)						
10	0.05	3.0	3.6	3.9	4.7	1
25	0.33	7.0	7.0	8.7	11	1
50	1.25	13	16	17	21	1

6.5. Conclusions of consequence assessment

Table 6.3 summarises the results of the consequence assessment for the identified scenarios. As INC-003 was assessed to have an offsite impact in terms of fatality and injury, this was carried forward to frequency assessment.

Table 6.3: Summary of consequence assessment results

Scenario No.	Scenario Description	Offsite Impact?	Comments
INC-001	Failure of Desulphurisation process resulting in increased emissions of SO_2	No	Maximum downwind concentration was derived from work carried out by Engitec, Ref (10), and AUSPLUME modelling. The concentration of 0.4 mg/m^3 is less than the AEGL-2 (injury) criterion of 2 mg/m^3. ***No further analysis is required.***
INC-002	Molten metal explosion in the foundry area due to contact with water	No	Maximum distance to injury overpressure (7 kPa) 13.6 m from the foundry, and is retained on site. ***No further analysis is required.***
INC-003	Fuel gas release and ignition resulting in a fire	Yes	Provide an emergency 'automatic slam' shutoff valve for fuel gas supply to isolate leaks. ***Further analysis of frequency required.***

7. FREQUENCY ANALYSIS

INC-003 was assessed to have an offsite impact in terms of fatality and injury, hence a frequency assessment was carried out. The fire frequency resulting from a fuel gas release was calculated based on:

- generic equipment leak frequencies
- a count of the equipment items, with reference to the metering skid layout
- ignition probabilities based on the leak rate
- direction adjustment, i.e. the chance that the jet fire would go offsite (to the east of the site
- No additional probabilities were used, e.g. detection and isolation.

Further details of the analysis are provided in APPENDIX F, and the resulting frequency of a fire for each hole size category is shown in Table 7.1.

Table 7.1: Fire frequencies

Hole size	Total leak frequency (per year)	Mass flow rate (kg/s)	Ignition probability	Direction	Total jet fire frequency (per year)
10 mm	6.07E-04	0.05	0.01	0.5	3.04E-06
25 mm	4.85E-05	0.33	0.01	0.5	2.43E-07
50 mm	1.75E-06	1.25	0.07	0.5	6.13E-08
				Total	***3.34E-06***

8. RISK ASSESSMENT

8.1. Risk evaluation - site scenarios

Fuel gas release and fire was the only scenario found with offsite impact. The frequency of the ignited release was therefore calculated assuming that all of the gas metering station was operating at 2 MPag, and that all hole sizes resulted in the maximum consequence distance, i.e. assuming a 50 mm leak. This leads to a conservative estimation of the risk. The resulting risk was calculated to compare against the criteria based on the thermal radiation levels from the consequence analysis.

The results are presented in Table 8.1, where it can be seen that the risk posed by the natural gas metering skid meets all of the required criteria.

Table 8.1: Risk comparison against criteria

	Escalation (23 kW/m^2)	**Fatality (12.6 kW/m^2)**	**Injury (4.7 kW/m^2)**
Individual risk (per year) @ distance from source	3E-06 @ 16 m	3E-06 @ 17 m	3E-06 @ 21 m
Outcome - comparison with risk criteria	Escalation risk does not exceed 5E-05 per year	Does not affect residential areas, sensitive land use or active open space Fatality risk does not exceed 5E-05 per year	Does not affect residential areas
Results	**Complies**	**Complies**	**Complies**

8.2. Risk evaluation - off site scenarios

This assessment has found that incidents resulting from the operation of the proposed ULAB recycling facility would not impact offsite areas in terms of injury and fatality. The potential for external incidents from adjacent sites that could affect the proposed facility were also reviewed, by investigation of publically available Preliminary Hazard Analyses. No PHA could be found for the sites immediately adjacent to the proposed facility, i.e. Weston Aluminium and Allightsykes, and it is therefore concluded that events from adjacent facilities impacting on the proposed facility are of minimal concern.

Other external events are considered in Table 8.2.

Table 8.2: External events

Issue	Discussion
External Flooding	Flooding is accounted for within the design, and the following mitigation measures will be in place in the event flood level reaches above 16.6 m Australian Height Datum: • lead paste/slag storage areas will be encased with concrete materials • weir gates on all doors of encasements, i.e. material preparation area & slag room where Average Recurrent Interval level is 18.1 m Australian Height Datum • ULAB warehouse will be fitted with 7-layered Racking System where a 1.5 m high 1st-layer slots are vacant. Thus, attaining an Average Recurrent Interval level of 18.1 m Australian Height Datum.
Earthquakes	According to GSHAP this area is classified as a low to moderate earthquake hazard.
Land slip/ subsidence	No potential subsidence issues identified.
Cyclones	Not a high wind risk area. Facility structures designed in accordance with relevant codes.
Lightning	Systems complying with relevant Australian Standards to be installed to manage the risks associated with lightning.
Plane crash	Not in flight path. Risk not considered significant.
Vehicle crash	Not exposed to outside traffic. Site speed limits and plant protection for structures installed to prevent vehicle impact on critical plant.
Utilities failure	Loss of power results in “fail safe” condition.
Bushfire	According to the bush fire risk management plan, Ref (11), the site is located in an area with a low bush fire frequency (<1), and as such, bushfires are not perceived as a significant issue.

8.3. Risks to biophysical environment

The main concern relating to environmental risk from accident events is generally with effects on whole systems or populations. For completeness, risks to the biophysical environment due to loss of containment events, and control measures in place to prevent or reduce any impacts are briefly summarised below.

8.3.1. Escape of materials to atmosphere

Hazardous gaseous emissions from the proposed facility include toxic combustion products and metallic dusts, e.g. lead. These are primarily air quality issues and are covered in the EIS.

A large loss of containment of gaseous materials was not identified and no incident scenarios were identified where whole systems or populations could be affected by the release.

8.3.2. Escape of materials to soil, waterways or sewerage system

Chemicals Stored in Bunded Areas

Chemicals stored include various acids and alkalis. Any spillages will be contained in bunds and flow to the neutralisation tanks for treatment and to be recycled as process water.

Oily Materials

Oily materials, e.g. used for maintenance, spilt in the plant or maintenance areas, drain to an oil/water separator with sufficient capacity to handle spills of oil or diesel from equipment items.

Drainage systems and site grades:

All runoff/stormwater from the proposed facility will be collected and diverted to the facility waste water treatment plant. In addition, the proposed facility will have a stormwater detention dam.

8.4. Conclusions

The risk resulting from operations of the ULAB recycling facility was found to meet the DPE criteria for adjacent land uses.

The proposed battery facility is therefore not ‘hazardous’ as defined by the SEPP 33 guidelines Ref (1) as the assessed risk levels meet the DPE risk criteria for surrounding land uses.

8.5. Recommendations

The following recommendation was made during the assessment:

- An emergency 'automatic slam' shutoff valve be provided for the natural gas supply to isolate leaks.
- Review the effectiveness of the scrubbing system (reliability/redundancy) in the collection area, such that lead contaminated dust is prevented from being released to atmosphere.
- If the facility is to accept local ad-hoc deliveries then an approved collection area should be provided on- site. Options for providing a container and collection point near the front gate should be reviewed.
- Review options for fire detection in battery storage area.
- Develop a preventive maintenance schedule and procedures, especially for the scrubbing systems in order to reduce the likelihood of failure.
- Update this PHA when the design is finalised to form the FHA for the proposed development.

APPENDIX A. HAZARD IDENTIFICATION

Table A.1 shows the hazard identification table for the proposed facility. The table identifies the following for each scenario:

- The hazardous event
- The consequence of the event
- The initiating causes of the event
- The safeguards proposed which will either reduce the likelihood of the event occurring or minimise the consequences of the event if it should occur. Safeguards can be classified as:
  - Prevention
  - Detection
  - Mitigation
- Any recommendations for additional safeguards or actions
- Whether the scenario has a potential offsite impact. (Incidents which have been identified to have an offsite impact have been identified with a code, e.g. INC 001 for clarification in reporting).

Incidents related to transport of material to and from the proposed facility are covered in the Route Evaluation study, Ref (5).

Table A.1: Hazard Identification Table

HAZID No	Hazardous Events	Potential Consequence / Effects	Threats / Causes	Safeguards			Assessment / Recommendations	Potential offsite impact?	Comments
				Prevention	Detection	Mitigation			
Collection									
1.	Electrolyte spill at collection point	Environmental impact - burns on contact (operator injury)	Leaky battery, dropped loads	Acid resistant containers. Handling procedures to ensure that electrolyte is contained during collection and transport	Inspection for leaky batteries at receiving end or collection point	Sealed, bunded, storage areas, drain to collection point Emergency eyewash and shower at strategic locations. Acid spill kit available at the clinic.	If recycling facility site is to accept local ad hoc deliveries then an approved collection area is to be provided on- site. Review options for providing a container and collection point near front gate	No	
2.	Rain ingress to bulk storage	Runoff, environmental impact	Leaks in building, building design	Bunded area in bulk storage, drainage to electrolyte treatment			Storage areas are covered to prevent rain ingress and ventilated.	No	
3.	Electrolyte spill at bulk storage on site	Environmental impact burns on contact (operator injury)	Leaky battery, inadequate storage area design	ULABs are palletized, shrink-wrapped and stored upright in a heavy-duty Racking System. Leaky batteries are stored inside plastic drums and covered, while awaiting processing. Acid resistant floor. Storage area drains to electrolyte treatment Covered storage		Sealed, bunded, storage areas, drain to collection point Emergency eyewash and shower at strategic locations. Acid spill kit available at the clinic.		No	

HAZID No	Hazardous Events	Potential Consequence / Effects	Threats / Causes	Safeguards			Assessment / Recommendations	Potential offsite impact?	Comments
				Prevention	Detection	Mitigation			
4.	Dust /vapour release ULAB warehouses	Environmental impact, health impact on inhalation (long term occupational impact)	Battery condition, electrolytic action, contaminants	Storage in covered, ventilated area. Minimal number of access doors to prevent fugitive emissions. ULABs are palletized, shrink-wrapped and stored upright in a heavy-duty Racking System. Leaky batteries are stored inside plastic drums and covered, while awaiting processing.	-	In the event of acid spill, the spilled acid will be collected in an electrolyte pit via canal system at warehouse building floor.		No	PHA covers only acute/ short term impact from accidental releases
5.	Hydrogen buildup in bulk storage	Fire hazard/ explosion	Electrolytic action	Minimal hydrogen generation from discharged batteries	-	Open, well ventilated area.		No	Low hydrogen generation
6.	Batteries shorting resulting in arcing between batteries	Fire hazard	Contact between batteries with residual charge	Batteries will only be in motion during processing with operators in attendance Low likelihood of batteries having residual charge AND coming into contact with metal/ other batteries	-	Hand held extinguishers Hydrants and Hose reels	Review options for fire detection in battery storage area	No	Localised fire only. Batteries stored on pallets in a building, which is a minimum of 3 m from the site boundary.
Battery Breaking/Processing									
7.	Splashing of electrolyte during emptying of batteries	Environmental impact burns on contact (operator injury)	Mishandling	Acid resistant floor. Storage area drains to electrolyte treatment Personal Protective Equipment		Emergency eyewash and shower at strategic locations. Acid spill kit available at the clinic.		No	Contained on site
8.	Not used								

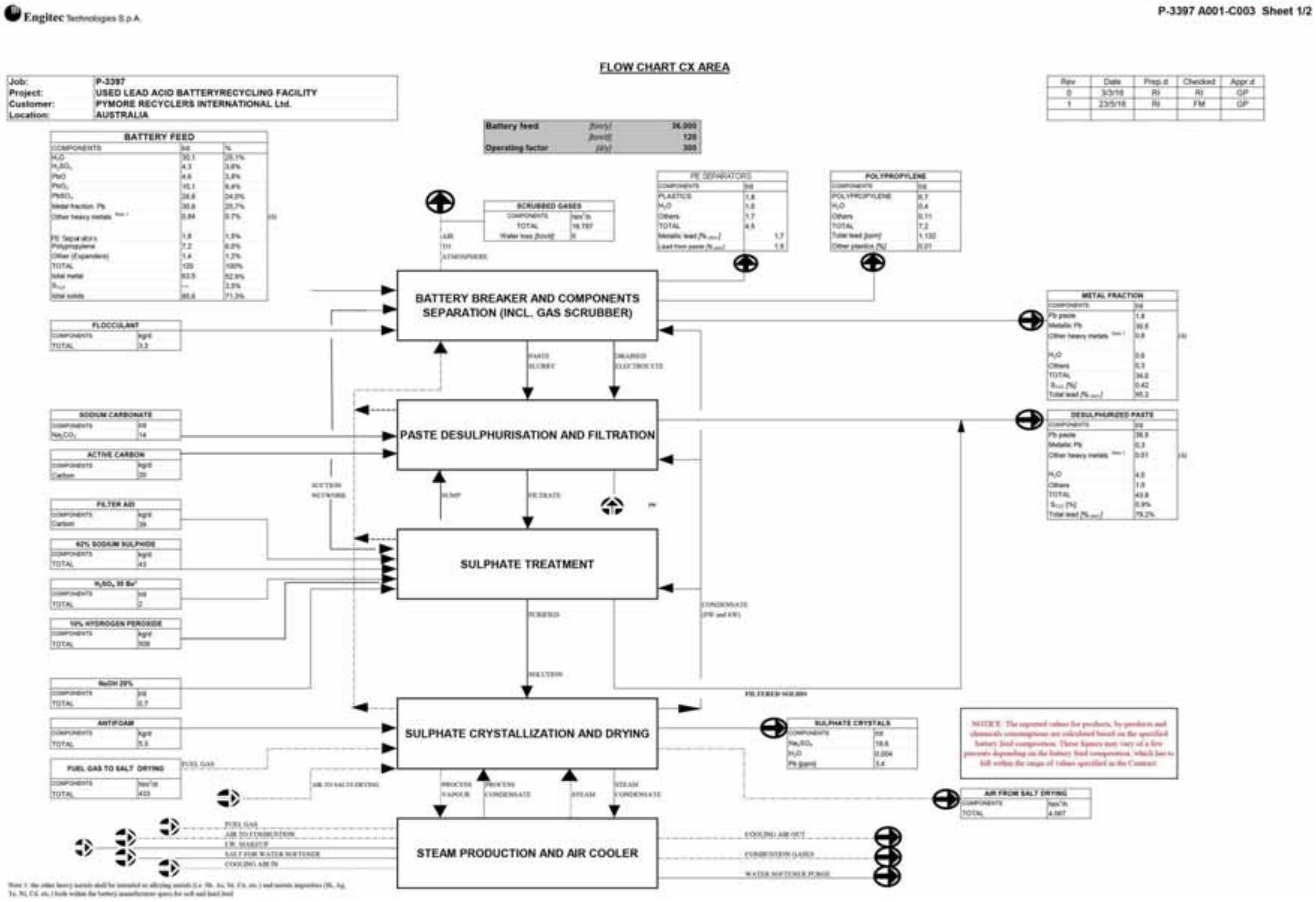
HAZID No	Hazardous Events	Potential Consequence / Effects	Threats / Causes	Safeguards			Assessment / Recommendations	Potential offsite impact?	Comments
				Prevention	Detection	Mitigation			
9.	Splashing of electrolyte during battery breaking	Environmental impact, burns on contact	Mishandling, blockage, residual electrolyte in battery feed	Acid resistant floor. Storage area to drain to electrolyte treatment Mechanised process with no direct contact Tramp iron collector and metal detection Packing removed before processing Personnel to wear PPE		Sealed, bunded, process and conveyor areas , drain to collection point. Emergency eyewash and shower at strategic locations. Acid spill kit available at the clinic.		No	Low concentration of H_2SO_4 (15%). Contained on site.
10.	Blockage in milling process	Potential blockages if oversized batteries, tramp iron in feed	Too many industrial batteries in stream, Tramp iron, packing material and metal in feed,	Plant capacity reduced to 70% if 100% industrial batteries in feed Tramp iron collector and metal detection Packing removed before processing	Visual inspection of battery stream		Collection procedures ensure inappropriate batteries are not processed Contract requirements with supply sources state requirements for packing on pallets, limits on battery types, etc	No	Quality/ capacity issue only. Not a hazard.
11.	Dust /vapour release during battery breaking	Environmental impact, health impact on inhalation Potential offsite impact	Dust and fumes generated during processing	Processing equipment is air and noise isolated and ventilated to scrubbing system	-	PPE Process can be shutdown in event of scrubbing system failure without major impact on process	Minimal dust generated as solids are not pulverised and lead paste is wet.	No	See Hazard 15
12.	Dust explosion	Plant damage, fire, safety hazard	Dried, finely divided lead combined with static and/or heat sources	Minimal dust generated as solids are not pulverised and lead paste is wet. Wet – totally enclosed system for the dust recycling Ventilation and water sprays in stockpile area				No	

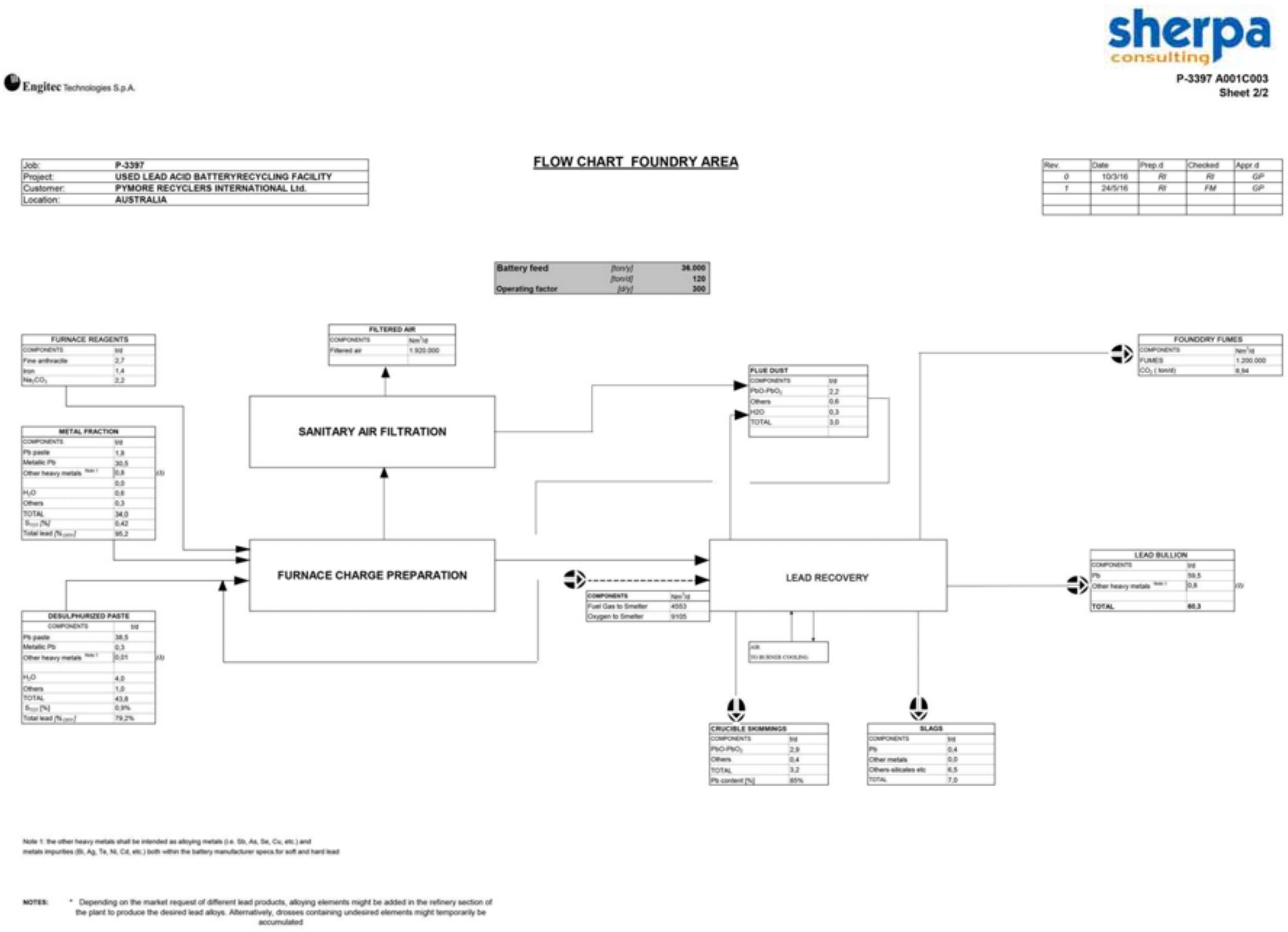
HAZID No	Hazardous Events	Potential Consequence / Effects	Threats / Causes	Safeguards			Assessment / Recommendations	Potential offsite impact?	Comments
				Prevention	Detection	Mitigation			
13.	Failure of hydrostatic separators	Contamination of product streams, carryover of organics to lead recovery, increased slag and SO_x generation	Equipment failure	Process design minimises potential for carryover.	Monitoring of system flow rates and process parameters			No	
14.	Failure of washing process	Contamination of product streams with residual electrolyte, carryover of sulphates to lead recovery, Impacts recovery process increased SO_x generation	Equipment failure	Process design includes several stages of washing				No	
15.	Failure of Gas scrubbing system	Dust release to atmosphere. Lead contaminated dust	Equipment failure, fan failure, mechanical	Shutdown of processing operations	Visual detection, alarms, Monitoring of gas scrubber operation	Environmental monitoring.	Review effectiveness of scrubbing system (reliability/ redundancy). Preventive maintenance schedule should reduce the likelihood of this threat.	No	
Desulphurisation									
16.	Failure of Desulphurisation process	Sulphate contamination of paste leads to increased SO_x emission from foundry off gas, potential offsite impact	Failure of soda ash dosing feed, blocked hopper/ conveyor		pH monitoring, Monitoring of soda ash flow	Recirculation of paste if high residual sulphur levels		Yes (INC-001)	

HAZID No	Hazardous Events	Potential Consequence / Effects	Threats / Causes	Safeguards			Assessment / Recommendations	Potential offsite impact?	Comments
				Prevention	Detection	Mitigation			
17.	Acid leaks from Desulphurisation equipment	Environmental impact, burns on contact	Tank/ flange/ pump seal leaks	Low concentrations Containment of area, chemical resistant sealed floor Monitoring of flows Equipment maintenance		PPE		No	Minimal operator presence in area. Onsite risk.
18.	Failure of scrubbing system	Release of vapours from process	Equipment failure, fan failure, mechanical	Gas generated in desulphurisation system is mainly CO_2 Shutdown of processing operations	Visual detection, alarms		Preventive maintenance schedule should reduce the likelihood of this threat.	No	
19.	Sulphuric acid spill during dosing of Sodium Sulphate solution	Environmental impact, burns on contact	Flange/ pump seal leaks	Containment of area, chemical resistant sealed floor Equipment maintenance		PPE		No	
20.	Burns from hot air / steam release in sodium sulphate crystallisation/ drying	Burns/scalds	Pipe / equipment failure	Automated process Equipment insulation Equipment maintenance		PPE		No	
21.	Dust release from top of sodium sulphate dryer or lead carbonate stockpile	Dust release to atmosphere, nuisance dust impact. Lead carbonate dust is toxic.	Bag filter failure. Lead carbonate stockpile allowed to dry.	Equipment maintenance Monitoring of lead carbonate stockpile	Operator inspection	PPE		No	
Recovery									
22.	Failure of Baghouse filter (foundry)	Dust/ fumes release to atmosphere, lead contaminated dust impact	Bagfilter failure, Fan failure	Redundant baghouse sections. Failed bags can be isolated without stopping process. Baghouse maintenance/ inspection	Enviro. monitoring			No	

HAZID No	Hazardous Events	Potential Consequence / Effects	Threats / Causes	Safeguards			Assessment / Recommendations	Potential offsite impact?	Comments
				Prevention	Detection	Mitigation			
23.	Burns/scalds during decanting of molten lead (foundry)	Safety Hazard/ operator impact	Molten metal spills	Minimal operator handling required for operations.		PPE		No	
24.	Molten metal explosion (foundry)	Safety hazard, potential explosion impact, molten metal spray	Moisture in crucibles	Preheated crucibles, elimination of water sources Separation distances to other plant and amenities areas		PPE		Yes (INC-002)	
25.	Fuel gas (natural gas) release and ignition	Jet fire impact, potential fire impact, potential offsite impact Furnace explosion	Regulator leak, mechanical failure, valve/gland leak, third party impact, corrosion	Inspection/ maintenance of equipment			Provision of bollards around pressure regulator equipment. Pipeline feed to be underground with marker signs	Yes (INC-003)	Furnace explosion localised. Furnace in building approximately more than 20 m from the site boundary.
Other									
26.	Mixing of sulphuric acid and sodium sulphide	Reaction would produce hydrogen sulphide	Accidental spillage of sulphuric acid on sodium sulphide	Storage areas well separated remote. Not used in the same process step/ area.				No	
27.	Loss of containment from oxygen plant or liquid oxygen storage	Localised oxygen enrichment. Expected to remain on-site. Fire. Cold burn on exposure to liquefied gas.	Equipment failure	Oxygen plant and storage facility designed to appropriate Australian standards.				No	

APPENDIX B. PROCESS FLOW CHARTS


Engitec Technologies S.p.A.
P-3397 A001-C003 Sheet 1/2
FLOW CHART CX AREA
Job: P-3397
Project: USED LEAD ACID BATTERYRECYCLING FACILITY
Customer: PYMORE RECYCLERS INTERNATIONAL Ltd.
Location: AUSTRALIA
Rev
Date
Prep.d
Checked
Appr.d
0
3/3/16
RI
RI
GP
1
23/5/16
RI
FM
GP
Battery feed
Operating factor
BATTERY FEED
SCRUBBED GASES
PE SEPARATORS
POLYPROPYLENE
FLOCCULANT
METAL FRACTION
DESULPHURIZED PASTE
SODIUM CARBONATE
ACTIVE CARBON
FILTER AID
42% SODIUM SULPHIDE
10% HYDROGEN PEROXIDE
NaOH 20%
ANTIFOAM
FUEL GAS TO SALT DRYING
SULPHATE CRYSTALS
AIR FROM SALT DRYING
BATTERY BREAKER AND COMPONENTS SEPARATION (INCL. GAS SCRUBBER)
PASTE DESULPHURISATION AND FILTRATION
SULPHATE TREATMENT
SULPHATE CRYSTALLIZATION AND DRYING
STEAM PRODUCTION AND AIR COOLER
AIR TO ATMOSPHERE
PASTE SLURRY
DRAINED ELECTROLYTE
SUCTION NETWORK
SUMP
FILTRATE
CONDENSATE (PW and SW)
PURIFIED SOLUTION
FILTERED SOLIDS
FUEL GAS
AIR TO SALTS DRYING
PROCESS VAPOUR
PROCESS CONDENSATE
STEAM
STEAM CONDENSATE
AIR TO COMBUSTION
CW MAKEUP
SALT FOR WATER SOFTENER
COOLING AIR IN
COOLING AIR OUT
COMBUSTION GASES
WATER SOFTENER PURGE



P-3397 A001C003
Sheet 2/2

FLOW CHART FOUNDRY AREA

Job:	**P-3397**
Project:	**USED LEAD ACID BATTERYRECYCLING FACILITY**
Customer:	**PYMORE RECYCLERS INTERNATIONAL Ltd.**
Location:	**AUSTRALIA**

Rev.	Date	Prep.d	Checked	Appr.d
0	10/3/16	*RI*	*RI*	*GP*
1	24/5/16	*RI*	*FM*	*GP*

Battery feed	*[ton/y]*	**36.000**
	[ton/d]	**120**
Operating factor	*[d/y]*	**300**

FURNACE REAGENTS

COMPONENTS	t/d
Fine anthracite	2,7
Iron	1,4
Na_2CO_3	2,2

METAL FRACTION

COMPONENTS	t/d	
Pb paste	1,8	
Metallic Pb	30,5	
Other heavy metals $^{Note 1}$	0,8	(1)
	0,0	
H_2O	0,6	
Others	0,3	
TOTAL	34,0	
S_{TOT} [%]	0,42	
Total lead [%$_{(w/w)}$]	95,2	

DESULPHURIZED PASTE

COMPONENTS	t/d	
Pb paste	38,5	
Metallic Pb	0,3	
Other heavy metals $^{Note 1}$	0,01	(1)
H_2O	4,0	
Others	1,0	
TOTAL	43,8	
S_{TOT} [%]	0,9%	
Total lead [%$_{(w/w)}$]	79,2%	

FILTERED AIR

COMPONENTS	Nm^3/d
Filtered air	1.920.000

FLUE DUST

COMPONENTS	t/d
PbO-PbO_2	2,2
Others	0,6
H2O	0,3
TOTAL	3,0

FOUNDDRY FUMES

COMPONENTS	Nm^3/d
FUMES	1.200.000
CO_2 (ton/d)	8,94

COMPONENTS	Nm^3/d
Fuel Gas to Smelter	4553
Oxygen to Smelter	9105

LEAD BULLION

COMPONENTS	t/d	
Pb	59,5	
Other heavy metals $^{Note 1}$	0,8	(1)
TOTAL	**60,3**	

CRUCIBLE SKIMMINGS

COMPONENTS	t/d
PbO-PbO_2	2,9
Others	0,4
TOTAL	3,2
Pb content [%]	85%

SLAGS

COMPONENTS	t/d
Pb	0,4
Other metals	0,0
Others-silicates etc	6,5
TOTAL	7,0

Note 1: the other heavy metals shall be intended as alloying metals (i.e. Sb, As, Se, Cu, etc.) and metals impurities (Bi, Ag, Te, Ni, Cd, etc.) both within the battery manufacturer specs.for soft and hard lead

NOTES: * Depending on the market request of different lead products, alloying elements might be added in the refinery section of the plant to produce the desired lead alloys. Alternatively, drosses containing undesired elements might temporarily be accumulated

APPENDIX C. SAFETY DATA SHEETS

The chemical information was obtained from Safety Data Sheets, however, in some cases, the information was obtained from the Australian Dangerous Goods Code or the Australian Hazardous Chemicals Information System. The SDS information is reproduced in this appendix.

ID	Name	Information source	MSDS Name	Shipping Name	UN	DG	sub	PG	Comment
1	Activated Carbon	SDS	Activated Carbon	N/A	N/A	N/A	N/A	N/A	
2	Flocculant	SDS	Anionic Polymer	N/A	N/A	N/A	N/A	N/A	
3	Anthracite Coal	SDS	Anthracite Coal	N/A	N/A	N/A	N/A	N/A	
4	Anti-foam	SDS	Antifoam	N/A	N/A	N/A	N/A	N/A	
	Lead Carbonate	HCIS	N/A	N/A	N/A	N/A	N/A	N/A	HCIS states that this is GHS07/08. Acute toxicity category 4. Hence not Class 6.1
	Diesel Fuel	SDS	Diesel	N/A	N/A	N/A	N/A	N/A	Flashpoint in SDS states > 60C, hence it is not classified as a flammable liquid under ADG 7.4.
	Electrolyte	ADG 7.4	N/A	SULPHURIC ACID, SPENT	1832	8	-	II	
6	Polyethylene separators	SDS	Ground Plastics	N/A	N/A	N/A	N/A	N/A	
7	Calcium Hydroxide	SDS	Hydrated Lime	N/A	N/A	N/A	N/A	N/A	
8	Hydrogen Peroxide	SDS	Hydrogen Peroxide	Hydrogen peroxide, aqueous solutions	2984	5.1	8	III	
9	Iron Sinter	SDS	Iron Sinter	N/A	N/A	N/A	N/A	N/A	
10	Lead Bullion	SDS	Lead Bullion	N/A	N/A	N/A	N/A	N/A	
11	Liquid Oxygen	SDS	Liquid Oxygen	OXYGEN, REFRIGERATED LIQUID	1073	2.2	5.1	-	
12	Polypropylene Plastics	SDS	PP Chips	N/A	N/A	N/A	N/A	N/A	
13	Slag	SDS	Slag	N/A	N/A	N/A	N/A	N/A	
14	Soda Ash	SDS	Soda Ash	N/A	N/A	N/A	N/A	N/A	
15	Sodium Sulfate Anhydrous	SDS	Sodium Sulfate Anhydrous	N/A	N/A	N/A	N/A	N/A	
16	Sodium Sulphide (62%)	SDS	Sodium Sulfide	SODIUM SULFIDE, HYDRATED	1849	8	-	II	
	ULAB	ADG 7.4	ULAB	BATTERIES, WET, FILLED WITH ACID, electric storage	2794	8	-	-	
	SDS = Safety Data Sheet ADG 7.4 = Australian Dangerous Goods Code v7.4 (http://www.ntc.gov.au/Media/Reports/(7E6FD0E5-2D6A-4747-BE48-C0DDDF676A3A).pdf) HCIS = Hazardous Chemicals Information System (http://www.hcis.safeworkaustralia.gov.au/HazardousChemical/Details?chemicalID=827)								

Material Safety Data Sheet
(Activated Carbon)

DATE PREPARED: 6/18/2009
REVISION NUMBER: 6/18/2009
EMERGENCY NUMBER: CHEMTREC: 1-800-424-9300

415 Huguenot Street
New Rochelle, NY 10801
Phone: (914) 654-6800 Fax: (914) 654-6899

SECTION 1 – PRODUCT AND COMPANY INFORMATION

PRODUCT NAME	Activated Carbon
SYNONYM	Charcoal, Activated
FORMULA	C
CAS NUMBER	7440-44-0

SECTION 2 – COMPOSITON/INFORMATION ON INGREDIENTS

PRODUCT NAME	CAS NUMBER	PURITY
Activated Carbon	7440-44-0	90 - 100%

SECTION 3- HAZARDS IDENTIFICATION

Emergency Overview
CAUTION! ACTIVATED CARBON AFFECTS THE RESPIRATORY AND CARDIOVASCULAR SYSTEMS.

SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate
Flammability Rating: 1 - Slight
Reactivity Rating: 1 - Slight
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES
Storage Color Code: Green (General Storage)

Potential Health Effects

Inhalation:
No adverse effects expected. May cause mild irritation to the respiratory tract.
Ingestion:
No adverse effects expected. May cause mild irritation to the gastrointestinal tract.
Skin Contact:
Not expected to be a health hazard from skin exposure. May cause mild irritation and redness.
Eye Contact:
No adverse effects expected. May cause mild irritation, possible reddening.
Chronic Exposure:
Prolonged inhalation of excessive dust may produce pulmonary disorders.
Aggravation of Pre-existing Conditions:
No information found.

Material Safety Data Sheet
(Activated Carbon)

SECTION 4 – FIRST AID MEASURES

Inhalation:
Remove to fresh air. Get medical attention for any breathing difficulty.

Ingestion:
Give several glasses of water to drink to dilute. If large amounts were swallowed, get medical advice.

Skin Contact:
Not expected to require first aid measures. Wash exposed area with soap and water. Get medical advice if irritation develops.

Eye Contact:
Wash thoroughly with running water. Get medical advice if irritation develops.

SECTION 5 – FIRE FIGHTING MEASURES

Fire:
As with most organic solids, fire is possible at elevated temperatures or by contact with an ignition source. Activated carbon is difficult to ignite and tends to burn slowly (smolder) without producing smoke or flame.

Wet activated carbon depletes oxygen from the air. Materials allowed to smolder for long periods in enclosed spaces, may produce amounts of carbon monoxide which may reach the lower explosive limit for carbon monoxide of 12.5% in air.

Contact with strong oxidizers such as ozone or liquid oxygen may cause rapid combustion.

Explosion:

Fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard. Minimum explosible concentration 0.140 g/l.

Fire Extinguishing Media:

Water spray, dry chemical, alcohol foam, or carbon dioxide.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Remove all sources of ignition. Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8.

Spills: Clean up spills in a manner that does not disperse dust into the air. Use non-sparking tools and equipment. Reduce airborne dust and prevent scattering by moistening with water. Pick up spill for recovery or disposal and place in a closed container.

Warning! Spent product may have absorbed hazardous materials.

SECTION 7- HANDLING AND STORAGE

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Keep away from moisture and oxidizers. Avoid dust dispersal.

Wet activated carbon depletes oxygen from the air and therefore dangerously low levels of oxygen may be encountered in confined spaces. Work procedures for potentially low oxygen areas should be followed.

Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

SECTION 8 - EXPOSURE CONTROLS/ PERSONAL PROTECTION

Airborne Exposure Limits:

- OSHA Permissible Exposure Limits (PELs):

activated carbon (graphite, synthetic): total particulate = 15 mg/m3 (TWA), respirable fraction = 5 mg/m3 (TWA).

- ACGIH Threshold Limit Values (TLVs): graphite, all forms except graphite fibers: 2 mg/m3 (TWA).

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits.

Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area.

Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

For conditions of use where exposure to the dust or mist is apparent, a half-face dust/mist respirator may be worn. For emergencies or instances where the exposure levels are not known, use a full-face positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear protective gloves and clean body-covering clothing.

Eye Protection:
Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Black powder.

Odor: Odorless.

Solubility: Insoluble in water.

Specific Gravity: 1.8 - 2.1

pH: 5.0-10.0

% Volatiles by volume @ 21C (70F): 0

Boiling Point: Sublimes.

Melting Point: 3550C (6422F)

Vapor Density (Air=1): 0.4

Vapor Pressure (mm Hg): 1 @ 3586C (6487F)

Evaporation Rate (BuAc=1): No information found.

SECTION 10 – STABILITY AND REACTIVITY DATA

Stability:
Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:
Involvement in a fire causes formation of carbon dioxide and carbon monoxide.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
Strong oxidizers such as ozone, liquid oxygen, chlorine, permanganate, etc. may result in rapid combustion. Avoid contact with strong acids.

Conditions to Avoid:
Moisture and incompatibles.

SECTION 11 – TOXICOLOGICAL INFORMATION

Investigated as a reproductive effector.

--------------------------------\Cancer Lists\--

	---NTP Carcinogen---		
Ingredient	Known	Anticipated	IARC Category
Steam Activated Carbon (7440-44-0)	No	No	None

SECTION 12 – ECOLOGICAL INFORMATION

Environmental Fate: No information found.

Environmental Toxicity: No information found.

SECTION 13 – DISPOSAL CONSIDERATION

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options.

State and local disposal regulations may differ from federal disposal regulations.

Dispose of container and unused contents in accordance with federal, state and local requirements.

SECTION 14 - TRANSPORTATION DATA

Not regulated.

SECTION 15 – REGULATORY INFORMATION

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Steam Activated Carbon (7440-44-0)	Yes	Yes	No	Yes

---------\Chemical Inventory Status - Part 2\---------------------------------

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Steam Activated Carbon (7440-44-0)	Yes	Yes	No	Yes

----------\Federal, State & International Regulations - Part 1\----------------

	-SARA 302-		------SARA 313------	
Ingredient	RQ	TPQ	List	Chemical Catg.
Steam Activated Carbon (7440-44-0)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------------

		-RCRA-	-TSCA-
Ingredient	CERCLA	261.33	8(d)
Steam Activated Carbon (7440-44-0)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: No Fire: No Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: None allocated.

Poison Schedule: None allocated.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

SECTION 16 – OTHER INFORMATION

NFPA Ratings: Health: **0** Flammability: **1** Reactivity: **0**

Label Hazard Warning:

CAUTION! ACTIVATED CARBON AFFECTS THE RESPIRATORY AND CARDIOVASCULAR SYSTEMS.

Material Safety Data Sheet
(Activated Carbon)

Label Precautions:
Avoid contact with eyes, skin and clothing.
Avoid breathing dust.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.

Label First Aid:
If inhaled, remove to fresh air. Get medical attention for any breathing difficulty.

Product Use:
Laboratory Reagent.

Disclaimer

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product.

degussa.

Material Safety Data Sheet

POLYSTABIL S-450 **MSDS ID: WT-217**

* * * Section 1 - Chemical Product and Company Identification * * *

Chemical Name: Water soluble anionic polymer.

Manufacturer Information

Stockhausen Inc.
2401 Doyle Street
Greensboro, NC 27406

Phone: (800) 242-2271

Emergency # (800) 424-9300

* * * Section 2 - Composition / Information on Ingredients * * *

CAS #	Component	Percent
Not Available	Trade Secret Non-regulated	40-50

Component Information/Information on Non-Hazardous Components

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

* * * Section 3 - Hazards Identification * * *

Emergency Overview

Water soluble anionic polymer. This product may be mildy irritating to the eyes, skin, and respiratory system.This product, when spilled, will cause slippery conditions.

Potential Health Effects: Eyes

This product may be mildly irritating to the eyes.

Potential Health Effects: Skin

This product may be midly irritation to the skin.

Potential Health Effects: Ingestion

This product may be harmful if ingested. Seek medical advice.

Potential Health Effects: Inhalation

This product may be mildly irritating to the respiratory system.

HMIS Ratings: Health: 1 **Fire:** 0 **Reactivity:** 0 **Pers. Prot.:** X= consult supervisor depending upon the situation.

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

Immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation persists.

First Aid: Skin

For skin contact, flush with large amounts of water. If irritation persists, get medical attention.

First Aid: Ingestion

If ingested, seek medical advice.

First Aid: Inhalation

If inhaled, immediately remove the affected person to fresh air. Consult a physician regarding any continued discomfort.

* * * Section 5 - Fire Fighting Measures * * *

General Fire Hazards

Method Used:
Flash Point: Not applicable -high water content
Flammability Classification:

Hazardous Combustion Products

This product will not burn unless water is evaporated off. On thermal decomposition: oxides of carbon.

Extinguishing Media

Dry chemical, foam, carbon dioxide, or water spray/fog.

Fire Fighting Equipment/Instructions

Normal firefighting procedures require self-contained breathing apparatus and protective gear for any hostile fire.

* * * Section 6 - Accidental Release Measures * * *

Containment Procedures

Contain spill with inert materials (sand, earth, absorbent). Shovel material into appropriate container for disposal.

Clean-Up Procedures

Flush small residuals to the drain for normal biological wastewater treatment. Observe all applicable local, state and federal waste management regulations.

Evacuation Procedures

Isolate area. Keep unnecessary personnel away.

Special Procedures

* * * Section 7 - Handling and Storage * * *

Handling Procedures

Handle as a mild irritant.

Storage Procedures

Keep container tightly closed when not in use.

* * * Section 8 - Exposure Controls / Personal Protection * * *

Exposure Guidelines

A: General Product Information

Provide adequate ventilation to minimize worker exposure.

B: Component Exposure Limits

No information is available.

Engineering Controls

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face

Wear safety glasses with side shields or goggles.

Personal Protective Equipment: Skin

Impervious gloves are recommended. Work clothing sufficient to prevent all skin contact should be worn, such as coveralls and long sleeves.

Personal Protective Equipment: Respiratory

Not required for normal product end use. Use general ventilation.

Personal Protective Equipment: General

* * * Section 9 - Physical & Chemical Properties * * *

Appearance: Slightly tan liquid
Physical State: liquid
Vapor Pressure: not available
Boiling Point: about 212ºF (100ºC)
Solubility (H2O): soluble
Evaporation Rate: <1 (Butyl acetate=1)

Odor: Mild acrylic odor
pH: 7.5
Vapor Density: not available
Melting Point:
Specific Gravity: approximately 1.16 (water=1)

* * * Section 10 - Chemical Stability & Reactivity Information * * *

Chemical Stability

The product is stable.

Chemical Stability: Conditions to Avoid

None identified.

Incompatibility

None identified.

Hazardous Decomposition

On thermal decomposition oxides of carbon.

Hazardous Polymerization

Hazardous polymerization will not occur.

* * * Section 11 - Toxicological Information * * *

Acute and Chronic Toxicity

A: General Product Information

This product may cause mild irritation.

B: Acute Toxicity-LD50/LC50

No LD50/LC50's are available for this product's components.

Carcinogenicity

A: General Product Information

This material is not listed as a carcinogen by IARC, NTP or OSHA.

B: Component Carcinogenicity

No information is available.

* * * Section 12 - Ecological Information * * *

Ecotoxicity

Component Analysis - Ecotoxicity - Aquatic Toxicity

No information available,

Environmental Fate

* * * Section 13 - Disposal Considerations * * *

US EPA Waste Number & Descriptions

Component Waste Numbers

No EPA Waste Numbers are applicable for this product's components.

Disposal Instructions

* * * Section 14 - Transportation Information * * *

International Transportation Regulations
This product is not transport regulated.

* * * Section 15 - Regulatory Information * * *

US Federal Regulations
A: General Product Information
All components are on the U.S. EPA TSCA Inventory List.
B: Clean Air Act
No information is available.
C: Component Analysis
No information is available.
D: Food & Drug Administration
None of the components in this product are listed by the FDA under regulations for Direct and Indirect Food Additives.
Component Analysis - State
None of this product's components are listed on the state lists from CA, FL, MA, MN, NJ, or PA.
Component Analysis - WHMIS IDL
No components are listed in the WHMIS IDL.

* * * Section 16 - Other Information * * *

Other Information
The information herein is presented in good faith and believed to be accurate as of the effective date given. However, no warranty, expressed or implied, is given. It is the buyer's responsibility to ensure that its activities comply with Federal, State or provincial, and local laws.
MSDS History
Re-issue: This MSDS issued on 8/7/03 replaces the MSDS prepared on 1/14/97.
Key/Legend

Contact: Product Compliance Officer
Contact Phone: (800)242-2271

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

River Sands Pty Ltd
ACN 009 919 215
ABN 41 009 919 215
683 Beenleigh Redland Bay Rd
CARBROOK QLD 4129
Tel: +61 7 3287 6444
Fax: +61 7 3287 6445

Emergency Advice All Hours:
Australia Wide: 131 126

Product Name: Anthracite

Use: Anthracite products are used for their water and waste purification. As a filtration medium in fixed beds filters, for the physical removal of suspended solids from liquids.

UN Number: None allocated
Proper Shipping Name: None allocated
Dangerous Goods Class: None allocated
Packing Group: None allocated
Hazchem Code: None allocated
Poison Schedule: None allocated

2. COMPOSITION / INFORMATION ON INGREDIENTS

SUBSTANCE NAME	**Proportion**
Carbon	>95%

Physical Description: Black uniform granules, with no odour.

3. HAZARD IDENTIFICATION

Not hazardous according to the criteria of Worksafe Australia

ACUTE HEALTH EFFECTS

Swallowed: May cause irritation to mouth, oesophagus and stomach. Not hazardous

Eye: May cause mechanical irritation in contact with the eyes, which can result in redness and itching. Not anticipated to, cause permanent eye injury.

Skin: May cause mechanical irritation in contact with the skin. Not hazardous

Acute - Inhaled Inhalation may cause irritation to the mucous membrane and upper airways.

Chronic-Inhaled Repeated inhalation of dust may result in excessive mucus and coughing.

4. FIRST AID MEASURES

Swallowed: Drink plenty of water and contact a Doctor if irritation develops. **DO NOT induce vomiting**.

Eye: If in eyes, flush with plenty of water for at least 15 minutes, ensuring eyelids are held open and see a Doctor if irritation continues.

Skin: If skin contact occurs, remove contaminated clothing and wash skin thoroughly with soap and water.

Inhaled: Move to fresh air. Monitor for respiratory distress. Seek medical attention if irritation occurs.

First Aid Facilities: Eye wash fountain shall be available.

Advice to Doctor: Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Fire/Explosion Hazard: Anthracite is a combustible material. The ignition point is above 100°C. When ignited, will produce no flame but will glow or smoulder until all combustible material is consumed. **Keep away from possible ignition sources.**

Extinguishing media: Fine water mist spray, hose or foam extinguisher.

Special fire fighting procedure: Prevent run off, bundy or dyke area to prevent run off into drains, sewers or waterways.

Flammability: >100°C Flammable/ Non-Explosion Hazard

6. ACCIDENTAL RELEASE MEASURES

Emergency Action: None available

Spill or Leak Procedure: Not Applicable

Spills: Prevent entering sewer, stormwater drains or waterways. Avoid creating dust, sweep, shovel or vacuum spill place in suitable containers. Contaminated materials should be disposed of at an approved disposal landfill site.

7. HANDLING AND STORAGE

Storage: Stable under normal conditions. Keep away from naked flames.

Transport: Not classified as a Dangerous good, according to the Australian Code for the Transport of Dangerous Goods by Road and Rail (6th Edition).

Proper Shipping Name: None allocated

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Standards

No value assigned for this specific material by the National Occupational Health and Safety Commission.

Nuisance dust: 8hr TWA = 10 mg/m3

As published by the National Occupational Health and Safety Commission.

TWA - The time-weighted average airborne concentration over an eight-hour working day, for a five-day working week over an entire working life.

Do not store or consume food, drink or tobacco in an area where they may become contaminated with this material. Wash thoroughly before eating, smoking, applying cosmetics etc. Thoroughly launder work clothes before reuse.

Engineering Controls

Local ventilation not normally necessary but should be considered if used in poorly ventilated or very confined space.

Personal Protection Equipment

CLOTHING: PVC or rubber apron, coveralls, safety shoes/boots.
GLOVES: PVC or rubber.
EYES: Safety glasses to protect eyes.

RESPIRATORY PROTECTION: Select and use respirators in accordance with AS/NZS 1715/1716. If used in poorly ventilated or very confined spaces, a standard disposable dust mask fitted with a type P1 filter should be used that complies with AS1716 Respiratory Devices and used in accordance with AS1715 which describes use and maintenance.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Black uniform granules
Boiling Point: Not relevant
Vapour Pressure: Not relevant
Bulk Density: 650- 750 kg/m^3
Autoignition Temp: >100℃
Solubility: Insoluble in water and organic solvents

10. STABILITY AND REACTIVITY

Stability: Stable under normal conditions, avoid naked flame
Incompatibility: None Known
Hazardous Decomposition: None

11. TOXICOLOGICAL INFORMATION

No toxicological information is available for this product.

12. ECOLOGICAL INFORMATION

No environmental impact information is available for this product.
Avoid contaminating waterways, drains or sewers.

13. DISPOSAL CONSIDERATIONS

Refer to appropriate authority in your State. Dispose of material through a licensed waste contract. Suitable for disposal by approved waste disposal agent.

14. TRANSPORT INFORMATION

UN Number: None allocated
Proper Shipping Name: None allocated
Dangerous Goods Class: None allocated
Packing Group: None allocated
Hazchem Code: None allocated

15. REGULATORY INFORMATION

Poison Schedule:
This material is not scheduled.

16. OTHER INFORMATION

PRINCIPAL REFERENCES:
Material Safety Data Sheet – River Sands Pty Ltd
Issued by: Paul Moorfool – General Manager
Supersedes: All previous Material Safety Data Sheets Issued

The customer is advised to consult the product Technical Data Sheets for further information including advice on suitable equipment.
Information used in the compilation of this MSDS obtained from investigations conducted at outside laboratories.

Issue date: 8/3/2011
Supersedes: All previous Material Safety Data Sheets Issued

REASONS FOR UPDATE:

1. MSDS revision

MSDS's are updated frequently. Please ensure that you have a current copy.

Contact Point
Emergency Advice All Hours:
Australia Wide: 131 126
River Sands Pty Ltd
Tel: +61 7 3287 6444
Fax: +61 7 3287 6445
Contact: Paul Moorfoot – General Manager

Disclaimer
This Material Safety Data Sheet should be used in conjunction with the Technical Data Sheet. It does not replace them. The information given is based on our knowledge of the health and safety data of this product, at the time of publication. It is given in good faith. The attention of the user is drawn to the possible risks incurred by using the product for any purpose other than that for which it was intended. If clarification or further information is needed to enable appropriate risk assessment, the user should contact River Sands Pty Ltd. Our responsibility for a product sold is subject to our standard terms and conditions sent to customers. No liability whatsoever can be accepted with regard to the handling, processing or use of the product concerned which, in all cases, shall be in accordance with the appropriate regulations and / or legislation.

END OF DOCUMENT

ANTI-FOAM

Material Safety Data Sheet

SECTION I - COMPANY IDENTIFICATION

PRODUCT: ANTI-FOAM **CAT. NO.:** AF1

MANUFACTURED BY:
Virginia KMP Corporation
4100 Platinum Way
Dallas, Texas 75237

TELEPHONE NUMBERS:
Office: 1-(214) 330-7731
Emergency Only: 1-(800) 424-9300

SECTION II - HAZARDOUS INGREDIENTS

OSHA Hazardous Components (29 CFR 1910.1200) **EXPOSURE LIMITS: 8 HR. TWA**

This product does not qualify as a hazardous material as defined by OSHA (29CFR 1910.1200).

Non-Hazardous Components:	**OSHA PEL**	**ACGIH TLV**
Polyoxyethylene Stearate (9004-99-3)	NAP	
Dimethylpolysiloxane Oil (9016-00-6)	NAP	
Sorbitan Monostearate (1338-41-6)	NAP	

SECTION III - HAZARDS IDENTIFICATIONS

EMERGENCY OVERVIEW: NONE.

POTENTIAL HEALTH EFFECTS:
INHALATION: None known.
EYE CONTACT: May irrate eys.
SKIN CONTACT: None known.
INGESTION: None known.

CHRONIC Effects: None known.

NOTE:

CARCINOGENICITY: LISTED IN NTP? No IARC? No OSHA Regulated? No

SECTION IV - FIRST AID MEASURES

INHALATION: None known.
EYE CONTACT: None known.
SKIN CONTACT: None known.
INGESTION: None known.

SECTION V - FIRE FIGHTING MEASURES

FLASHPOINT (TEST METHOD): None (PMCC)
FLAMMABLE LIMITS: **LOWER:** NA **UPPER:** NA
AUTOIGNITION TEMPERATURE: NA

GENERAL HAZARD: None Known.
FIRE FIGHTING INSTRUCTIONS: Approach from upwind side. Avoid breathing smoke, fumes, mists or vapors on downwind side. Firefighters wear protective clothing, especially eye protection, and self contained breathing apparatus.

EXTINGUISHING MEDIA: Carbon dioxide, ABC dry chemical, water spray and fog and foam.
HAZARDOUS COMBUSTION PRODUCTS: Smoke, carbon monoxide, carbon dioxide and silicon dioxide.

SECTION VI - ACCIDENTAL RELEASE MEASURES

LAND SPILL: Wipe, scrape or soak up in an inert material and put in a container for disposal.
WATER SPILL: Soak up in an inert material and put in a container for disposal

SECTION VII - HANDLING AND STORAGE

HANDLING: FOR INDUSTRIAL USE ONLY. Do not breathe decomposition products.

STORAGE: Rotate stock.

ANTI-FOAM

SECTION VIII - EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: None known.
PERSONAL PROTECTION: Respirator not required under normal conditions of use. Wear safety glasses. Gloves and other protective equipment are not known to be required.

SECTION IX - PHYSICAL AND CHEMICAL PROPERTIES

VAPOR PRESSURE @ 20 C: 17.6 mm Hg
SPECIFIC GRAVITY (H_2O=1): 1.01
SOLUBILITY IN WATER: NA
pH: 5-7
BOILING POINT: 212 °F
APPEARANCE & ODOR: Green liquid. No noticeable odor.

VAPOR DENSITY (Air=1): NA
EVAPORATION RATE (H_2O=1): >1
VOC (LB/GAL): 0.0
FREEZING POINT: 32 °F

SECTION X - STABILITY AND REACTIVITY

STABILITY: Stable
CONDITIONS TO AVOID: None known.
MATERIALS TO AVOID: NA
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon dioxide, carbon monoxide and silicon dioxide.
HAZARDOUS POLYMERIZATION: Will not occur.

SECTION XI - TOXICOLOGICAL INFORMATION

ND

SECTION XII - ECOLOGICAL INFORMATION

ND

SECTION XIII - DISPOSAL CONSIDERATIONS

Disposal should be made in accordance with Federal, State and local environmental reg's.

SECTION XIV - TRANSPORTATION INFORMATION

PROPER SHIPPING NAME: Not regulated.

HAZARD CLASS: NA
IDENTIFICATION NUMBER: NA
DOT Emergency Guide #: NA
Reportable Quantity (RQ): NA
International: NA

SECTION XV - REGULATORY INFORMATION

TSCA (Toxic Substance Control Act): Components of this product are listed on the TSCA Inventory.
CERCLA (Comprehensive Environmental Response, Compensation and Liability Act): Not listed.

SARA TITLE III (Superfund Amendments and Reauthorization Act): Not listed.

CALIFORNIA PROPOSITION 65: Not listed.

SECTION XVI - OTHER INFORMATION

State Right-to-Know Programs: Not listed.

NFPA Ratings
Health: 0
Flammability: 0
Reactivity: 0
HMIS Protective Equipment: X See your supervisor

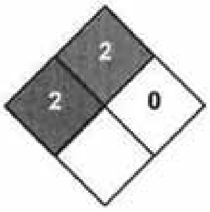
Prepared by: Virginia KMP Corporation revised 27-Oct-16
This information is furnished without warranty, expressed or implied, except that it is accurate to the best knowledge of Virginia KMP. The data on this sheet related only to specific material designated here in. Virginia KMP assumes no legal responsibility for use or reliance upon these data.

MGO

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product Name	MGO
Manufacturer	PETRON CORPORATION JESUS ST., PANDACAN, MANILA
Chemical Family	Petroleum Hydrocarbons
Product Type	Petroleum Distillate (Industrial Diesel Fuel)
Emergency Phone No.	(632) 563-31-21

NFPA Hazard Identification



Hazard	Degree of Hazard
Blue - Health	0 - Least
Red - Flammability	1 - Slight
Yellow - Reactivity	2 - Moderate
White - Special	3 - High
	4 - Extreme

SECTION 2: COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Ingredients	The product predominantly consists of aliphatic, alicyclic and aromatic hydrocarbons. In general, the product is combustible and may contain carcinogenic components. However, as long as normal precautions in handling petroleum products are observed and good standards of industrial and personal hygiene are maintained, no significant safety and health hazard is expected.

SECTION 3: HAZARDS IDENTIFICATION

Primary Entry Routes	Inhalation of vapors, eye contact, skin contact/absorption
Target Organs	Respiratory system, eyes, skin
Eye Contact	May cause eye irritation upon direct contact.
Skin Contact	Low order of toxicity under normal use. However, avoid prolonged or repeated contact with the product to prevent defatting and dermatitis. Carcinogenic materials are also present.
Ingestion	Ingestion is an unlikely event. However, accidental ingestion can lead to vomiting and aspiration into the lungs. This can result in chemical pneumonitis, which can be fatal.

Inhalation	Not expected to present an inhalation hazard under normal conditions. Exposure to high vapor concentrations can lead to nausea, headache and dizziness. Prolonged and excessive exposure to mists may cause chronic inflammatory reaction of the lungs and a form of pulmonary fibrosis.
Workplace Exposure Limits	There is no known limit for the product. However, available information recommends a maximum exposure limit of 100 ppm (8-hour Time Weighted Average) for aromatic and aliphatic compounds, which may be present as mixed hydrocarbons in air. Oil mists must not exceed 5 mg/m^3.

SECTION 4:	FIRST AID MEASURES
Eye Contact	Rinse eyes immediately with plenty of water for at least 15 minutes or until irritation subsides. If irritation persists, get prompt medical attention.
Skin Contact	Immediately clean contaminated skin with soap and water. Remove contaminated clothing, including shoes, and launder before reuse.
Ingestion	If swallowed, DO NOT induce vomiting due to risk of aspiration into the lungs. Give plenty of water to drink. Keep at rest and seek medical attention immediately.
Inhalation	If overexposed to oil mist, remove affected person immediately to fresh air. Administer artificial respiration if breathing is irregular or has stopped. Call for prompt medical attention.

SECTION 5:	FIRE FIGHTING MEASURES
Flash Point, PM, °C	75
Autoignition Temp., °C	220
Extinguishing Media	In case of fire use foam, carbon dioxide or dry chemical extinguishers.
Special Fire-fighting Procedures	Do not use water to extinguish fire unless in conjunction with foam compound or in cooling exposed surfaces or containers. Vapors are heavier than air and may travel considerable distances to a source of ignition and flashback.
Decomposition Products under Fire Conditions	Carbon dioxide, carbon monoxide, particulate matter, water, polycyclic aromatic hydrocarbons, nitrogen oxides, hydrogen sulfide, unburnt hydrocarbons, unidentified organic and inorganic compounds are expected from normal combustion.

SECTION 6:	ACCIDENTAL RELEASE MEASURES
Land Spill	Taking normal safety precaution, shut off source of product. Prevent the liquid from entering sewers, water courses or low- lying areas. Advise the relevant authorities, taking measures to minimize the effects on ground water. Recover from surface by skimming or pumping using explosion-proof

	equipment, booms or other suitable absorbent and remove mechanically into containers. If necessary, dispose material according to regulations of local authorities and environmental agencies.
Water Spill	Use booms to confine spills immediately. Remove from the water surface by skimming or with suitable absorbents. If permitted by local authorities and environmental agencies, disperse the residue in unconfined waters. Consult an expert on disposal of recovered material and ensure conformity to local disposal regulations.

SECTION 7: HANDLING AND STORAGE

Handling Procedures	Keep away from potential sources of ignition. Open container in a well-ventilated area. Avoid breathing vapors. Keep containers closed when not in use. Prevent small spills and leakages to avoid slip hazard. Wash thoroughly after handling. "Empty" containers with retained product residue (liquid or vapor) can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat, flame, sparks, static electricity or other sources of ignition; they may explode and cause death or injury. Empty drums should be completely drained, properly bunged and promptly returned to a drum reconditioner, or properly disposed off.
Storage Procedures	Store in cool, well-ventilated areas, away from sources of ignition.

SECTION 8: EXPOSURE CONTROL/PERSONAL PROTECTION

Ventilation Procedures	Use local exhaust ventilation to control mists or vapors. Additional ventilation or exhaust may be required to maintain air concentrations below exposure limits.
Gloves Protection	Use chemical resistant gloves.
Eye Protection	In case of splashing, wear safety glasses with side shields.
Respiratory Protection	Use NIOSH/MSHA approved full-face respirator with a combination organic vapor and high efficiency filter cartridge if the recommended exposure limit is exceeded. Use self-contained breathing apparatus for entry into confined space, for other poorly ventilated areas and for large spill clean-up sites.
Clothing Recommendation	Wear either a chemical protective suit or apron when potential for contact with material exists. Use neoprene or nitrile rubber boots when necessary to avoid contaminating shoes. Do not wear rings, watches or similar apparel that could entrap the material and cause a skin reaction.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Density at 15°C, kg/m3	837.4
Water Solubility	Insoluble

Odor	Characteristic of petroleum products
Appearance	Clear
Color, ASTM	5.0
KV at 40°C, cSt	3.740

SECTION 10: STABILITY AND REACTIVITY

Stability	Material is normally stable at ambient temperature.
Incompatibility	Strong oxidizing agents
Polymerization	Will not occur.
Hazardous Decomposition Products	In case of combustion or thermal decomposition, carbon monoxide and other toxic and irritant fumes may be formed.

SECTION 11: ECOLOGICAL INFORMATION

Ecotoxicity	Harmful to aquatic organisms and may cause long-term adverse effects to the aquatic environment; biodegradable in aerobic conditions; non-biodegradable in anaerobic conditions with high potential to bioaccumulate.

SECTION 12: DISPOSAL CONSIDERATIONS

Waste Disposal	Material, if discarded, is expected to be hazardous waste. The product may be burned under controlled conditions and should be in compliance with local and national waste management regulations.

SECTION 13: TRANSPORT REGULATIONS

UN	
UN Number	1202
Packing Group	III
Hazard Class	3
Road / Rail (ADR / RID)	
ADR UN Number	1203
ADR Item Number	31(c)
Tremcard	TEC(R)-27
ADR Hazard Class	3
ADR / RID Number	30
Sea (IMDG)	
IMDG UN Number	1202
IMDG Page Number	3375-

IMDG Hazard Class	3-07
IMDG Pack Group	3.3
IMDG MFAG	III

Air (ICAO / IATA)

ICAO UN Number	1202
ICAO Packing Group	III
ICAO Hazard Class	3

SECTION 14: APPROVALS

Approvals	Technical Department Petron Corporation

This is a computer-generated form and does not require a signature.

LG Chem	Material Safety Data Sheet	MSDS No.	LGCD-PP-015
		Rev.	2010. 06. 10.

POLYPROPYLENE HOMOPOLYMER

1. Product and company identification

a. Product name : H7500

○ POLYPROPYLENE HOMOPOLYMER

b. Recommended use of the chemical and restrictions on use :

○ Food Packaging Film, Raw Material for Automotive, Electric Machine, Expandable PP, Fiber, Yarn, Band, Multi-Filament

c. Information on manufacturer/supplier/distributor :

○ LG Chem., LTD. Deasan Plant,
○ 679, Daejuk-ri, Daesan-eup, Seosan-city, Chungcheongnam-do, KOREA (356-715)
○ Tel : 82-41-661-2621, Fax : 82-41-661-2641
○ HD/PP Production Team (PP Part)

2. Hazards identification

a. Hazard classification : Not classifiable.

b. Label elements including precautionary statements

○ Minimize source of ignition, such as static build-up, heat, spark or flame.
○ Material in form of dust is subject to explosions.
○ Store in a dry place. Store away from direct sunlight..

c. Other hazards which do not result in classification (e.g. dust explosion hazard)

○ NFPA : Health -1, Flammability -1, Reactivity -0

3. Composition/Information on ingredients

a. Chemical Name : POLYPROPYLENE HOMO POLYMER
b. Other name : 1-PROPENE HOMOPOLYMER
c. CAS No. : 9003-07-0
d. Content (%) : > 99.0

4. First aid measures

a. Eye contact

○ In the case of contact with eyes, rinse immediately with plenty of water for 15 minutes.
○ Process vapors may irritate eyes.
○ Seek medical advice.

b. Skin contact

○ Remove contaminated clothes, rinse skin with plenty of water or shower.
○ Exposure to molten resin may cause thermal burns.
○ Seek medical advice.

c. Inhalation

○ Remove from exposure to fresh air immediately.

○ Make him blow his nose and gargle.
○ Refer to medical attention immediately.
○ If not breathing, give artificial respiration.
○ If breathing is difficult, give oxygen. Get medical aid.

d. Ingestion

○ Rinse mouth. In case of large amount, drink large quantity of water and refer to medical attention.
○ Never give anything by mouth to an unconscious person. Get medical aid.
○ If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water

e. Most important acute and delay symptoms / effects : Not available**.**

f. First aid and note for physicians :

○ No specific antidote.
○ Treatment of exposure should be directed at the control of symptoms.

5. Fire-Fighting measures

a. Suitable (and unsuitable) extinguishing media

○ Suitable extinguishing media; Use an extinguishing agent suitable for the surrounding fire. Water. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam.
○ Unsuitable extinguishing media: Not available.

b. Specific hazards arising from the chemical (e.g. hazardous combustion products)

○ During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion : carbon dioxide, carbon monoxide, ketones, acrolein, aldehydes, unidentified organic compounds..
○ Dense smoke is emitted when burned without sufficient oxygen

c. Special protective equipment and precautions for fire-fighters

○ Special protective equipment for fire fighters
Wear positive-pressure self-contained breathing apparatus(SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves).
If protective equipment is not available or not use, fight fire from a protected location or safe distance.

○ Fire fighting procedures
Keep people away. Isolate fire and deny unnecessary entry.
Soak thoroughly with water to cool and prevent re-ignition.
Cool surroundings with water to localize fire zone.

6. Accidental release measures

a. Measures required for personal protection and protective equipment :

○ No special measures required.

b. Measures required for environment protection :

○ Avoid entering waterworks or a sewer.

c. Clean-up and removal method :

○ Sweep up then place into a suitable container for disposal.

7. Handling and storage

a. Precautions for safe handling :

○ Wash thoroughly after handling.
○ Remove contaminated clothing and wash before reuse.
○ Use with adequate ventilation.
○ Minimize dust generation and accumulation.
○ Avoid contact with eyes, skin, and clothing.
○ Avoid ingestion and inhalation

b. Conditions for safe storage (including incompatibilities) :

○ Store in a cool, dry, well-ventilated area away from incompatible substances.
○ Store in a tightly closed container.

8. Exposure controls & personal protection

a. Exposure limits of the chemical substance, biological exposure limits and etc

○ None established.

b. Appropriate engineering controls :

○ Minimize source of ignition, such as static build-up, heat, spark or flame.
○ Ventilation; Good general ventilation should be sufficient for most conditions.
○ Local exhaust ventilation may be necessary for some operations.
○ Check the recommended threshold exposure limit.

c. Personal protective equipment

○ Respiratory Protection : Use an approved air-purifying respirator when vapors are generated at increased temperatures. And when dust or mist is present.
○ Eye Protection : Protective goggles with side shield or tightly fitting protective goggles,
○ Hand protection : Recommend using an approved chemical protective gloves.
○ Body protection : Put on approved chemical protective clothes.

9. PHYSICAL AND CHEMICAL PROPERTIES

a. Appearance (physical state, color, etc.) ; Solid (Translucent to white pellets or Powder)

b. Odor ; Odorless or Slight waxy odor.

c. Odor threshold ; Not available.

d. pH ; Not applicable.

e. Melting point / freezing point ; 140~170℃

f. Initial boiling point and boiling range ; Not available.

g. Flash point ; > 340℃

h. Evaporation rate ; Not applicable.

i. Flammability (solid, gas) ; Not available.

j. Upper/lower flammable or explosive limits ; Not applicable.

k. Vapor pressure ; Not applicable.

l. Solubility ; Insoluble in water.

m. Vaper density ; Not applicable.

n. Specific gravity ; 0.89 ~ 0.92 (base on water)

o. Partition coefficient ; n-octanol/water : Not applicable.

p. Auto-ignition temperature ; > 350℃

q. Decomposition temperature ; Not applicable.

r. Viscosity ; Not applicable.

s. Molecular weight ; > 1,000

10. Stability and reactivity

a. Chemical stability ; Stable under normal conditions.

b. Possibility of hazardous reactions ; Not available.

c. Conditions to avoid (e.g. static discharge, shock, vibration, etc)

- ○ Keep away from heat, sparks and flame.
- ○ Keep away from substance of mixing prohibition. (e.g. Halogen, Oxidizer, Acid)

d. Hazardous decomposition products

- ○ At elevated temperatures the material will begin to decompose, producing fumes that can contain carbon dioxide, carbon monoxide, ketones, acrolein, aldehydes, unidentified organic compounds.

11. Toxicological information

a. Information on the likely routes of exposure

- ○ (Respiratory system) : Not available.
- ○ (Oral) : Not available.
- ○ (Eye, skin) : Negligible hazard at ambient temperature (-18 to 38℃)
  Particulates may scratch eye surfaces/ cause mechanical irritation.

b. Delay and immediate effects and chronic effects from short or long term exposure.

- ○ Acute toxicity (All routes of possible exposure shall be mentioned.)
  - Acute oral toxicity; Not available
  - Acute dermal toxicity; Not available
  - Acute inhalation toxicity; Not available
- ○ Skin corrosion / irritation : Not classifiable.
- ○ Serious eye damage / eye irritation : Not classifiable.
- ○ Respiratory sensitization : Not classifiable.
- ○ Skin sensitization : Not classifiable

○ Carcinogencity : Not classifiable
○ Germ cell mutagenicity : Not available.
○ Reproductive toxicity : Not available.
○ Specific target organ toxicity (single exposure) : Not available.
○ Specific target organ toxicity (repeated exposure : Not available.
○ Aspiration hazard : Not available.

c. Numerical measurees of toxicity (acute toxicity estimation (ATE), etc.) ; Not available.

12. Ecological information

a. Toxicity : Not available.

b. Persistence and degradability : Not available.

c. Bioaccumulative protential : Not available.

d. Mobility in soil : Not available.

e. Other adverse effects : Not available.

13. Disposal considerations

a. Disposal methods

○ The user of this product must properly characterize the waste/container generated from the use of this product in accordance with all applicable federal, state and/or local laws and regulations in order to determine the proper disposal of the waste in accordance with all applicable federal, state and/or local laws and regulations.

b. Precaution for disposal (including the disposal method of contaminated containers and packages)

○ The user of this product must disposal by oneself or entrust to waste disposer or person who other's waste recycle and dispose, person who establish and operate waste disposal facilities.

○ Dispose of waste in accordance with local regulation.

14. Transport information

a. UN Number. ; Not available

b. UN proper shipping name : Not available.

c. Transport hazard classes : Not available.

d. Packing group, if applicable : Not available.

e. Marine pollutant (Yes/No) : Not available.

f. Information on any special precautions, which a user needs to be aware of, or needs to comply with in connection with transport ; Not available.

15. Regulatory information

a. Industrial Safety and Health Law : Not applicable.

b. Toxic Chemical Control Law : Not applicable.

c. Dangerous Goods Safety Control Law : Not available.

d. Waste Management Law : Not available.

e. Other regulations in domestic and foreign countries

○ **US Federal**

- CERCLA : None of the chemicals in this material
- EPCRA Section 302 (RQ) : None of the chemicals in this material
- EPCRA Section 304 (TPQ) : None of the chemicals in this product
- EPCRA Section 313 : No chemicals are reportable under section 313.

○ **European/ international regulation**

- Risk phrases : Not available
- Safety phrases : Avoid contact with eyes.

○ **Canada**

- CAS No. is listed on Canada's DSL/NDSL list.

16. Other information

a. Sources of reference materials

○ Korea Occupational Safety & Health Agency (http://www.Kosha.net)

○ Uakron University (http://ull.chemistry.uakron.edu/erd)

b. the first date of preparation : 2008.04.30

c. Number of revision times and the latest revision date: 2010. 06. 10 (Rev.1)

Material Safety Data Sheet

Section 1: PRODUCT AND COMPANY INFORMATION

Product Name(s): Lafarge Hydrated Lime

Product Identifiers: Hydrated Lime, Slaked Lime, Dolomitic Hydrated Lime, Lime, Caustic Lime, Lime Hydrate, Calcium Hydroxide, Calcium Dihydroxide, Calcium Magnesium Hydroxide, Type N Lime, Type S Lime

Manufacturer:
Lafarge North America Inc.
12950 Worldgate Drive, Suite 500
Herndon, VA 20170

Information Telephone Number:
703-480-3600 (9am to 5pm EST)
Emergency Telephone Number:
1-800-451-8346 (3E Hotline)

Product Use: Hydrated lime is used as an additive for mortar, cement, concrete and concrete products. It is also used in soil stabilization, as an anti-stripping agent in asphalt, for pH adjustment, and in other products that are widely used in construction.

Note: This MSDS covers many types of hydrated lime. Individual composition of hazardous constituents will vary between types of hydrated lime.

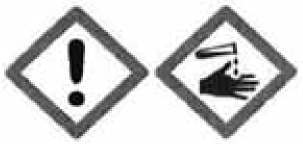
Section 2: COMPOSITION/INFORMATION ON INGREDIENTS

Component	Percent (By Weight)	CAS Number	OSHA PEL -TWA (mg/m^3)	ACGIH TLV-TWA (mg/m^3)	LD_{50} (mouse)	LC_{50}
Calcium Hydroxide	50-95	1305-62-0	15 (T); 5 (R)	5 (T)	7300mg/kg, oral	NA
Magnesium Hydroxide	0-50	1309-42-8	NA	NA	8500mg/kg, oral	NA
Calcium Oxide	0-5	1305-78-8	5 (T)	2 (T)	3059 mg/kg, intraperitoneal	NA
Magnesium Oxide	0-5	1309-48-4	15 (T)	10 (T)	NA	NA
Calcium Carbonate*	0-3	1317-65-3	15 (T), 5 (R)	10 (T)	NA	NA
Crystalline Silica	0-1	14808-60-7	[(10) / (%SiO_2+2)] (R); [(30) / (%SiO_2+2)] (T)	0.025 (R)	NA	NA

Note: Exposure limits for components noted with an * contain no asbestos and <1% crystalline silica

Hydrated lime is produced from the slow addition of water to crushed or ground quicklime (calcium oxide) which is produced by burning various forms of limestone. Trace amounts of chemicals may be detected during chemical analysis. For example, hydrated lime may contain trace amounts of iron oxide, aluminum oxide, fluoride compounds, and other trace compounds.

Section 3: HAZARD IDENTIFICATION



WARNING

Corrosive - Causes severe burns.
Toxic - Harmful by inhalation.
(Contains crystalline silica)

Use proper engineering controls, work practices, and personal protective equipment to prevent exposure to wet or dry product.

Read MSDS for details.

Section 3: HAZARD IDENTIFICATION (continued)

Emergency Overview:	Hydrated lime is a granular, white or grey, odorless powder. It is not combustible or explosive. A single, short-term exposure to the dry powder presents little or no hazard. Exposure of sufficient duration to hydrated lime can cause serious, potentially irreversible tissue (skin, eye, respiratory tract) damage due to chemical (caustic) burns, including third degree burns.
Potential Health Effects:	
Eye Contact:	Airborne dust may cause immediate or delayed irritation or inflammation. Eye contact with large amounts of dry powder or with wet hydrated lime can cause moderate eye irritation, chemical burns and blindness. Eye exposures require immediate first aid and medical attention to prevent significant damage to the eye.
Skin Contact:	Hydrated lime may cause dry skin, discomfort, irritation, and severe burns.
Burns:	Exposure of sufficient duration to wet hydrated lime, or to dry hydrated lime on moist areas of the body, can cause serious, potentially irreversible damage to skin, eye, respiratory and digestive tracts due to chemical (caustic) burns, including third degree burns. A skin exposure may be hazardous even if there is no pain or discomfort.
Inhalation (acute):	Breathing dust may cause nose, throat or lung irritation, including choking, depending on the degree of exposure. Inhalation of high levels of dust can cause chemical burns to the nose, throat and lungs.
Inhalation (chronic):	Risk of injury depends on duration and level of exposure.
Silicosis:	This product contains crystalline silica. Prolonged or repeated inhalation of respirable crystalline silica from this product can cause silicosis, a seriously disabling and fatal lung disease. See Note to Physicians in Section 4 for further information.
Carcinogenicity:	Hydrated lime is not listed as a carcinogen by IARC or NTP; however, hydrated lime contains trace amounts of crystalline silica which is classified by IARC and NTP as known human carcinogen.
Autoimmune Disease:	Some studies show that exposure to respirable crystalline silica (without silicosis) or that the disease silicosis may be associated with the increased incidence of several autoimmune disorders such as scleroderma (thickening of the skin), systemic lupus erythematosus, rheumatoid arthritis and diseases affecting the kidneys.
Tuberculosis:	Silicosis increases the risk of tuberculosis.
Renal Disease:	Some studies show an increased incidence of chronic kidney disease and end-stage renal disease in workers exposed to respirable crystalline silica.
Ingestion:	Do not ingest hydrated lime. Although ingestion of small quantities of hydrated lime is not known to be harmful, large quantities can cause chemical burns in the mouth, throat, stomach, and digestive tract.
Medical Conditions Aggravated by Exposure:	Individuals with lung disease (e.g. bronchitis, emphysema, COPD, pulmonary disease) can be aggravated by exposure.

Section 4: FIRST AID MEASURES

Eye Contact: Rinse eyes thoroughly with water for at least 15 minutes, including under lids, to remove all particles. Seek medical attention for abrasions and burns.

Skin Contact: Wash with cool water and a pH neutral soap or a mild skin detergent. Seek medical attention for rash, burns, irritation, and prolonged unprotected exposures to wet hydrated lime, cement, cement mixtures or liquids from wet cement.

Inhalation: Move person to fresh air. Seek medical attention for discomfort or if coughing or other symptoms do not subside.

Ingestion: Do not induce vomiting. If conscious, have person drink plenty of water. Seek medical attention or contact poison control center immediately.

Note to Physician: The three types of silicosis include:

- Simple chronic silicosis – which results from long-term exposure (more than 20 years) to low amounts of respirable crystalline silica. Nodules of chronic inflammation and scarring provoked by the respirable crystalline silica form in the lungs and chest lymph nodes. This disease may feature breathlessness and may resemble chronic obstructive pulmonary disease (COPD).
- Accelerated silicosis – occurs after exposure to larger amounts of respirable crystalline silica over a shorter period of time (5-15 years). Inflammation, scarring, and symptoms progress faster in accelerated silicosis than in simple silicosis.
- Acute silicosis – results from short-term exposure to very large amounts of respirable crystalline silica. The lungs become very inflamed and may fill with fluid, causing severe shortness of breath and low blood oxygen levels.

Progressive massive fibrosis may occur in simple or accelerated silicosis, but is more common in the accelerated form. Progressive massive fibrosis results from severe scarring and leads to the destruction of normal lung structures.

Section 5: FIREFIGHTING MEASURES

Flashpoint & Method:	Non-combustible	**Firefighting Equipment:**	Hydrated lime poses no fire-related hazard. A SCBA is recommended to limit exposures to combustion products when fighting any fire.
General Hazard:	Avoid breathing dust. Hydrated lime is caustic.		
Extinguishing Media:	Use extinguishing media appropriate for surrounding fire.	**Combustion Products:**	None.

Section 6: ACCIDENTAL RELEASE MEASURES

General: Place spilled material into a container. Avoid actions that cause the hydrated lime to become airborne. Avoid inhalation of hydrated lime and contact with skin. Wear appropriate protective equipment as described in Section 8. Scrape wet hydrated lime and place in container. Allow material to dry or solidify before disposal. Do not wash hydrated lime down sewage and drainage systems or into bodies of water (e.g. streams).

Waste Disposal Method: Dispose of hydrated lime according to Federal, State, Provincial and Local regulations.

Section 7: HANDLING AND STORAGE

General: Keep bulk and bagged hydrated lime dry until used. Stack bagged material in a secure manner to prevent falling. Bagged material is heavy and poses risks such as sprains and strains to the back, arms, shoulders and legs during lifting and mixing. Handle with care and use appropriate control measures.

Engulfment hazard. To prevent burial or suffocation, do not enter a confined space, such as a silo, bin, bulk truck, or other storage container or vessel that stores or contains hydrated lime. Hydrated lime can buildup or adhere to the walls of a confined space. The hydrated lime can release, collapse or fall unexpectedly.

Usage: Cutting, crushing or grinding hardened cement, concrete or other crystalline silica-bearing materials will release respirable crystalline silica. Use all appropriate measures of dust control or suppression, and Personal Protective Equipment (PPE) described in Section 8 below.

Housekeeping: Avoid actions that cause the hydrated lime to become airborne during clean-up such as dry sweeping or using compressed air. Use HEPA vacuum to clean-up dust. Use PPE described in Section 8 below.

Storage Temperature: Unlimited. **Storage Pressure:** Unlimited.

Storage: Sore in a cool, dry and well ventilated location. Do not store near incompatible materials. Keep away from moisture. Do not store or ship in aluminum containers.

Clothing: Promptly remove and launder clothing that is dusty or wet with hydrated lime. Thoroughly wash skin after exposure to dust or wet hydrated lime.

Section 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls: Use local exhaust or general dilution ventilation or other suppression methods to maintain dust levels below exposure limits.

Personal Protective Equipment (PPE):

Respiratory Protection: Under ordinary conditions no respiratory protection is required. Wear a NIOSH approved respirator that is properly fitted and is in good condition when exposed to dust above exposure limits.

Eye Protection: Wear ANSI approved glasses or safety goggles when handling dust or wet hydrated lime to prevent contact with eyes. Wearing contact lenses when using hydrated lime, under dusty conditions, is not recommended.

Skin Protection: Wear gloves, boot covers and protective clothing impervious to water to prevent skin contact. Do not rely on barrier creams, in place of impervious gloves. Remove clothing and protective equipment that becomes saturated with wet hydrated lime and immediately wash exposed areas.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid (powder).	**Evaporation Rate:**	NA.
Appearance:	White or grey powder.	**pH (in water):**	12-13
Odor:	None.	**Boiling Point:**	>1000° C
Vapor Pressure:	NA.	**Freezing Point:**	None, solid.
Vapor Density:	NA.	**Viscosity:**	None, solid.
Specific Gravity:	2-3	**Solubility in Water:**	Negligible

Section 10: STABILITY AND REACTIVITY

Stability: Stable, but reacts slowly with carbon dioxide to form calcium and magnesium carbonate. Keep dry until use. Hydrated lime may react with water, resulting in a slight release of heat, depending on the amount of lime (Calcium oxide) present. Avoid contact with incompatible materials.

Incompatibility: Wet hydrated lime and cement is alkaline and is incompatible with acids, ammonium salts and aluminum metal. Hydrated lime and cement dissolves in hydrofluoric acid, producing corrosive silicon tetrafluoride gas. Hydrated lime and cement reacts with water to form silicates and calcium hydroxide. Silicates react with powerful oxidizers such as fluorine, boron trifluoride, chlorine trifluoride, manganese trifluoride, and oxygen difluoride.

Hazardous Polymerization: None.

Hazardous Decomposition: Hydrated lime will decompose at 540°C to produce calcium oxide (quicklime), magnesium oxide, and water.

Section 11 and 12: TOXICOLOGICAL AND ECOLOGICAL INFORMATION

For questions regarding toxicological and ecological information refer to contact information in Section 1.

Section 13: DISPOSAL CONSIDERATIONS

Dispose of waste and containers in compliance with applicable Federal, State, Provincial and Local regulations.

Section 14: TRANSPORT INFORMATION

This product is not classified as a Hazardous Material under U.S. DOT or Canadian TDG regulations.

Section 15: REGULATORY INFORMATION

OSHA/MSHA Hazard Communication: This product is considered by OSHA/MSHA to be a hazardous chemical and should be included in the employer's hazard communication program.

CERCLA/SUPERFUND: This product is not listed as a CERCLA hazardous substance.

EPCRA SARA Title III: This product has been reviewed according to the EPA Hazard Categories promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 and is considered a hazardous chemical and a delayed health hazard.

EPRCA SARA Section 313: This product contains none of the substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

RCRA: If discarded in its purchased form, this product would not be a hazardous waste either by listing or characteristic. However, under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified as a hazardous waste.

TSCA: Hydrated lime and crystalline silica are exempt from reporting under the inventory update rule.

California Proposition 65: Crystalline silica (airborne particulates of respirable size) is known by the State of California to cause cancer.

Section 15: REGULATORY INFORMATION (continued)

WHMIS/DSL: Products containing crystalline silica and calcium carbonate are classified as D2A, E and are subject to WHMIS requirements.

Section 16: OTHER INFORMATION

Abbreviations:

>	Greater than	NA	Not Applicable
ACGIH	American Conference of Governmental Industrial Hygienists	NFPA	National Fire Protection Association
CAS No	Chemical Abstract Service number	NIOSH	National Institute for Occupational Safety and Health
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act	NTP	National Toxicology Program
		OSHA	Occupational Safety and Health Administration
CFR	Code for Federal Regulations	PEL	Permissible Exposure Limit
CL	Ceiling Limit	pH	Negative log of hydrogen ion
DOT	U.S. Department of Transportation	PPE	Personal Protective Equipment
EST	Eastern Standard Time	R	Respirable Particulate
HEPA	High-Efficiency Particulate Air	RCRA	Resource Conservation and Recovery Act
HMIS	Hazardous Materials Identification System	SARA	Superfund Amendments and Reauthorization Act
IARC	International Agency for Research on Cancer	T	Total Particulate
		TDG	Transportation of Dangerous Goods
LC_{50}	Lethal Concentration	TLV	Threshold Limit Value
LD_{50}	Lethal Dose	TWA	Time Weighted Average (8 hour)
mg/m^3	Milligrams per cubic meter	WHMIS	Workplace Hazardous Materials Information System
MSHA	Mine Safety and Health Administration		

This MSDS (Sections 1-16) was revised on March 1, 2008.

An electronic version of this MSDS is available at: www.lafarge-na.com under the Products section.

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NO WARRANTY IS MADE, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE.

Safety Data Sheet

Hydrogen Peroxide, 10% (w/w)

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Hydrogen Peroxide, 10% (w/w)

Synonyms/Generic Names: Peroxide

Product Number: 8836

Product Use: Industrial, Manufacturing or Laboratory use

Manufacturer: Columbus Chemical Industries, Inc.
N4335 Temkin Rd.
Columbus, WI. 53925

For More Information Call: 820-623-2140 (Monday-Friday 8:00-4:30)

In Case of Emergency Call: CHEMTREC - 800-424-9300 or 703-527-3887 (24 Hours/Day, 7 Days/Week)

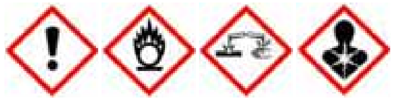
2. HAZARDS INDENTIFICATION

OSHA Hazards: Oxidizer, Target organ effect, Toxic by ingestion, Corrosive, Carcinogen

Target Organs: Eyes, Skin, Respiratory system

Signal Words: Danger

Pictograms:



GHS Classification

Oxidizing liquids	Category 1
Acute toxicity, Dermal	Category 4
Acute toxicity, Oral	Category 4
Skin corrosion	Category 1
Eye irritation	Category 1
Respiratory sensitizer	Category 1B

GHS Label Elements, including precautionary statements:

Hazard Statements:

H271	May cause fire or explosion; strong oxidizer
H302	Harmful if swallowed
H314	Causes severe skin burns and eye damage
H333	May be harmful if inhaled
H402	Harmful to aquatic life

Precautionary Statements:

P220	Keep/store away from clothing/combustible materials.
P280	Wear protective gloves/protective clothing/eye protection/face protection
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing.
P310	Immediately call a POISON CENTER or doctor/physician.

Potential Health Effects

Eyes	May cause serious damage.
Inhalation	Irritating to the respiratory system. Causes irritation to the respiratory tract.
Skin	Irritating to skin. Contact causes redness, burns, itching and pain. Prolonged or repeated skin exposure may cause dermatitis.
Ingestion	Causes irritation and pain.

NFPA Ratings

Health	3
Flammability	0
Reactivity	1
Specific hazard	OX

HMIS Ratings

Health	3
Fire	0
Reactivity	1
Personal	D

3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	Weight %	CAS #	EINECS# / ELINCS#	Formula	Molecular Weight
Hydrogen Peroxide	10	7722-84-1	231-765-0	H_2O_2	34.01 g/mol
Water	Balance	7732-18-5	231-791-2	H_2O	18.00 g/mol

4. FIRST-AID MEASURES

Eyes	In case of eye contact, rinse with plenty of water and seek medical attention immediately.
Inhalation	Move casualty to fresh air and keep at rest. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Get medical attention.
Skin	Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and wash using soap. Get medical attention immediately.
Ingestion	**Do Not Induce Vomiting!** Never give anything by mouth to an unconscious person. If conscious, wash out mouth with water. Get medical attention immediately.

5. FIREFIGHTING MEASURES

Suitable (and unsuitable) extinguishing media	Product is not flammable. Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Use flooding quantities of water to cool containers.
Special protective equipment and precautions for firefighters	Wear self-contained, approved breathing apparatus and full protective clothing, including eye protection and boots.
Specific hazards arising from the chemical	Product components will burn producing oxygen. (See also Stability and Reactivity section).

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	See section 8 for recommendations on the use of personal protective equipment.
Environmental precautions	Prevent spillage from entering drains. Any release to the environment may be subject to federal/national or local reporting requirements.
Methods and materials for containment and cleaning up	Neutralize spill with sodium bicarbonate or lime. Absorb spill with noncombustible absorbent material, then place in a suitable container for disposal. Clean surfaces thoroughly with water to remove residual contamination. Dispose of all waste and cleanup materials in accordance with regulations.

7. HANDLING AND STORAGE

Precautions for safe handling
See section 8 for recommendations on the use of personal protective equipment. Use with adequate ventilation. Wash thoroughly after using. Keep container closed when not in use.

Conditions for safe storage, including any incompatibilities
Store in cool, dry well ventilated area. Isolate from combustible material. Store in the dark. Keep away from incompatible materials (see section 10 for incompatibilities).

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational exposure controls:

Component	Exposure Limits	Basis	Entity
Hydrogen Peroxide	1 ppm 1.4 mg/m^3	TLV	ACGIH
	1 ppm 1.4 mg/m^3	PEL	OSHA
	1 ppm 1.4 mg/m^3	REL	NIOSH

TWA: Time Weighted Average over 8 hours of work.
TLV: Threshold Limit Value over 8 hours of work.
REL: Recommended Exposure Limit
PEL: Permissible Exposure Limit
STEL: Short Term Exposure Limit during x minutes.
IDLH: Immediately Dangerous to Life or Health
WEEL: Workplace Environmental Exposure Levels
CEIL: Ceiling

Personal Protection

Eyes	Wear chemical safety glasses with a face shield for splash protection.
Inhalation	Provide local exhaust, preferably mechanical. If exposure levels are excessive, use an approved respirator.
Skin	Wear neoprene or nitrile gloves, apron and other protective clothing appropriate to the risk of exposure.
Other	Not Available

Other Recommendations
Provide eyewash stations, quick-drench showers and washing facilities accessible to areas of use and handling. Have supplies and equipment for neutralization and running water available.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance (physical state, color, etc.)	Clear, colorless liquid
Odor	No Odor
Odor threshold	Not Applicable
pH	Not Available
Melting point/freezing point	Not Available
Initial boiling point and boiling range	Not Available
Flash point	Not Flammable
Evaporation rate	Not Available
Flammability (solid, gas)	Not Flammable
Upper/lower flammability or explosive limit	Not Explosive
Vapor pressure	Not Available
Vapor density	Not Available
Relative density	Not Available
Solubility (ies)	Completely soluble in water
Partition coefficient: n-octanol/water	Not Available
Auto-ignition temperature	Not Applicable
Decomposition temperature	Not Available

10. STABILITY AND REACTIVITY

Chemical Stability	Stable
Possibility of Hazardous Reactions	Will not occur.
Conditions to Avoid	Store out of direct light
Incompatible Materials	Brass, Copper, Powdered metals, Iron, Iron and iron salts, combustible materials
Hazardous Decomposition Products	Not Available

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Skin	LD50 Dermal – rat – 4060 mg/kg
Eyes	Not Available
Respiratory	LC50 Vapor – rat – 2000 mg/m – 4 hours
Ingestion	LD50 Oral – mouse – 2000 mg/kg

Carcinogenicity

IARC	3-Group 3: Not classifiable as to its carcinogenicity to humans.
ACGIH	A3: Confirmed animal carcinogen with unknown relevance to humans.
NTP	No components of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA	No components of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Signs & Symptoms of Exposure

Skin	Redness, burning, itching and pain.
Eyes	Eye burns, pain, watering eyes.
Respiratory	Coughing, shortness of breath, burning, choking, coughing, wheezing, laryngitis, headache or nausea.
Ingestion	Causes irritation and pain.

Chronic Toxicity	Not Available
Teratogenicity	Not Available
Mutagenicity	Not Available
Embryotoxicity	Not Available
Specific Target Organ Toxicity	Not Available

12. ECOLOGICAL INFORMATION

Ecotoxicity

Aquatic Vertebrate	Not Available
Aquatic Invertebrate	Not Available
Terrestrial	Not Available

Persistence and Degradability	Not Available
Bioaccumulative Potential	Not Available
Mobility in Soil	Not Available
PBT and vPvB Assessment	Not Available
Other Adverse Effects	Not Available

13. DISPOSAL CONSIDERATIONS

Waste Residues	Users should review their operations in terms of the applicable federal/national or local regulations and consult with appropriate regulatory agencies if necessary before disposing of waste product container.
Product Containers	Users should review their operations in terms of the applicable federal/national or local regulations and consult with appropriate regulatory agencies if necessary before disposing of waste product container.

The information offered in section 13 is for the product as shipped. Use and/or alterations to the product may significantly change the characteristics of the material and alter the waste classification and proper disposal methods.

14. TRANSPORTATION INFORMATION

US DOT	UN2984, Hydrogen peroxide, aqueous solutions 5.1, (8), pg III
TDG	UN2984, HYDROGEN PEROXIDE, AQUEOUS SOLUTIONS 5.1, (8), PG III
IMDG	UN2984, HYDROGEN PEROXIDE, AQUEOUS SOLUTIONS 5.1, (8), PG III
Marine Pollutant	No
IATA/ICAO	UN2984, Hydrogen peroxide, aqueous solutions 5.1, (8), pg III

15. REGULATORY INFORMATION

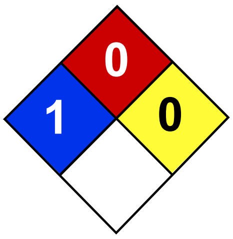
TSCA Inventory Status	All ingredients are listed on the TSCA inventory.
DSCL (EEC)	All ingredients are listed on the DSCL inventory.
California Proposition 65	Not Listed

SARA 302	Listed: Hydrogen Peroxide
SARA 304	Listed: Hydrogen Peroxide
SARA 311	Hydrogen Peroxide
SARA 312	Hydrogen Peroxide
SARA 313	Listed: Hydrogen Peroxide
WHMIS Canada	Class C: Oxidizing Material Class D-2B: Toxic Material Causing Other Toxic Effects

16. OTHER INFORMATION

Revision	Date
Revision 1	12/03/2012

Disclaimer: Columbus Chemical Industries, Inc. ("Columbus") believes that the information herein is factual but is not intended to be all inclusive. The information relates only to the specific material designated and does not relate to its use in combination with other materials or its use as to any particular process. Because safety standards and regulations are subject to change and because Columbus has no continuing control over the material, those handling, storing or using the material should satisfy themselves that they have current information regarding the particular way the material is handled, stored or used and that the same is done in accordance with federal, state and local law. COLUMBUS MAKES NO WARRANTY, EXPRESS OR IMPLIED, INCLUDING (WITHOUT LIMITATION) WARRANTIES WITH RESPECT TO THE COMPLETENESS OR CONTINUING ACCURACY OF THE INFORMATION CONTAINED HEREIN OR WITH RESPECT TO FITNESS FOR ANY PARTICULAR USE.



Health	1
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Ferric oxide MSDS

Section 1: Chemical Product and Company Identification

Product Name: Ferric oxide

Catalog Codes: SLF1657

CAS#: 1309-37-1

RTECS: N07400000

TSCA: TSCA 8(b) inventory: Ferric oxide

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: Fe_2O_3

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Ferric oxide	1309-37-1	100

Toxicological Data on Ingredients: Ferric oxide LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of ingestion. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: No known effect on eye contact, rinse with water for a few minutes.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions: No specific safety phrase has been found applicable for this product.

Storage:
No specific storage is required. Use shelves or cabinets sturdy enough to bear the weight of the chemicals. Be sure that it is not necessary to strain to reach materials, and that shelves are not overloaded.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 5 (mg/m3) from ACGIH [1995] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 159.7 g/mole

Color: Not available.

pH (1% soln/water): Not applicable.

Boiling Point: Decomposes.

Melting Point: 1565°C (2849°F)

Critical Temperature: Not available.

Specific Gravity: 5.24 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans: The substance is toxic to lungs, mucous membranes.

Other Toxic Effects on Humans:
Hazardous in case of ingestion. Slightly hazardous in case of skin contact (irritant), of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: Ferric oxide Massachusetts RTK: Ferric oxide TSCA 8(b) inventory: Ferric oxide

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
This product is not classified according to the EU regulations.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 05:32 PM

Last Updated: 05/21/2013 12:00 PM

MATERIAL SAFETY DATA SHEET

Section 1: Chemical Product Company Identification

Manufacturer :
Address :
Tel/Fax No. :
Product Class : **Lead Bullion**
Chemical / Trade Name : **Lead Bullion**

Section 2: Composition

Trade Name	**COMPOSITION, %**					
	Pb	**Sb**	**Cu**	**Sn**	**As**	**Bi**
Inorganic Lead Alloy	Balance	6.5 max	0.36 max	2.25 max	0.25 max	0.02 max

Section 3: Hazards Identification

Routes of Entry: Hazardous exposure can occur only when product is heated above the melting point, oxidized or otherwise processed or damaged to create dust, vapor, or fume.

☐ Inhalation : Dust, vapor, and/or fumes may cause irritation of upper respiratory tract and lungs and can result in both acute and chronic overexposure.
☐ Eye Contact : Dust, vapor, and/or fumes may cause eye irritation or conjunctivitis.
☐ Skin Contact : Dust, vapor, and/or fumes may cause irritation, dermatitis, or contact dermatitis. Dust, vapor, and/or fumes are not readily absorbed through the skin. Molten metal cause severe burns
☐ Ingestion : Dust, vapor, and/or fumes may be absorbed by the digestive system and can result in both acute and chronic overexposure.

CLASS D: POISONOUS AND INFECTIOUS MATERIAL
Division 2: Materials Causing Other Toxic EFFECTS

These materials can cause life-threatening and serious long-term health problems as well as less severe but immediate reactions in a person who is repeatedly exposed to small amounts.

Section 4: First Aid Measures

☐ Skin : Wash immediately with brush, with soap and water, flush with plenty of water, contact physician.
☐ Eye : Flush immediately with large amounts of water for at least 15 minutes; consult physician immediately.
☐ Inhalation : Remove from exposure, gargle, wash nose and lips; consult physician.
☐ Ingestion : Induce vomiting if conscious, gargle, wash nose and lips; give a demulcent, consult physician.

Section 5: Fire Fighting Measures

Flammable:

☐ Yes, what conditions? N/A
☑ No

Flash Point : N/A - Inorganic lead compound is not a combustible material, nor will it explode under normal conditions
Auto-ignition Temp : N/A
Explosion Data:
Sensitivity to impact : None known
Sensitivity to static discharge : None known

Means of Extinction:

This product is non-combustible. For fires involving molten lead, use Class D extinguisher agents approved for this use. Ring the burning area with dry sand and allow fire to burn out. DO NOT USE WATER.

Special Procedures:

Wear full body protective clothing and use positive pressure, self-contained respiratory breathing apparatus with a full face piece.

Hazardous Decomposition Products:

Temperatures above the melting point are likely to produce toxic metal fume, vapor, or dust; contact with strong acid or base or presence of nascent hydrogen may generate highly toxic arsine gas (TLV 0.05 ppm).

Section 6: Accidental Release Measures

If molten, contain the flow by using sand or alumina as a dam. Do not attempt to halt the flow of metal with shovels or hand tools.

Section 7: Handling and Storage

Handling and Storage Procedure:

Store in a dry area where accidental contact with acids, strong oxidizing agents and water is not possible

Spill or Leak Procedure:

For molten metal, use controls that minimize fugitive emissions. Place in dry containers for or recycling.

Section 8: Exposure Control / Personal Protection

OSHA PEL : *TWA 0.05 mg(Pb)/m*^{3}
ACGIH TLV : *TWA 0.15 mg(Pb)/m*^{3}
NIOSH REL : *(Inorganic Lead) TWA 0.10 mg(Pb)/m*^{3}

Engineering Control and Work Practices:

Ventilation shall be provided in areas where exposures are above the permissible exposure limits or threshold limit values specified by OSHA.

Respiratory Protection:

Where exposure is above the permissible exposure limit or the threshold limit values, the minimum respiratory protection recommended is a negative pressure half-mask respirator with high-efficiency cartridges that are NIOSH/MSHA approved against dust, mist, and fumes having a TWA of 0.05 mg/m3.

Personal Protective Equipment:

Gloves : Protective gloves should be worn when handling this product

Eyewear : Safety glasses with side shields or goggles shall be worn when using this product to prevent the dust from getting into the eyes. Whenever working with molten metal, always use a face shield.

Other Protection : Coveralls or other full body clothing shall be worn during product use and properly laundered after use, with the wash water disposed of in accordance with local, state and federal regulations. Hard hat, safety boots and other safety equipment shall be worn as appropriate for the industrial environment. Personal clothing and shoes should be protected from contamination with this product.

Section 9: Physical and Chemical Properties

☐ Boiling Point	: >1,380 °C
☐ Specific gravity	: 9.6 -11.3
☐ Vapor Pressure	: N/A
☐ Vapor Density	: N/A
☐ Coefficient of water Oil distillation	: N/A
☐ Odor Threshold	: N/A
☐ Melting Point	: 327 °C min
☐ Solubility	: Insoluble
☐ Physical State	: Grey metal with no apparent odor.
☐ pH	: N/A
☐ Evaporation Rate	: N/A

Section 10: Stability and Reactivity

Stability:

☑ **Stable**
☐ **Unstable**

Conditions to avoid:

Avoid storage near strong oxidizers and acids.

Incompatibility:

Strong oxidizers and this product may react violently and liberate hydrogen gas. Mixing with strong acids may release stibine or arsine gas.

Hazardous Decomposition:

Molten metals produce fume, vapor and/or dust that may be toxic and/or respiratory irritants. This product, or its dust, can react vigorously with strong oxidizing agents.

Section 11: Toxicological Information

Effects of Acute Exposure:

Symptoms of toxicity include headache, fatigue, abdominal pain, loss of appetite, vomiting, muscular aches and weakness, loss of coordination, sleep disturbances, irritability, convulsions, stupor, and possibly coma.

Effects of Chronic Exposure:

May cause weakness, insomnia, metallic taste in mouth, anemia; constipation, headache, muscle and joint pain, neuromuscular dysfunction, liver or kidney damage; reproductive changes in both males and females, possible paralysis and encephalopathy.

Irritancy of Product:

Mild

Skin Sensitization:

None known

Carcinogenicity:

Lead compounds - human studies are inconclusive regarding lead exposure and an increased cancer risk. The EPA and the International Agency for Research on Cancer (IARC) have categorized lead and inorganic lead compounds as a B2 classification (probable / possible human carcinogen) based on sufficient animal evidence and inadequate human evidence.

Arsenic - Listed by National Toxicology Program (NTP), International agency for Research on Cancer (IARC), OSHA and NIOSH as a carcinogen only after prolonged exposure at high levels.

Reproductive Effects:

None known for metallic lead, but lead compounds may pose risk to human reproductive health

Mutagenicity:

None known

Medical Conditions Generally Aggravated by Exposure:

Lead and its compounds can aggravate some forms of kidney, liver, and neurological diseases.

Section 12: Ecological Information

NOT AVAILABLE

Section 13: Disposal Consideration

This material is recycled in a lead smelter for further recovery of lead and other metals.
For disposal of this material as a waste, act in accordance with all waste management laws and regulations.

Section 14: Transport Information

This product is not regulated in ingot form.

Section 15: Regulatory Information

This product is not regulated by DENR unless it is in a powdered form.

Section 16: Other Information

ALL STATEMENTS, TECHNICAL INFORMATION AND RECOMMENDATIONS CONTAINED HEREIN ARE BASED ON TESTS AND DATA WHICH THIS COMPANY BELIEVES TO BE CURRENTLY RELIABLE, BUT THE ACCURACY OR COMPLETENESS THEREOF IS NOT GUARANTEED AND NO WARRANTY OF ANY KIND IS MADE WITH RESPECT THERETO. THIS INFORMATION IS NOT INTENDED AS A LICENSE TO OPERATE UNDER OR A RECOMMENDATION TO PRACTICE OR INFRINGE ANY PATENT OF THIS COMPANY OR OTHERS COVERING ANY PROCESS, COMPOSITION OF MATTER OR USE. SINCE THE COMPANY SHALL HAVE NO CONTROL OF THE USE OF THE PRODUCT DESCRIBED HEREIN, THE COMPANY ASSUMES NO LIABILITY FOR LOSS OR DAMAGE INCURRED FROM THE PROPER OR IMPROPER USE OF SUCH PRODUCT.

MATERIAL SAFETY DATA SHEET

Revised edition no : 1
Date : 30 / 7 / 2010
Supersedes : 0 / 0 / 0

OXYGEN, REFRIGERATED LIQUID (O2)

AL610

Label 2.2 : Non flammable, non toxic gas.

Label 5.1 : Oxidizing substances.

1 IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Trade name : OXYGEN, REFRIGERATED LIQUID (O2)
MSDS Nr : AL610
Use : Industrial applications.
Chemical formula : O2
Company identification : Air Liquide Australia Limited
Level 9 / 380 St. Kilda Road
Melbourne VIC 3004 Australia
Tel: + 61 3 9697 9888
Fax: + 61 3 9690 7107
ALAEnquiries@AirLiquide.com
Emergency phone nr : 1800 812 588

2 HAZARDS IDENTIFICATION

Hazard classification : Not classified as hazardous according to NOHSC criteria.
Classified as a dangerous good by the criteria of the ADG code.

Hazards identification : Refrigerated liquefied gas. Contact with product may cause cold burns or frostbite. Oxidant. Strongly supports combustion. May react violently with combustible materials.

R Phrase(s) : R8 : Contact with combustible material may cause fire.

S Phrase(s) : S17 : Keep away from combustible material.

3 COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Preparation : Substance.

Substance name		Contents	CAS No	EC No	Annex No	Classification
Oxygen (refrigerated)	:	100 %	7782-44-7	231-956-9	008-001-00-8	O; R8

Contains no other components or impurities which will influence the classification of the product.

4 FIRST AID MEASURES

First aid measures

- Inhalation : Continuous inhalation of concentrations higher than 75% may cause nausea, dizziness, respiratory difficulty and convulsion.
Remove victim to uncontaminated area.

- Skin/eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes.
In case of frostbite spray with water for at least 15 minutes. Apply a sterile dressing. Obtain medical assistance.

- Ingestion : Ingestion is not considered a potential route of exposure.

5 FIRE-FIGHTING MEASURES

Specific hazards : Exposure to fire may cause containers to rupture/explode.
Supports combustion.

5 FIRE-FIGHTING MEASURES (continued)

Hazardous combustion products : None.

Extinguishing media

- Suitable extinguishing media : All known extinguishants can be used.

Specific methods : If possible, stop flow of product.
Move away from the container and cool with water from a protected position.
If leaking do not spray water onto container. Water surrounding area (from protected position) to contain fire.

Special protective equipment for fire fighters : None.

6 ACCIDENTAL RELEASE MEASURES

Personal precautions : Evacuate area.
Ensure adequate air ventilation.
Eliminate ignition sources.
Use protective clothing.

Environmental precautions : Try to stop release.
Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.

Clean up methods : Ventilate area.
Keep area evacuated and free from ignition sources until any spilled liquid has evaporated. (Ground free from frost).

7 HANDLING AND STORAGE

Storage : Segregate from flammable gases and other flammable materials in store.
Keep container below 50℃ in a well ventilated place.

Handling : Use no oil or grease.
Open valve slowly to avoid pressure shock.
Suck back of water into the container must be prevented.
Do not allow backfeed into the container.
Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Contact your gas supplier if in doubt.
Keep away from ignition sources (including static discharges).
Refer to supplier's container handling instructions.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Personal protection : Do not smoke while handling product.
Ensure adequate ventilation.
Protect eyes, face and skin from liquid splashes.
Avoid oxygen rich (>21%) atmospheres.

9 PHYSICAL AND CHEMICAL PROPERTIES

Physical state at 20 ℃ : Gas.
Colour : Bluish liquid.
Odour : No odour warning properties.
Molecular weight : 32
Melting point [℃] : -219
Boiling point [℃] : -183
Critical temperature [℃] : -118

9 PHYSICAL AND CHEMICAL PROPERTIES (continued)

Vapour pressure [20℃] : Not applicable.
Relative density, gas (air=1) : 1.1
Relative density, liquid (water=1) : 1.1
Solubility in water [mg/l] : 39
Flammability range [vol% in air] : Oxidiser.
Auto-ignition temperature [℃] : Not applicable.
Other data : Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.

10 STABILITY AND REACTIVITY

Stability and reactivity : May react violently with combustible materials.
May react violently with reducing agents.
Violently oxidises organic material.
Liquid spillages can cause embrittlement of structural materials.
Risk of explosion if spilt on organic structural materials (eg wood or asphalt)..
Hazardous decomposition products : None.

11 TOXICOLOGICAL INFORMATION

Toxicity information : No toxicological effects from this product.

12 ECOLOGICAL INFORMATION

Ecological effects information : Can cause frost damage to vegetation.

13 DISPOSAL CONSIDERATIONS

General : To atmosphere in a well ventilated place.
Do not discharge into any place where its accumulation could be dangerous.
Contact supplier if guidance is required.

14 TRANSPORT INFORMATION

UN No. : 1073
• Labelling ADG, IMDG, IATA

: Label 5.1 : Oxidizing substances.
Label 2.2 : Non flammable, non toxic gas.

Land transport
H.I. nr : 225
Proper shipping name : OXYGEN, REFRIGERATED LIQUID
HAZCHEM - Emergency Action Code : 2P
: *2 = Fine water spray.*
P = Risk of violent reaction or explosion. Recommended personal protective equipment : Liquid-tight chemical protective clothing and breathing apparatus. Appropriate measures : dilute.
- ADG Class : 2
- ADG Classification code : 3 O

14 TRANSPORT INFORMATION (continued)

- Packing Instruction(s) - General : P203

Sea transport

- IMO-IMDG code

• Proper shipping name : OXYGEN, REFRIGERATED LIQUID

• Class : 2.2

- IMO Packing group : P203

- Emergency Schedule (EmS) - Fire : F-C

- Emergency Schedule (EmS) - Spillage : S-W

- Instructions - Packing : P203

Air transport

- ICAO/IATA

- Proper shipping name : OXYGEN, REFRIGERATED LIQUID

• Class : 2.2

• Passenger and Cargo Aircraft : DO NOT LOAD IN PASSENGER AIRCRAFT.

• Cargo Aircraft only : FORBIDDEN.

Other transport information : Avoid transport on vehicles where the load space is not separated from the driver's compartment.
Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency.
Before transporting product containers :
- Ensure that containers are firmly secured.
- Ensure cylinder valve is closed and not leaking.
- Ensure valve outlet cap nut or plug (where provided) is correctly fitted.
- Ensure valve protection device (where provided) is correctly fitted.
- Ensure there is adequate ventilation.
- Compliance with applicable regulations.

15 REGULATORY INFORMATION

EC Classification : Annex No : 008-001-00-8
O; R8

EC Labelling

Symbol(s) : O : Oxidizing

R Phrase(s) : R8 : Contact with combustible material may cause fire.

S Phrase(s) : S17 : Keep away from combustible material.

16 OTHER INFORMATION

May cause frostbite.
Ensure all national/local regulations are observed.
Ensure operators understand the hazard of oxygen enrichment.

This Safety Data Sheet has been established in accordance with the applicable European Directives and applies to all countries that have translated the Directives in their national laws.

DISCLAIMER OF LIABILITY : Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out.
Details given in this document are believed to be correct at the time of going to press. Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted.

End of document

MATERIAL SAFETY DATA SHEET

Section 1: Chemical Product Company Identification

Manufacturer :
Address :
Tel/Fax No. :
Product Class : **Polypropylene**
Chemical / Trade Name : **PP Chips**

Section 2: Composition

Trade Name	**COMPOSITION, %**		
	Moisture	**Pb**	**Polypropylene**
PP Chips	3-11	0.033-0.11	89-98.5

Section 3: Hazards Identification

PP Chips is a multi-colored plastic composite from battery casings containing a little amount of lead sulfate and lead oxide. It is generally non-toxic but exposure to the adhering lead bearing compounds presents health hazards.

- ☐ Inhalation : Inhalation of high concentrations of dust may irritate the upper respiratory tract and damage lungs by accumulation
- ☐ Eye Contact : Eye contact with large amounts of dry powder or with wet PP chips can cause severe irritation.
- ☐ Skin Contact : Repeated exposure may cause slight irritation
- ☐ Ingestion : Ingestion of lead sulfate and lead oxide in the PP chips may lead to anemia, kidney and CNS damage, and may cause reproductive defects by accumulation.

CLASS D: POISONOUS AND INFECTIOUS MATERIAL
Division 2: Materials Causing Other Toxic EFFECTS

These materials can cause life-threatening and serious long-term health problems as well as less severe but immediate reactions in a person who is repeatedly exposed to small amounts.

MATERIAL SAFETY DATA SHEET

Section 4: First Aid Measures

☐ Skin : Wash skin with soap and plenty of water for at least 15 minutes. Remove contaminated clothing while washing.
☐ Eye : Immediately flush eyes with large amounts of water for at least 15 minutes. Get immediate medical attention if irritation persists.
☐ Inhalation : If inhaled in high amounts, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult give oxygen and get medical attention.
☐ Ingestion : Induce vomiting if conscious. Seek medical attention

Section 5: Fire Fighting Measures

Flash Point **:** 400 °C
Auto-ignition Temp **:** N/A
Explosion Data:
Sensitivity to impact : None
Sensitivity to static discharge : None

Means of Extinction:
Foam, dry chemicals, water, CO2

Hazardous Decomposition Products:
CO, CO_2

Special Firefighting Protective Equipment:
Fire fighters should be equipped with self-contained breathing apparatus during large fires

Section 6: Accidental Release Measures

Place spilled material into a container for proper disposal or recycling. When dry, avoid actions that cause adhering powder lead compounds to become airborne. Wear appropriate protective equipment as described in section 8.

Dispose of PP chips according to DENR regulations.

Section 7: Handling and Storage

Handle with care and use appropriate control measures to avoid spillage and contamination of area with lead bearing dust and leachate.

Sweep and shovel into proper container for disposal or recycling when spilled. Flush powder with water. Use PPE described in Section 8 below.

Section 8: Exposure Control / Personal Protection

OSHA PEL : *TWA 0.05* $mg(Pb)/m^3$
ACGIH TLV : *TWA 0.15* $mg(Pb)/m^3$
NIOSH REL : *(Inorganic Lead) TWA 0.10* $mg(Pb)/m^3$

Engineering Control and Work Practices:

Ventilation shall be provided in areas where exposures are above the permissible exposure limits or threshold limit values specified by OSHA.

Respiratory Protection:

Where exposure is above the permissible exposure limit or the threshold limit values, the minimum respiratory protection recommended is a negative pressure half-mask respirator with high-efficiency cartridges that are NIOSH/MSHA approved against dust, mist, and fumes having a TWA of 0.05 mg/m3.

Personal Protective Equipment:

Gloves : Protective gloves should be worn when handling this product

Eyewear : Safety glasses with side shields or goggles shall be worn when using this product to prevent the dust from getting into the eyes. Whenever working with molten metal, always use a face shield.

Other Protection : Coveralls or other full body clothing shall be worn during product use and properly laundered after use, with the wash water disposed of in accordance with local, state and federal regulations. Hard hat, safety boots and other safety equipment shall be worn as appropriate for the industrial environment. Personal clothing and shoes should be protected from contamination with this product.

Section 9: Physical and Chemical Properties

☐ Boiling Point : N/A, decomposes at > 300 °C
☐ Flash Point : 400 °C
☐ Specific gravity : 0.9-0.92
☐ Vapor Pressure : N/A
☐ Vapor Density : N/A
☐ Coefficient of water Oil distillation : N/A
☐ Odor Threshold : N/A
☐ Melting Point : 160 °C
☐ Solubility : Insoluble
☐ Physical State : Solid chips
☐ pH : N/A
☐ Evaporation Rate : N/A

MATERIAL SAFETY DATA SHEET

Section 10: Stability and Reactivity

Stability:

☑ **Stable**
☐ **Unstable**

Incompatibility:

Chlorine and strong oxidants.

Hazardous Decomposition:

Fire decomposition products mainly include CO, CO_2. Oxides and other compounds of sulfur are likely to be formed.

Section 11: Toxicological Information

Effects of Acute Exposure:

Symptoms of toxicity include headache, fatigue, abdominal pain, loss of appetite, vomiting, muscular aches and weakness, loss of coordination, sleep disturbances, irritability, convulsions, stupor, and possibly coma.

Effects of Chronic Exposure:

May cause weakness, insomnia, metallic taste in mouth, anemia; constipation, headache, muscle and joint pain, neuromuscular dysfunction, liver or kidney damage; reproductive changes in males and females, possible paralysis and encephalopathy.

Irritancy of Product:

Mild

Skin Sensitization:

None known

Carcinogenicity:

The EPA and the International Agency for Research on Cancer (IARC) have categorized lead and inorganic lead compounds as a B2 classification (probable / possible human carcinogen) based on sufficient animal evidence and inadequate human evidence.

Reproductive Effects:

None known

Mutagenicity:

None known

Medical Conditions Generally Aggravated by Exposure:

Lead and its compounds can aggravate some forms of kidney, liver, and neurological diseases.

MATERIAL SAFETY DATA SHEET

Section 12: Ecological Information

NOT AVAILABLE

Section 13: Disposal Consideration

Reuse, recycle or dispose waste and containers in compliance with DENR regulatory standards.

Section 14: Transport Information

Compliance to DAO 2004-36 Transport Requirements Needed.

Section 15: Regulatory Information

This product contains a chemical or chemicals subject to the reporting requirement of DAO 29 - Classification of Hazardous Waste - Waste number D406.

Section 16: Other Information

ALL STATEMENTS, TECHNICAL INFORMATION AND RECOMMENDATIONS CONTAINED HEREIN ARE BASED ON TESTS AND DATA WHICH THIS COMPANY BELIEVES TO BE CURRENTLY RELIABLE, BUT THE ACCURACY OR COMPLETENESS THEREOF IS NOT GUARANTEED AND NO WARRANTY OF ANY KIND IS MADE WITH RESPECT THERETO. THIS INFORMATION IS NOT INTENDED AS A LICENSE TO OPERATE UNDER OR A RECOMMENDATION TO PRACTICE OR INFRINGE ANY PATENT OF THIS COMPANY OR OTHERS COVERING ANY PROCESS, COMPOSITION OF MATTER OR USE. SINCE THE COMPANY SHALL HAVE NO CONTROL OF THE USE OF THE PRODUCT DESCRIBED HEREIN, THE COMPANY ASSUMES NO LIABILITY FOR LOSS OR DAMAGE INCURRED FROM THE PROPER OR IMPROPER USE OF SUCH PRODUCT.

Section 1: Chemical Product Company Identification

Manufacturer	:	
Address	:	
Tel/Fax No.	:	
Product Class	:	**Slag**
Chemical / Trade Name	:	**Slag**

Section 2: Composition

Trade Name	TCLP, ppm
Slag	**<5**

Bulk chemical composition of slag for a CX System desulphurised paste smelted through fuel gas burner

COMPOSITION, %

AgS	0,00049 %
As_2S_3	0,0073 %
B_2O_3	1,59 %
$BaSO_4$	0,37 %
$CaSO_4$	2,04 %
Cr_2O_3	0,0042 %
FeS	25,92 %
HgS	0,00032 %
Na_2SO_4	41,92 %
PbS	4,62 %
SiO_2	14,50 %
Al_2O_3	6,61 %
MgO	1,33 %
Other ND	1,10 %

Section 3: Hazards Identification

Routes of Entry

- ☐ Inhalation : Risk of injury depends on duration and level of exposure.

Silicosis: This product contains crystalline silica. Prolonged or repeated inhalation of respirable crystalline silica from this product can cause silicosis, a seriously disabling and fatal lung disease.

Autoimmune Disease: Some studies show that exposure to respirable crystalline silica or that the disease silicosis may be associated with the increased incidence of several autoimmune disorders such as scleroderma (thickening of the skin), systemic lupus erythematous, rheumatoid arthritis and diseases affecting the kidneys.

Tubercolosis: Silicosis increases the risk of tubercolosis.

Renal Disease: Some studies show an increased incidence of chronic kidney disease and end-stage renal disease in workers exposed to respirable crystalline silica.

- ☐ Eye Contact : Airborne dust may cause immediate or delayed irritation or inflammation. Eye contact with large amounts of dry powder or with wet slag can cause moderate eye irritation. Eye exposure requires immediate first aid to prevent significant damage to the eye.
- ☐ Skin Contact : Slag may cause dry skin, discomfort, irritation and dermatitis.

Dermatitis: Slag is capable of causing dermatitis by irritation and allergy. Skin affected by dermatitis may include symptoms such as, redness, itching, rash, scaling and cracking.

Irritant dermatitis is caused by the physical properties of slag including moisture and abrasion.

Allergic contact dermatitis is caused by sensitization to hexavalent chromium (chromate) present in slag. The reaction can range from a mild rash to severe skin ulcers. Persons already sensitized may react to the first contact with slag. Others may develop allergic dermatitis after years of repetaed contact with slag.

- ☐ Ingestion : Ingestion of small quantities of slag is not known to be harmful, large quantities can cause distress to the digestive tract.

CLASS D: POISONOUS AND INFECTIOUS MATERIAL
Division 2: Materials Causing Other Toxic EFFECTS

These materials can cause life-threatening and serious long-term health problems as well as less severe but immediate reactions in a person who is repeatedly exposed to small amounts.

Section 4: First Aid Measures

- ☐ Skin : Wash with soap and plenty of water
- ☐ Eye : Immediately flush with water for 15 minutes. Seek medical attention if irritation persists.
- ☐ Inhalation : Move to area with fresh air.
- ☐ Ingestion : Give water or milk. Induce vomiting, if conscious. Report cases to physician for blood testing.

Section 5: Fire Fighting Measures

Flammable:

☐ Yes, what conditions? N/A
☑ No

Flash Point **: N/A**
Auto-ignition Temp **: N/A**
Explosion Data:

Sensitivity to impact : None known
Sensitivity to static discharge : None known

Means of Extinction:
This product is non-combustible. For fires involving lead fumes, use Class D extinguisher or dry sand.

Special Procedures:
For fire fighting, use breathing apparatus and full body protective clothing.

Hazardous Combustion Products:

Hydrogen sulfide gas may be released from moist or wet slag when it is heated.

Section 6: Accidental Release Measures

If it contains molten metal, contain the flow by using sand or alumina as a dam. Do not attempt to halt the flow of metal with shovels or hand tools.

Spilled material should be swept or vacuumed (using HEPA filter). Use controls that minimize fugitive emissions. Place in dry, closed containers for disposal.

Section 7: Handling and Storage

Handle with care and use appropriate control measures. Keep bulk slag dry until used. When slag is kept wet for long periods of time, the leachate may be discolored and have a sulfurous odor. When this liquid is exposed to oxygen elemental sulfur may precipitate out leaving a solution of calcium thiosulfate.

Avoid actions that cause the slag to become airborne during clean-up such as dry sweeping or using compressed air. Use PPE described in Section 8 below.

Section 8: Exposure Control / Personal Protection

OSHA PEL **:** *TWA 0.05 mg(Pb)/m*^{3}
ACGIH TLV **:** *TWA 0.15 mg(Pb)/m*^{3}
NIOSH REL **:** *(Inorganic Lead) TWA 0.10 mg(Pb)/m*^{3}

Engineering Control and Work Practices:
Ventilation shall be provided in areas where exposures are above the permissible exposure limits or threshold limits values specified by OSHA or other government regulations

Respiratory Protection:
Where exposure is above the permissible exposure limit or the threshold limit values, the minimum respiratory protection recommended is a negative pressure half-mask respirator with high-efficiency cartridges that are NIOSH/MSHA approved against dust, mist, and fumes having a TWA of 0.05 mg/m3.

Personal Protective Equipment:

Gloves **:** Protective gloves should be worn when handling this product

Eyewear **:** Safety glasses with side shields or goggles shall be worn when using this product to prevent the dust from getting into the eyes. Whenever working with molten metal, always use a face shield.

Other Protection **:** Coveralls or other full body clothing shall be worn during product use and properly laundered after use, with the wash water disposed of in accordance with local, state and federal regulations. Hard hat, safety boots and other safety equipment shall be worn as appropriate for the industrial environment. Personal clothing and shoes should be protected from contamination with this product.

Section 9: Physical and Chemical Properties

☐ Boiling Point : >1000 °C
☐ Specific gravity : 2-3
☐ Vapor Pressure : N/A
☐ Vapor Density : N/A
☐ Odor Threshold : N/A
☐ Melting Point : No available data

☐ Solubility : Insoluble
☐ Physical State : Gray/black or brown/tan powder/bulk solid
☐ pH : 10-12
☐ TCLP : <5ppm
☐ Evaporation Rate : N/A

Section 10: Stability and Reactivity

Stability:

☑ **Stable.** Keep dry until use. Slag may react with water resulting in a slight release of heat, depending on the amount of lime (calcium oxide) present. Avoid contact with incompatible materials.
☐ **Unstable**

Conditions to avoid: None

Incompatibility:

Slag is incompatible with acids, ammonium salts and aluminum metal. Slag dissolves in hydrofluoric acid, producing corrosive silicon tetrafluoride gas. Slag reacts with water to form silicates and calcium hydroxide. Silicates react with powerful oxidizers such as fluorine, boron trifluoride, chlorine trifluoride, manganese trifluoride and oxygen difluoride.

Hazardous Decomposition:

Hydrogen sulfide gas may be released from moist or wet slag when it is heated.

Section 11: Toxicological Information

Effects of Acute Exposure:

Symptoms of toxicity include headache, fatigue, abdominal pain, loss of appetite, vomiting, muscular aches and weakness, loss of coordination, sleep disturbances, irritability, convulsions, stupor, and possibly coma.

Effects of Chronic Exposure:

May cause weakness, insomnia, metallic taste in mouth, anemia; constipation, headache, muscle and joint pain, neuromuscular dysfunction, liver or kidney damage; reproductive changes in both, males and females, possible paralysis and encephalopathy.

Irritancy of Product:

Mild

Skin Sensitization:

None known

Carcinogenicity:

Human studies are inconclusive regarding lead exposure and an increased cancer risk. The EPA and the International Agency for Research on Cancer (IARC) have categorized lead and inorganic lead compounds as a B2 classification (probable/possible human carcinogen) based on sufficient animal evidence and inadequate human evidence.

Reproductive Effects:

Yes

Mutagenicity:

None known

Medical Conditions Generally Aggravated by Exposure:

Pre-existing respiratory and lung diseases, such as, but not limited to, bronchitis, emphysema and asthma

Section 12: Ecological Information

NOT AVAILABLE

Section 13: Disposal Consideration

For disposal of this material as a waste, act in accordance with all applicable government waste management laws regulations.

Section 14: Transport Information

Accompany each transport with Waste Manifest. Prevent contact with liquid. Do not mix with other waste material. Transport vehicle must be covered so as to prevent rainwater from wetting the slag. Compliance to DAO 2004-36 Transport Requirements Needed.

Section 15: Regulatory Information

This product contains a chemical or chemicals subject to the reporting requirement of DAO 29 - Classification of Hazardous Waste - Waste number D406.

Section 15: Other Information

ALL STATEMENTS, TECHNICAL INFORMATION AND RECOMMENDATIONS CONTAINED HEREIN ARE BASED ON TESTS AND DATA WHICH THIS COMPANY BELIEVES TO BE CURRENTLY RELIABLE, BUT THE ACCURACY OR COMPLETENESS THEREOF IS NOT GUARANTEED AND NO WARRANTY OF ANY KIND IS MADE WITH RESPECT THERETO. THIS INFORMATION IS NOT INTENDED AS A LICENSE TO OPERATE UNDER OR A RECOMMENDATION TO PRACTICE OR INFRINGE ANY PATENT OF THIS COMPANY OR OTHERS COVERING ANY PROCESS, COMPOSITION OF MATTER OR USE. SINCE THE COMPANY SHALL HAVE NO CONTROL OF THE USE OF THE PRODUCT DESCRIBED HEREIN, THE COMPANY ASSUMES NO LIABILITY FOR LOSS OR DAMAGE INCURRED FROM THE PROPER OR IMPROPER USE OF SUCH PRODUCT.

SAFETY DATA SHEET

SECTION 1 IDENTIFICATION: PRODUCT IDENTIFIER AND CHEMICAL IDENTITY

Product Identifier	**SODA ASH (DENSE)**
Other Names	Sodium Carbonate
Manufacturer's Product Code	21023
Recommended Use	Water treatment, detergent ingredient, glass manufacture and other various uses

Details of Supplier/Manufacturer

Company:	Recochem Inc. ABN: 69 010 485 999
Address:	1809 Lytton Road, Lytton, Queensland 4178
Phone:	(07) 3308 5200 Fax: (07) 3308 5201
Website:	www.recochem.com.au

Emergency Telephone Numbers

Business Hours:	(07) 3308 5200
After Hours:	1300 131 001
Poisons Information:	Australia: 13 11 26 New Zealand: 0800 764 766

SECTION 2 HAZARDS IDENTIFICATION

Hazardous chemical	*according to classification by Safe Work Australia*
Non-dangerous goods	*according to the Australian Code for the Transport of Dangerous Goods by Road and Rail*

Signal Word	**WARNING**

Hazardous chemical classification	**Pictogram**	**Hazard statement**
Serious Eye Damage/Irritation, Category 2A	 EXCLAMATION MARK	H319 Causes serious eye irritation

Precautionary statements:

GENERAL	
P101	If medical advice is needed, have product container or label at hand
P102	Keep out of reach of children
P103	Read label before use

PREVENTATIVE	
P264	Wash thoroughly after handling
P280	Wear eye protection/face protection
RESPONSE	
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P337 + P313	If eye irritation persists: Get medical advice/attention

SECTION 3 COMPOSITION AND INFORMATION ON INGREDIENTS

Ingredients Names and Proportions

Chemical Entity	CAS Number	Proportion (%)
Sodium Carbonate	497-19-8	99

SECTION 4 FIRST AID MEASURES

Description of necessary first aid measures

Inhalation:	Remove victim from exposure if safe to do so. If rapid recovery does not occur, transport to nearest medical facility for additional treatment. Remove contaminated clothing.
Skin Contact:	If skin contact occurs, remove contaminated clothing and wash skin thoroughly with water and follow by washing with soap if available. If irritation occurs seek medical advice.
Eye Contact:	If in eyes, hold eyes open, flood with water for at least 15 minutes. Seek immediate medical assistance.
Ingestion:	If swallowed, do NOT induce vomiting. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. If rapid recovery does not occur, seek medical attention.

Symptoms caused by exposure

Inhalation:	May cause respiratory tract irritation.
Skin:	May cause irritation - redness and itching.
Eye:	May include redness, burning, blurred vision, or swelling.
Ingestion:	May cause irritation.

Medical attention and special treatment

Treat symptomatically.

SECTION 5 FIRE FIGHTING MEASURES

Suitable extinguishing equipment

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Specific hazards arising from the chemical

Carbon oxides, Sodium oxides.

Special protective equipment and precautions for fire fighters

Wear full protective clothing and self-contained breathing apparatus.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Avoid contact with spilled or released material. Shut off leaks, if possible without personal risks. Isolate hazard area and deny entry to unnecessary or unprotected personnel.

Environmental precautions

Use appropriate containment to avoid environmental contamination. Keep product out of storm water and sewer drains.

Methods and materials for containment and cleaning up

Best cleaned up by vacuum device to avoid generating airborne dust. Retain as contaminated waste. Dispose of safely according to local and national regulations.

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Avoid contact with skin, eyes and clothing. Avoid breathing in dust. Wash thoroughly after handling. Do not eat, drink or smoke in contaminated areas. Handle and open containers with care in a well-ventilated area. Do not empty into drains.

Conditions for safe storage, including any incompatibilities

Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Protect from moisture to prevent hardening.

SECTION 8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure control measures

From National Occupational Health & Safety Commission (NOHSC) Worksafe Australia -
No exposure standard data available.

Biological monitoring

No biological limit allocated.

Engineering controls

Ensure that adequate ventilation is provided. Avoid generating and inhaling dusts. Keep containers closed when not in use.

Individual protection measures

Eye and face protection:	Wear safety goggles.
Skin protection:	Use solvent resistant gloves, nitrile for longer term protection or PVC and neoprene for incidental splashes.
Respiratory protection:	If work practices do not maintain adequate airborne levels, use appropriate respiratory protection equipment. When using respirators, select an appropriate combination of mask and filter. Select a filter for organic gases and vapours (boiling point > 65°C). Respirators should comply with AS1716 or an equivalent approved by a state/territory authority.
Thermal hazards:	Not applicable.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	White powder
Odour:	None
Odour threshold (ppm):	Data not available
pH:	12 (10% solution)
Melting point/freezing point (°C):	851
Initial boiling point and boiling range (°C):	Data not available
Flash point (°C):	Data not available
Evaporation rate (Butyl acetate = 1):	Data not available
Flammability:	Non-flammable
Upper/lower flammability or explosive limits (%):	Data not available
Vapour pressure (mmHg @ 20°C):	Data not available
Vapour density (air = 1):	Data not available
Density (g/ml @ 15°C):	2.5 approx.
Solubility:	Soluble
Partition coefficient: n-octanol/water:	Data not available
Auto-ignition temperature (°C):	Data not available
Decomposition temperature (°C):	Data not available
Kinematic viscosity (mm^2/s @ 20°C):	Data not available

SECTION 10 STABILITY AND REACTIVITY

Reactivity

Stable under normal conditions of use.

Chemical stability

Stable under normal conditions of use.

Possibility of hazardous reactions

Stable under normal conditions of use.

Conditions to avoid

Keep free of moisture.

Incompatible materials

Strong acids.

Hazardous decomposition products

Carbon oxides, Sodium oxides, Sodium.

SECTION 11 TOXICOLOGICAL INFORMATION

Acute toxicity:	Expected to be of low toxicity. LD50 Oral (Rat) = 4,090 mg/kg
Skin corrosion/irritation:	May be harmful if absorbed through skin. May cause skin irritation.
Serious eye damage/irritation:	Irritating to eyes.
Respiratory or skin sensitisation:	Not expected to cause sensitisation
Germ cell mutagenicity:	Not expected to be mutagenic
Carcinogenicity:	Not expected to be carcinogenic
Reproductive toxicity:	Not expected to impair fertility
Specific Target Organ Toxicity (STOT) – single exposure:	Data not available
Specific Target Organ Toxicity (STOT) – repeated exposure:	Data not available
Aspiration hazard:	Data not available

SECTION 12 ECOLOGICAL INFORMATION

Ecotoxicity

Acute toxicity:

Fish –	LC50 - Lepomis marcrochirus (Bluegill) – 300mg/l – 96h
Aquatic invertebrate –	EC50 - Daphnia magna (water flea) – 265mg/l – 48h
Algae –	No data available
Microorganisms –	No data available

Chronic toxicity:

Fish –	No data available
Aquatic invertebrate –	No data available
Algae –	No data available
Microorganisms –	No data available

Persistence and degradability

No data available.

Bioaccumulative potential

No data available.

Mobility in soil

No data available.

Other adverse effects

No data available.

SECTION 13 DISPOSAL CONSIDERATIONS

Ensure waste disposal conforms to local waste disposal regulations.

SECTION 14 TRANSPORT INFORMATION

UN number:	Not applicable
Proper shipping name:	Not applicable
Australian Dangerous Goods class:	Not applicable
Australian Dangerous Goods packing group:	Not applicable
Hazchem code:	Not applicable

SECTION 15 REGULATORY INFORMATION

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP), Poisons Schedule:	5
Australian Inventory of Chemical Substances (AICS):	Listed
Dangerous Goods Initial Emergency Response Guide (SAA/SNZ HB76):	Not applicable

SECTION 16 OTHER INFORMATION

Date of preparation:	13/06/2016
Revision number:	4
Changes in this revision:	Update to GHS SDS standard

This SDS summarises product safety information at the date of issue, to the best of our knowledge, as a general guide. Recochem cannot anticipate or control the conditions under which the product is used, so prior to usage each user must assess and control the risks associated with their use of the product. Users should also consult the relevant legislation governing the use and storage of this product. We make no warranties, express or implied, and assume no liability in connection with any use of information contained within this document. If clarification or further information is needed, the user should contact Recochem on (07) 3308 5200.

chem-supply

Safety Data Sheet

Infosafe No™ 1CH6Q Issue Date : July 2014 RE-ISSUED by CHEMSUPP

Product Name : **SODIUM SULFATE Anhydrous**

Not classified as hazardous

1. Identification

GHS Product Identifier SODIUM SULFATE Anhydrous

Company Name CHEM-SUPPLY PTY LTD (ABN 19 008 264 211)

Address
38 - 50 Bedford Street GILLMAN
SA 5013 Australia

Telephone/Fax Number
Tel: (08) 8440-2000
Fax: (08) 8440-2001

Recommended use of the chemical and restrictions on use Paper pulp, plate and window glass, soaps and detergents, sodium salts, ceramic glazes, processing textile fibers, dyes, tanning, pharmaceuticals, freezing mix, food additive, laboratory reagent, solar heat storage, air-conditioning and pharmaceutical production.

Other Names

Name	Product Code
SODIUM SULFATE Decahydrate LR	SL066
Glauber's salt	
SODIUM SULFATE	
SODIUM SULFATE Anhydrous Granular AR	SA192
SODIUM SULFATE Anhydrous Powder AR	SA007
SODIUM SULFATE Anhydrous Powder LR	SL007
SODIUM SULFATE Anhydrous Powder BP	SP007

Other Information EMERGENCY CONTACT NUMBER: +61 08 8440 2000
Business hours: 8:30am to 5:00pm, Monday to Friday.

Chem-Supply Pty Ltd does not warrant that this product is suitable for any use or purpose. The user must ascertain the suitability of the product before use or application intended purpose. Preliminary testing of the product before use or application is recommended. Any reliance or purported reliance upon Chem-Supply Pty Ltd with respect to any skill or judgement or advice in relation to the suitability of this product of any purpose is disclaimed. Except to the extent prohibited at law, any condition implied by any statute as to the merchantable quality of this product or fitness for any purpose is hereby excluded. This product is not sold by description. Where the provisions of Part V, Division 2 of the Trade Practices Act apply, the liability of Chem-Supply Pty Ltd is limited to the replacement of supply of equivalent goods or payment of the cost of replacing the goods or acquiring equivalent goods.

2. Hazard Identification

GHS classification of the substance/mixture Not classified as hazardous according to the Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(2004] 3rd Edition, Safe Work Australia.
Not classified as dangerous goods according to the Australian Dangerous Goods Code (ADG).

3. Composition/information on ingredients

Chemical Characterization Solid

Ingredients

Name	CAS	Proportion	Hazard Symbol	Risk Phrase
Sodium Sulfate Decahydrate	7727-73-3	98-100 %		
Sodium sulfate	7757-82-6	98-100 %		

4. First-aid measures

Inhalation If inhaled, remove from contaminated area to fresh air immediately. Apply artificial respiration if not breathing. If breathing is difficult, give oxygen. Get medical aid if cough or other symptoms appear.

Ingestion Rinse mouth thoroughly with water immediately. Give plenty of water to drink. Do not induce vomiting. Seek medical advice if effects persist.

Skin Wash affected areas with copious quantities of water. Remove contaminated clothing and wash before re-use. Seek medical advice if effects persist.

Eye contact Irrigate with copious quantity of water for 15 minutes. Seek medical assistance if symptoms persist.

First Aid Facilities Maintain eyewash fountain and safety shower in work area.

Advice to Doctor Treat symptomatically.

Other Information For advice, contact the National Poisons Information Centre (Phone Australia 13 11 26; New Zealand 0800 764 766) or a doctor.

5. Fire-fighting measures

Hazards from Combustion Products	May librate toxic fumes in fire (sulfur oxides).
Specific Methods	Small fire: Use dry chemical, CO2, water spray or foam. Large fire: Use water spray, fog or foam. If safe to do so, move undamaged containers from the fire area. Cool containers with flooding quantities of water until well after the fire is out. Contain escaping vapours with water. Prevent runoff entering surface water or groundwater.
Specific hazards arising from the chemical	Not considered a fire hazard. Violent explosions occur when potassium sulfate and sodium sulfate are melted with aluminium. Ambient fire may liberate hazardous vapours.
Precautions in connection with Fire	Use suitable protective equipment for surrounding fire.

6. Accidental release measures

Spills & Disposal	Do NOT touch or walk through this product. Stop leak if safe to do so. Prevent entry into waterways, drains, confined areas. Prevent dust cloud.
Personal Protection	Wear protective clothing specified for normal operations (see Section 8)

7. Handling and storage

Precautions for Safe Handling	Avoid generation or accumulation of dusts. Use in well ventilated areas away from all ignition sources. In case of insufficient ventilation, wear suitable respiratory equipment. Wash hands and face thoroughly after working with material.
Conditions for safe storage, including any incompatabilities	Keep containers closed at all times. Keep container tightly closed and in a cool, dry, well-ventilated place.
Other Information	Dry product can be stored in mild steel. Hot concentrated aqueous solutions are corrosive to mild steel. Wet product or hot solutions are aggressive towards ordinary concrete.

8. Exposure controls/personal protection

Other Exposure Information	A time weighted average (TWA) concentration for an 8 hour day, and 5 day week has not been established by Safe Work Australia for this product. There is a blanket limit of 10 mg/m³ for dusts or mists when limits have not otherwise been established.
Appropriate engineering controls	In industrial situations maintain the concentrations values below the TWA. This may be achieved by process modification, use of local exhaust ventilation, capturing substances at the source, or other methods.
Respiratory Protection	Where ventilation is not adequate, respiratory protection may be required. Avoid breathing dust, vapours or mists. Respiratory protection should comply with AS 1716 - Respiratory Protective Devices and be selected in accordance with AS 1715 - Selection, Use and Maintenance of Respiratory Protective Devices. Filter capacity and respirator type depends on exposure levels. In event of emergency or planned entry into unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.
Eye Protection	The use of a face shield, chemical goggles or safety glasses with side shield protection as appropriate. Must comply with Australian Standards AS 1337 and be selected and used in accordance with AS 1336.
Hand Protection	Hand protection should comply with AS 2161, Occupational protective gloves - Selection, use and maintenance. Recommendation: Rubber or plastic gloves.
Personal Protective Equipment	Final choice of personal protective equipment will depend on individual circumstances and/or according to risk assessments undertaken.
Footwear	Safety boots in industrial situations is advisory, foot protection should comply with AS 2210, Occupational protective footwear - Guide to selection, care and use.
Body Protection	Clean clothing or protective clothing should be worn, preferably with an apron. Clothing for protection against chemicals should comply with AS 3765 Clothing for Protection Against Hazardous Chemicals.
Hygiene Measures	Always wash hands before smoking, eating or using the toilet. Wash contaminated clothing and other protective equipment before storing or re-using.

9. Physical and chemical properties

Form	Solid

Appearance	Colourless to White crystals, granules or powder.
Odour	Odourless.
Melting Point	888 °C (anhydrous); 32.4 °C (decahydrate)
Solubility in Water	Soluble.
Solubility in Organic Solvents	Soluble in glycerol, hydrogen iodide. Insoluble in alcohol.
Specific Gravity	2.67 (anhydrous); 1.46 (decahydrate)
pH	5.2 - 8.0 (50 g/L, H2O, 20 °C) Solutions neutral to litmus.
Volatile Component	Zero.
Flammability	Non combustible material.
Molecular Weight	142.04 (anhydrous); 322.13 (decahydrate)
Other Information	Taste: Saline taste

10. Stability and reactivity

Chemical Stability	Stable under normal use conditons. Hygroscopic Sensitive to strong heating.
Conditions to Avoid	Strong heating. Exposure to air. Incompatibles.
Incompatible Materials	Strong mineral acids and bases. In combination with sodium sulfate, aluminium and magnesium.
Hazardous Decomposition Products	Oxides of sulfur and sodium.
Possibility of hazardous reactions	Violent reaction with aluminium.
Hazardous Polymerization	Will not occur.

11. Toxicological Information

Acute Toxicity - Oral	LD50 (mouse): 5989 mg/kg.
Ingestion	Mildly toxic by ingestion. Slowly absorbed from the alimentary tract. May cause gastrointestinal irritation. Because of osmotic activity, this substance will draw water into the lumen of the bowel and may cause purging, fluid loss, blood in stools, fall of blood pressure and high sodium levels in the blood.
Inhalation	May cause irritation to respiratory tract and mucous membranes.
Skin	May cause skin irritation.
Eye	Dust may cause mechanical irritation to the eyes.
Carcinogenicity	No evidence of carcinogenic properties.
Chronic Effects	Prolonged or repeated skin contact may result in dermatitis. After swallowing of large amounts may cause cardiovascular disorders and symptoms in the gastrointestinal tract, possibly including nausea and vomiting.
Mutagenicity	No evidence of mutagenic effects.

12. Ecological information

Bioaccumulative Potential	When released into soil, this material is expected to leach into groundwater. This material is not expected to significantly bioaccumulate.
Acute Toxicity - Fish	LC50 (Gambusia affinis): 120 mg/l/96 h. LC50 (L. macrochirus): ~ 3040-4380 MG/L/96 H. LC50 (P. promelas): 13500-14500 mg/l/96 h. The following applies to sulfate in general: fish: toxic as from 7 g/l.
Acute Toxicity - Daphnia	EC50 (Daphnia magna): 2564 mg/l/48 h.
Acute Toxicity - Bacteria	The following applies to sulfate in general: bacteria: toxic as from 2.5 g/l.

13. Disposal considerations

Disposal Considerations	Whatever cannot be saved for recovery or recycling should be disposed of according to relevant local, state and federal government regulations.

14. Transport information

Transport Information	Not classified as a Dangerous Good according to the Australian Code for the Transport of Dangerous Goods by Road and Rail.

15. Regulatory information

Regulatory Information	Listed in the Australian Inventory of Chemical Substances (AICS).
Poisons Schedule	Not Scheduled

16. Other Information

Literature References	'Standard for the Uniform Scheduling of Medicines and Poisons No. 4', Commonwealth of Australia, June 2013. Lewis, Richard J. Sr. 'Hawley's Condensed Chemical Dictionary 13th. Ed.', Rev., John Wiley and Sons, Inc., NY, 1997. National Road Transport Commission, 'Australian Code for the Transport of Dangerous Goods by Road and Rail 7th. Ed.', 2007. 'Labelling of Hazardous Workplace Chemicals, Code of Proctice' Safe Work Australia. Standards Australia 'AS 1940-2004 The Storage and Handling of Flammable and Combustible Liquids. Standards Australia, 'SAA/SNZ HB 76:2010 Dangerous Goods - Initial Emergency Response Guide', Standards Australia/Standards New Zealand, 2010. Worksafe Australia, 'Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(2004)]'. Worksafe Australia, 'Hazardous Substances Information System, 2005'. Worksafe Australia, 'National Code of Practice for the Labelling of Workplace Hazardous Substances (2011)'. Worksafe Australia, 'National Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:1003(1995)]'.
Contact Person/Point	Paul McCarthy Ph. (08) 8440 2000 DISCLAIMER STATEMENT: All information provided in this data sheet or by our technical representatives is compiled from the best knowledge available to us. However, since data, safety standards and government regulations are subject to change and the conditions of handling and use, or misuse, are beyond our control, we make no warranty either expressed or implied, with respect to the completeness or accuracy to the information contained herein. Chem-Supply accepts no responsibility whatsoever for its accuracy or for any results that may be obtained by customers from using the data and disclaims all liability for reliance on information provided in this data sheet or by our technical representatives.
Empirical Formula & Structural Formula	Na_2SO_4 (anhydrous); $Na_2SO_4.10H_2O$ (decahydrate)

...End Of MSDS...

SAFETY DATA SHEET

SODIUM SULFIDE - FLAKES 60-62 %

Revision Date 06/13/2016

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

- Trade name	SODIUM SULFIDE - FLAKES 60-62 %
- Chemical name	Disodium sulfide
- Synonyms	SODIUM SULFIDE HYDRATED
- Molecular formula	Na2S xH2O; x >= 2,66

1.2 Relevant identified uses of the substance or mixture and uses advised against

Uses of the Substance / Mixture

- Chemical industry
- Waste treatment
- Water treatment
- De-hairing agent
- Textile industry
- Manufacture of pulp, paper and paper products

Uses advised against

- none

1.3 Details of the supplier of the safety data sheet

Company

SOLVAY FLUORIDES, LLC
3737 Buffalo Speedway,
Suite 800,
Houston, TX 77098
USA
Tel: 800-515-6065

1.4 Emergency telephone

FOR EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE OR ACCIDENT CONTACT: CHEMTREC 800-424-9300 within the United States and Canada, or 703-527-3887 for international collect calls.

SECTION 2: Hazards identification

Although OSHA has not adopted the environmental portion of the GHS regulations, this document may include information on environmental effects.

2.1 Classification of the substance or mixture

HCS 2012 (29 CFR 1910.1200)

Acute toxicity, Category 3	H301: Toxic if swallowed.
Skin corrosion, Category 1A	H314: Causes severe skin burns and eye damage.
Serious eye damage, Category 1	H318: Causes serious eye damage.

2.2 Label elements

HCS 2012 (29 CFR 1910.1200)

Pictogram

Signal Word

- Danger

Hazard Statements

- H301	Toxic if swallowed.
- H314	Causes severe skin burns and eye damage.
- H318	Causes serious eye damage.

Precautionary Statements

Prevention

- P260	Do not breathe dusts or mists.
- P264	Wash skin thoroughly after handling.
- P270	Do not eat, drink or smoke when using this product.
- P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response

- P301 + P310 + P330	IF SWALLOWED: Immediately call a POISON CENTER/doctor. Rinse mouth.
- P301 + P330 + P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
- P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
- P304 + P340 + P310	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician.
- P305 + P351 + P338 + P310	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/ physician.
- P363	Wash contaminated clothing before reuse.

Storage

- P405	Store locked up.

Disposal

- P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Other hazards which do not result in classification

- H400: Very toxic to aquatic life.

SECTION 3: Composition/information on ingredients

3.1 Substance

Hazardous Ingredients and Impurities

Chemical name	Identification number CAS-No.	Concentration [%]
Disodium sulfide (hydrate)	27610-45-3	>= 91
Sodium hydrogensulfide (hydrate)	207683-19-0	< 6.5
Thiosulfuric acid (H2S2O3), sodium salt (1:2)	7772-98-7	< 1
Carbonic acid sodium salt (1:2)	497-19-8	< 2.5

The specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret.

3.2 Mixture

Not applicable, this product is a substance.

SECTION 4: First aid measures

4.1 Description of first-aid measures

In case of inhalation

- Move to fresh air.
- Oxygen or artificial respiration if needed.
- Victim to lie down in the recovery position, cover and keep him warm.
- Call a physician immediately.

In case of skin contact

- Take off contaminated clothing and shoes immediately.
- Wash off immediately with plenty of water.
- Keep warm and in a quiet place.
- Call a physician or poison control center immediately.
- Wash contaminated clothing before re-use.

In case of eye contact

- Call a physician or poison control center immediately.
- Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
- In the case of difficulty of opening the lids, administer an analgesic eye wash (oxybuprocaine).
- Take victim immediately to hospital.

In case of ingestion

- Call a physician or poison control center immediately.
- Take victim immediately to hospital.
- If swallowed, rinse mouth with water (only if the person is conscious).
- Do NOT induce vomiting.
- Artificial respiration and/or oxygen may be necessary.

4.2 Most important symptoms and effects, both acute and delayed

In case of inhalation

Symptoms

- At high concentrations:
- slight irritation

Effects

- No hazards to be specially mentioned.

In case of skin contact

Symptoms

- Redness
- Swelling of tissue
- Burn

Effects

- Corrosive

In case of eye contact

Symptoms

- Redness
- Lachrymation
- Swelling of tissue
- Burn

Effects

- May cause irreversible eye damage.
- May cause blindness.

In case of ingestion

Symptoms

- Nausea
- Abdominal pain
- Bloody vomiting
- Diarrhea
- Suffocation
- Cough
- Severe shortness of breath

Effects

- If ingested, severe burns of the mouth and throat, as well as a danger of perforation of the esophagus and the stomach.

4.3 Indication of any immediate medical attention and special treatment needed

- no data available

SECTION 5: Firefighting measures

Flash point	Not applicable, inorganic
Autoignition temperature	> 806 °F (> 430 °C)
Flammability / Explosive limit	no data available

5.1 Extinguishing media

Suitable extinguishing media

- Foam
- powder

Unsuitable extinguishing media

- Water
- Carbon dioxide (CO2)

5.2 Special hazards arising from the substance or mixture

Specific hazards during fire fighting

- Not combustible.

- Hazardous decomposition products

Hazardous combustion products:

- Sulfur oxides

5.3 Advice for firefighters

Special protective equipment for fire-fighters

- Exposure to decomposition products may be a hazard to health.
- In the event of fire, wear self-contained breathing apparatus.
- Use personal protective equipment.
- Wear chemical resistant oversuit
- Cool containers/tanks with water spray.
- Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for emergency responders

- Isolate the area.
- Wear self-contained breathing apparatus and protective suit.

Advice for non-emergency personnel

- Prevent further leakage or spillage if safe to do so.

Advice for non-emergency personnel

- Sweep up to prevent slipping hazard.
- Avoid dust formation.

6.2 Environmental precautions

- Discharge into the environment must be avoided.
- Do not flush into surface water or sanitary sewer system.
- In case of accidental release or spill, immediately notify the appropriate authorities if required by Federal, State/Provincial and local laws and regulations.

6.3 Methods and materials for containment and cleaning up

- Pick up and arrange disposal without creating dust.
- Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

- Refer to protective measures listed in sections 7 and 8.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

- Use product only in closed system.
- Ensure adequate ventilation.
- Keep away from heat.
- Keep away from incompatible products

Hygiene measures

- Eye wash bottles or eye wash stations in compliance with applicable standards.
- When using do not eat, drink or smoke.
- Handle in accordance with good industrial hygiene and safety practice.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/Storage conditions

- Store in original container.
- Keep in a well-ventilated place.
- Keep in a dry place.
- Keep in properly labeled containers.
- Keep container closed.
- Keep away from heat.
- Avoid dust formation.
- Keep away from incompatible products

Packaging material

Suitable material
- Steel drum
- Polyethylene

7.3 Specific end use(s)

- Contact your supplier for additional information

SECTION 8: Exposure controls/personal protection

Introductory Remarks: These recommendations provide general guidance for handling this product. Because specific work environments and material handling practices vary, safety procedures should be developed for each intended application. Assistance with selection, use and maintenance of worker protection equipment is generally available from equipment manufacturers.

8.1 Control parameters

Components with workplace occupational exposure limits

Ingredients	Value type	Value	Basis
Carbonic acid sodium salt (1:2)	TWA	10 mg/m3	Solvay Acceptable Exposure Limit

8.2 Exposure controls

Control measures

Engineering measures
- Provide appropriate exhaust ventilation at places where dust is formed.
- Apply technical measures to comply with the occupational exposure limits.

Individual protection measures

Respiratory protection
- In case of insufficient ventilation, wear suitable respiratory equipment.
- When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.
- In case of decomposition (see section 10), face mask with combined type B-P3 cartridge.
- Use only respiratory protection that conforms to international/ national standards.
- Use NIOSH approved respiratory protection.

Hand protection
- chemical resistant gloves

Suitable material

- PVC
- Neoprene
- Natural Rubber

Eye protection

- Goggles

Skin and body protection

- Dust impervious protective suit
- Apron
- Boots
- Neoprene
- PVC

Hygiene measures

- Eye wash bottles or eye wash stations in compliance with applicable standards.
- When using do not eat, drink or smoke.
- Handle in accordance with good industrial hygiene and safety practice.

SECTION 9: Physical and chemical properties

Physical and Chemical properties here represent typical properties of this product. Contact the business area using the Product information phone number in Section 1 for its exact specifications.

9.1 Information on basic physical and chemical properties

Appearance	Form: Physical state: Color: Particle size:	flakes solid yellow 3,500 µm d 50
Odor	odorless rotten-egg like slight	
Odor Threshold	no data available	
Molecular weight	132.09 g/mol	
pH	12.9 (1 %) 13.1 saturated aqueous solution	
Melting point/freezing point	Melting point/range: 156 - 199 °F (69 - 93 °C) (ca. 747.81 mmHg (997 hPa))	
Initial boiling point and boiling range	Boiling point/boiling range: () Not applicable	
Flash point	Not applicable, inorganic	
Evaporation rate (Butylacetate = 1)	Not applicable, inorganic	
Flammability (solid, gas)	The product is not flammable.	

Flammability / Explosive limit	Explosiveness: Not explosive
Autoignition temperature	> 806 °F (> 430 °C)
Vapor pressure	Not applicable, inorganic
Vapor density	Not applicable, inorganic
Density	
Relative density	1.64 (70 °F (21 °C))
Solubility	Water solubility: 178 g/l (68 °F (20 °C)) Solubility in other solvents: Alcohol : slightly soluble
Partition coefficient: n-octanol/water	Not applicable, inorganic
Decomposition temperature	Not applicable
Viscosity	Viscosity, dynamic : Solid form, Not applicable
Explosive properties	no data available
Oxidizing properties	Not considered as oxidizing.

9.2 Other information

Corrosion of Metals	Corrosive to metals

SECTION 10: Stability and reactivity

10.1 Reactivity

- Contact with acids liberates toxic gas.

10.2 Chemical stability

- Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

- Corrosive in contact with metals, Contact with acids liberates toxic gas.

10.4 Conditions to avoid

- Keep away from flames and hot surfaces.
- Exposure to moisture.

10.5 Incompatible materials

- Carbon dioxide (CO2)
- Acids
- Oxidizing agents
- Metals

10.6 Hazardous decomposition products

- Sulfur oxides

Hydrogen sulfide (H2S)

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Acute oral toxicity	
Disodium sulfide (hydrate)	LD50 : 246 mg/kg - Rat , male and female Method: OECD Test Guideline 401 This product is classified as acute toxicity category 3
Acute inhalation toxicity	Corrosive to the respiratory tract.
Acute dermal toxicity	
Disodium sulfide (hydrate)	study scientifically unjustified
Acute toxicity (other routes of administration)	no data available

Skin corrosion/irritation

Disodium sulfide (hydrate)	Corrosive

Serious eye damage/eye irritation

Disodium sulfide (hydrate)	Corrosive

Respiratory or skin sensitization

Disodium sulfide (hydrate)	study scientifically unjustified

Mutagenicity

Genotoxicity in vitro

Disodium sulfide (hydrate)	Ames test with and without metabolic activation negative Method: OECD Test Guideline 471 Gene mutation assays in mammalian cells. Strain: mouse lymphoma cells with and without metabolic activation negative Method: OECD Test Guideline 476

Genotoxicity in vivo

Disodium sulfide (hydrate)	In vivo micronucleus test - Mouse male and female Intraperitoneal route Method: OECD Test Guideline 474 negative

Carcinogenicity

no data available

This product does not contain any ingredient designated as probable or suspected human carcinogens by:

NTP
IARC
OSHA
ACGIH

Toxicity for reproduction and development

Toxicity to reproduction / fertility

Disodium sulfide (hydrate)	By analogy Reproduction / developmental toxicity screening test - Rat , male and female Inhalation NOAEL parent: 80 ppm(m) Test substance: Hydrogen sulfide Method: OECD Test Guideline 421

Developmental Toxicity/Teratogenicity

Disodium sulfide (hydrate)	By analogy Rat , female Application Route: Inhalation NOAEL teratogenicity: 80 ppm(m) Test substance: Hydrogen sulfide Method: OECD Test Guideline 421

STOT

STOT-single exposure

Disodium sulfide (hydrate)	The substance or mixture is not classified as specific target organ toxicant, single exposure according to GHS criteria.

STOT-repeated exposure

Disodium sulfide (hydrate)	The substance or mixture is not classified as specific target organ toxicant, repeated exposure according to GHS criteria.
Disodium sulfide (hydrate)	By analogy - Rat - Mouse Inhalation (vapor) 90-day , male and female NOAEC: 80 ppm(m) Test substance: Hydrogen sulfide

Aspiration toxicity no data available

SECTION 12: Ecological information

12.1 Toxicity

Aquatic Compartment

Acute toxicity to fish

Disodium sulfide (hydrate)	LC50 - 96 h : 0.0027 mg/l - Fish Test substance: Hydrogen sulfide By analogy

Acute toxicity to daphnia and other aquatic invertebrates.

Disodium sulfide (hydrate)	EC50 - 96 h : 0.02 mg/l - Crustaceans Test substance: Hydrogen sulfide Fresh water By analogy EC50 - 96 h : 0.032 mg/l - Crustaceans Test substance: Hydrogen sulfide salt water By analogy

Toxicity to aquatic plants

Disodium sulfide (hydrate)	EC50 - 120 h : 1,900 mg/l Analytical monitoring: yes Fresh water By analogy EC50 - 4 h : 0.104 mg/l - Skeletonema costatum (marine diatom) Analytical monitoring: yes salt water By analogy

Toxicity to microorganisms	no data available

Chronic toxicity to fish

Disodium sulfide (hydrate)	NOEC: 0.0046 mg/l - 826 Days - Lepomis macrochirus (Bluegill sunfish) Test substance: Hydrogen sulfide By analogy

Chronic toxicity to daphnia and other aquatic invertebrates.	no data available
Chronic Toxicity to aquatic plants	no data available

M-Factor

Disodium sulfide (hydrate)	Acute aquatic toxicity = 100 (according to the Globally Harmonized System (GHS))

12.2 Persistence and degradability

Abiotic degradation

Stability in water	
Disodium sulfide (hydrate)	Water, Soil, complexation/precipitation of inorganic and organic materials Water, Soil, Oxidation, Degradation products:, sulfates
Photodegradation	
Disodium sulfide (hydrate)	Chemical degradation Half-life (direct photolysis): 1 h Sensitizer: sensitizer: OH/O3 radicals Degradat. indirect photolysis: 0.6 - 2 % Test substance: Hydrogen sulfide Air Degradation products: Sulphur dioxide sulfates Sulfides

Physical- and photo-chemical elimination	no data available

Biodegradation

Biodegradability	aerobic Method: Oxidation Test substance: Sulfides Degradation products: sulfites sulfates anaerobic Method: biodegradation by sulforeduction Test substance: sulfates Degradation products: Hydrogen sulfide anaerobic Method: methanogenesis Test substance: sulfates Inhibitor

Degradability assessment	Not applicable, inorganic substance

12.3 Bioaccumulative potential

Partition coefficient: n-octanol/water	Not applicable, inorganic substance
Bioconcentration factor (BCF)	
Disodium sulfide (hydrate)	Not potentially bioaccumulable

12.4 Mobility in soil

Adsorption potential (Koc)	
Disodium sulfide (hydrate)	Water/soil considerable solubility and mobility Air mobility as solid aerosols
Known distribution to environmental compartments	no data available
12.5 Results of PBT and vPvB assessment	Not applicable
12.6 Other adverse effects	no data available
Remarks	Very toxic to aquatic organisms., Product fate is highly dependent on environmental conditions: pH, temperature, redox potential, mineral and organic content of the medium ,...

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product Disposal

- In accordance with local and national regulations.
- Where possible recycling is preferred to disposal or incineration.
- Use an $FeCl_3$ solution to precipitate FeS.
- Filtrate the product and send the cake to a landfill for industrial waste.

Waste Code

- Environmental Protection Agency
- Hazardous Waste – YES
- Environmental Protection Agency
- Hazardous Waste – YES
- RCRA Hazardous Waste (40 CFR 302)
- D003 - Reactive waste – (R)
- RCRA Hazardous Waste (40 CFR 302)
- D002 - Corrosive waste – (C)
- D003 - Reactive waste – (R)

Advice on cleaning and disposal of packaging

- The empty and clean containers are to be reused in conformity with regulations.
- Uncleaned empty packaging
- Dispose of as unused product.

SECTION 14: Transport information

Transportation status: IMPORTANT! Statements below provide additional data on listed transport classification.
The listed Transportation Classification does not address regulatory variations due to changes in package size, mode of shipment or

other regulatory descriptors.

DOT

14.1 UN number	UN 1849
14.2 Proper shipping name	SODIUM SULFIDE, HYDRATED
14.3 Transport hazard class	8
Label(s)	8
14.4 Packing group	
Packing group	II
ERG No	153
14.5 Environmental hazards	YES
Marine pollutant	

TDG

14.1 UN number	UN 1849
14.2 Proper shipping name	SODIUM SULFIDE, HYDRATED
14.3 Transport hazard class	8
Label(s)	8
14.4 Packing group	
Packing group	II
ERG No	153
14.5 Environmental hazards	YES
Marine pollutant	

NOM

14.1 UN number	UN 1849
14.2 Proper shipping name	SODIUM SULPHIDE, HYDRATED
14.3 Transport hazard class	8
Label(s)	8
14.4 Packing group	
Packing group	II
ERG No	153
14.5 Environmental hazards	NO
Marine pollutant	

IMDG

14.1 UN number	UN 1849
14.2 Proper shipping name	SODIUM SULPHIDE, HYDRATED
14.3 Transport hazard class	8

Label(s)	8

14.4 Packing group

Packing group	II
14.5 Environmental hazards **Marine pollutant**	YES

14.6 Special precautions for user

EmS	F-A , S-B

For personal protection see section 8.

IATA

14.1 UN number	UN 1849
14.2 Proper shipping name	SODIUM SULPHIDE, HYDRATED
14.3 Transport hazard class	8
Label(s):	8

14.4 Packing group

Packing group	II
Packing instruction (cargo aircraft)	863
Max net qty / pkg	50.00 kg
Packing instruction (passenger aircraft)	859
Max net qty / pkg	15.00 kg
14.5 Environmental hazards	YES

14.6 Special precautions for user

For personal protection see section 8.

Note: The above regulatory prescriptions are those valid on the date of publication of this sheet. Given the possible evolution of transportation regulations for hazardous materials, it would be advisable to check their validity with your sales office.

SECTION 15: Regulatory information

15.1 Notification status

Inventory Information	Status
United States TSCA Inventory	- Listed on Inventory
Mexico INSQ (INSQ)	- Listed on Inventory - Anhydrous form
Canadian Domestic Substances List (DSL)	- Listed on Inventory
New Zealand. Inventory of Chemical Substances	- Listed on Inventory - Anhydrous form
Australia Inventory of Chemical Substances (AICS)	- Listed on Inventory
Japan. CSCL - Inventory of Existing and New Chemical Substances	- Listed on Inventory
Korea. Korean Existing Chemicals Inventory (KECI)	- Listed on Inventory
China. Inventory of Existing Chemical Substances in China (IECSC)	- Listed on Inventory
Philippines Inventory of Chemicals and Chemical Substances (PICCS)	- Listed on Inventory
EU. European Registration, Evaluation, Authorisation and Restriction of Chemical (REACH)	- If product is purchased from Solvay in Europe it is in compliance with REACH, if not please contact the supplier.

15.2 Federal Regulations

US. EPA EPCRA SARA Title III

SARA HAZARD DESIGNATION SECTIONS 311/312 (40 CFR 370)

Fire Hazard	no
Reactivity Hazard	yes
Sudden Release of Pressure Hazard	no
Acute Health Hazard	yes
Chronic Health Hazard	no

Section 313 Toxic Chemicals (40 CFR 372.65)
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Section 302 Emergency Planning Extremely Hazardous Substance Threshold Planning Quantity (40 CFR 355)
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

Section 302 Emergency Planning Extremely Hazardous Substance Reportable Quantity (40 CFR 355)
This material does not contain any components with a SARA 302 RQ.

Section 304 Emergency Release Notification Reportable Quantity (40 CFR 355)
This material does not contain any components with a section 304 EHS RQ.

US. EPA CERCLA Hazardous Substances and Reportable Quantities (40 CFR 302.4)

Ingredients	CAS-No.	Reportable quantity
Sodium hydrogensulfide (hydrate)	207683-19-0	5000 lb

15.3 State Regulations

US. California Safe Drinking Water & Toxic Enforcement Act (Proposition 65)

This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

SECTION 16: Other information

NFPA (National Fire Protection Association) - Classification

Health	3 serious
Flammability	1 slight
Instability or Reactivity	1 slight
Special Notices	None

HMIS (Hazardous Materials Identification System (Paint & Coating)) - Classification

Health	3 serious
Flammability	1 slight
Reactivity	1 slight
PPE	Determined by User; dependent on local conditions

Further information

- Product evaluated under the US GHS format.

Date Prepared: 06/13/2016

- ACGIH	American Conference of Governmental Industrial Hygienists
- OSHA	Occupational Safety and Health Administration
- NTP	National Toxicology Program
- IARC	International Agency for Research on Cancer
- NIOSH	National Institute for Occupational Safety and Health

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The information provided in this Safety Data Sheet is correct to the best of our knowledge, information, and belief at the date of its publication. Such information is only given as a guidance to help the user handle, use, process, store, transport, dispose, and release the product in satisfactory safety conditions and is not to be considered as a warranty or quality specification. It should be used in conjunction with technical sheets but do not replace them. Thus, the information only relates to the designated specific product and may not be applicable if such product is used in combination with other materials or in any other manufacturing process, unless otherwise specifically indicated. It does not release the user from ensuring he is in conformity with all regulations linked to its activity.

APPENDIX D. CHEMICALS STORAGE AND HANDLING

Table D.1: Summary of chemicals stored and handled at the proposed facility

ID	Classification	Class	Sub	PG	UN	Proper Shipping Name	Description	Storage methods	Quantity per unit	No	Total	Unit	Assessed in PHA?
1	Flammable gas	2.1		-	1073	OXYGEN, REFRIGERATED LIQUID	Liquid oxygen	Vertical vessel	25,000	1	25000	L	Yes(a)
2	Non-flammable, non-toxic gases	2.2	5.1	III	2984	Hydrogen peroxide, aqueous solutions	Hydrogen Peroxide	Small plastic containers (various sizes, but assumed average of 10kg each)	10	2100	21000	kg	Yes
3	Oxidising substances	5.1	8	II	1832	SULPHURIC ACID, SPENT	Electrolyte	Vertical acid tanks	42000	2	84000	kg	Yes
4	Corrosive substances	8	-	II	1849	SODIUM SULFIDE, HYDRATED	Sodium Sulphide (62%)	25 kg bags	25	80	2000	kg	Yes
5		8	-	-	2794	BATTERIES, WET, FILLED WITH ACID, electric storage	ULAB (5,000 tonnes, assuming 20% of mass is acid, and 10kg per battery)	Palletised and stored in warehouse	2	500000	1000000	kg	Yes
6		8	-	-	1073	OXYGEN, REFRIGERATED LIQUID	Liquid oxygen	Vertical vessel	25,000	1	25000	L	Yes
	Other materials	N/A	N/A	N/A	N/A	N/A	Lead carbonate	Designated chamber room	320000	1	320000	kg	No - not hazardous
		N/A	N/A	N/A	N/A	N/A	Activated carbon	25 kg bags	25	100	2500	kg	No - not hazardous
		N/A	N/A	N/A	N/A	N/A	Lead bullion	On shop floor	600 tonnes		N/A		No - not hazardous
		N/A	N/A	N/A	N/A	N/A	Iron Sinter	Jumbo bags – approx 1 tonne	60 tonnes		N/A		No - not hazardous
		N/A	N/A	N/A	N/A	N/A	Sodium Sulfate Anhydrous	Elevated silo tank	72 tonnes		N/A		No - not hazardous
		N/A	N/A	N/A	N/A	N/A	Soda ash	$60m^3$ silo	690 tonnes		N/A		No - not hazardous

ID	Classification	Class	Sub	PG	UN	Proper Shipping Name	Description	Storage methods	Quantity per unit	No	Total	Unit	Assessed in PHA?
		N/A	N/A	N/A	N/A	N/A	Anthracite coal	Designated chamber room	120 tonnes		N/A		No - not hazardous
		N/A	N/A	N/A	N/A	N/A	Calcium Hydroxide	25 kg packaging bags	1 tonne per year (approx)		N/A		No - not hazardous
		N/A	N/A	N/A	N/A	N/A	Diesel Fuel	Vertical storage tanks	5,000 L tank		N/A		No - not hazardous
		N/A	N/A	N/A	N/A	N/A	Flocculant	25 kg packing bags	150 kg		N/A		No - not hazardous
		N/A	N/A	N/A	N/A	N/A	Polypropylene Plastics	Ground polypropylene in jumbo bags – approximately 800 kg	70 tonnes		N/A		No - not hazardous
		N/A	N/A	N/A	N/A	N/A	Anti-foam	Plastic containers – 25 kg per container	2.64 tonnes		N/A		No - not hazardous
		N/A	N/A	N/A	N/A	N/A	Polyethylene separators	Designated chamber room	26 tonnes		N/A		No - not hazardous
		N/A	N/A	N/A	N/A	N/A	Slag	Slag room	260 tonnes		N/A		No - not hazardous

(a) 700m^3/h of methane will be used.

APPENDIX E. CONSEQUENCE ANALYSIS

E1. Failure of desulphurisation process (INC-001)

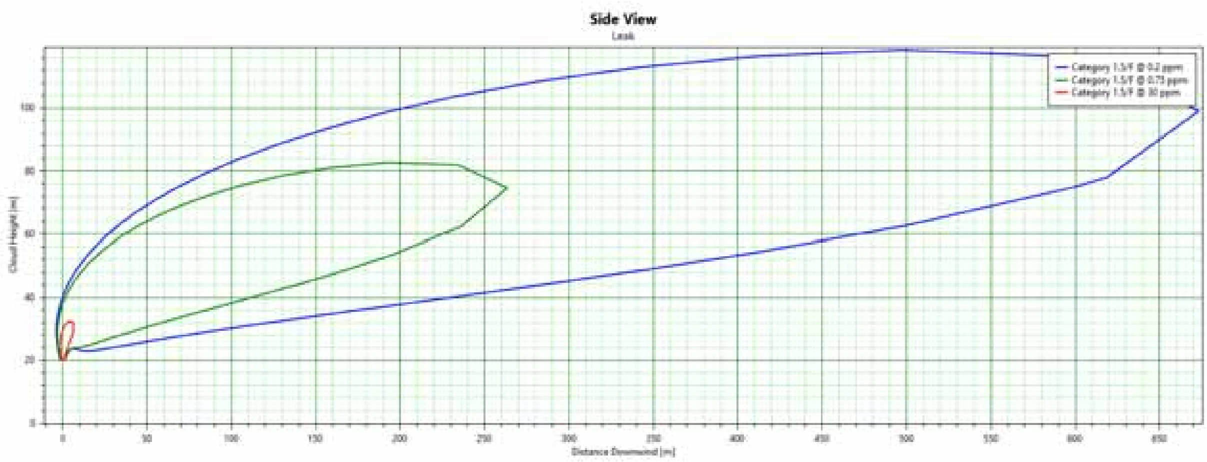
Rate of emission of SO_2 = 45.5 g/s, refer to Section 6.2.

Table E.1: Parameters for PHAST modelling of SO_2 emissions from stack

Parameter	Value
Emission Rate	45.5 g/s
Stack Flow Rate	130,000 Nm^3/h
Stack Height (m)	20 m
Stack Velocity (m/s)	20 m/s
Stack Diameter (m)	1.5 m
Stack Temp (Deg C)	90°C
Pasquill Stability Class	F
Wind Speed	1.5 m/s

Figure E.1 shows the contours resulting from the PHAST modelling, where it can be seen that the 0.2 ppm (irritation) contour does not reach the ground. Note that the plume was found to reach ground level at a concentration of approximately 0.01 ppm at 800 m.

Figure E.1: Concentration contours for desulphurisation plant failures (SO_2 dispersion from baghouse)



E2. Molten metal explosion in the foundry area (INC-002)

As the mass of water in the explosion (assumed to be 1kg) is much less than the mass of molten metal then the maximum equilibrium temperature will be the operating temperature of the furnace, i.e. 1100ºC. The explosive energy developed by the ingress of water is generated by the superheating of steam above atmospheric boiling point. Therefore, the explosive energy is given by:

Q = m x Cp x ΔT

= 1kg x 4.2 kJ/kg K x (1373ºK - 373ºK) = 4200kJ

where, Q = increase in sensible heat of water

m = mass of liquid, 1kg

Cp = heat capacity of liquid, 4.2 kJ/kg-K

ΔT = increase in temperature

Assuming that all the superheat energy is available for the molten metal explosion, this gives an explosive force equivalent to the following amount of TNT:

Equivalent mass of TNT = superheat energy/heat of combustion of TNT

= 4200kJ / 4600 kJ/kg

= 0.91kg TNT

The distance to overpressure levels of interest for molten metal explosions in the foundry area can be found by calculating the scaled distance as follows, Ref. (12):

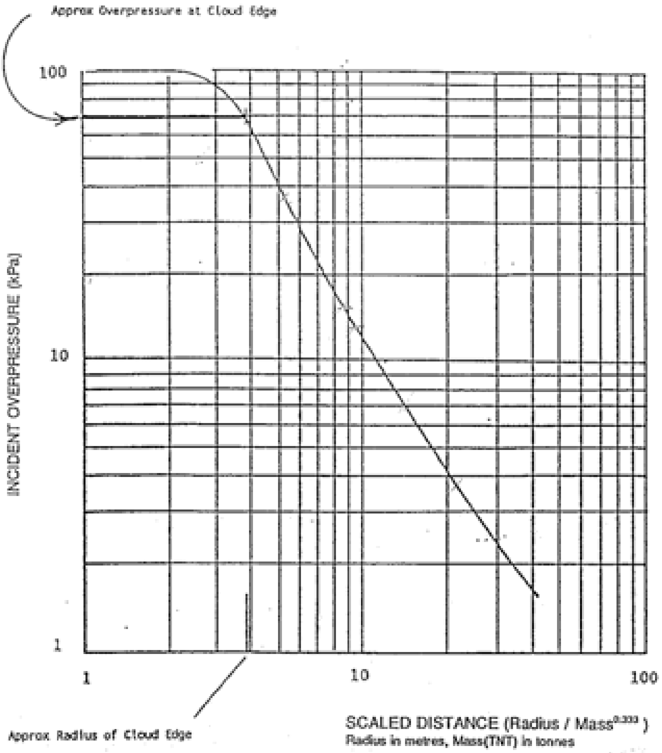
$$Scaled\ Distance = \frac{R}{M^{0.333}}$$

Where R = Radius to receiver (m)

M = Equivalent mass of TNT

A graph of overpressure versus scaled distance is shown in Figure E.2.

Figure E.2: Overpressure for ground-level explosion



As the consequence distances to standard overpressure levels of interest is to be assessed, the scaled distance to each overpressure can be read off the graph. The scaled distance to the overpressures of concern can then be estimated.

The radius to the overpressure level is then calculated as follows:

$$R = Scale\ Distance \times M^{0.333}$$

The results of the assessment are given in Table E.2.

Table E.2: Distance to explosion overpressure

Overpressure (kPa)	Scaled distance (m)	Radius to Overpressure Impact (m)
35	5.1	4.9
21	7	6.8
14	8.7	8.4
7	13.6	13.2
4	19.4	18.8

E3. Fuel gas release and jet fire (INC-003)

Jet fires were modelled using TNO Effects v9. The following hole sizes were modelled:

- 10mm
- 25mm
- 50mm

Table E.3 summarises the parameters for the jet fire modelling.

Table E.3: Parameters for jet fire modelling of fuel gas releases

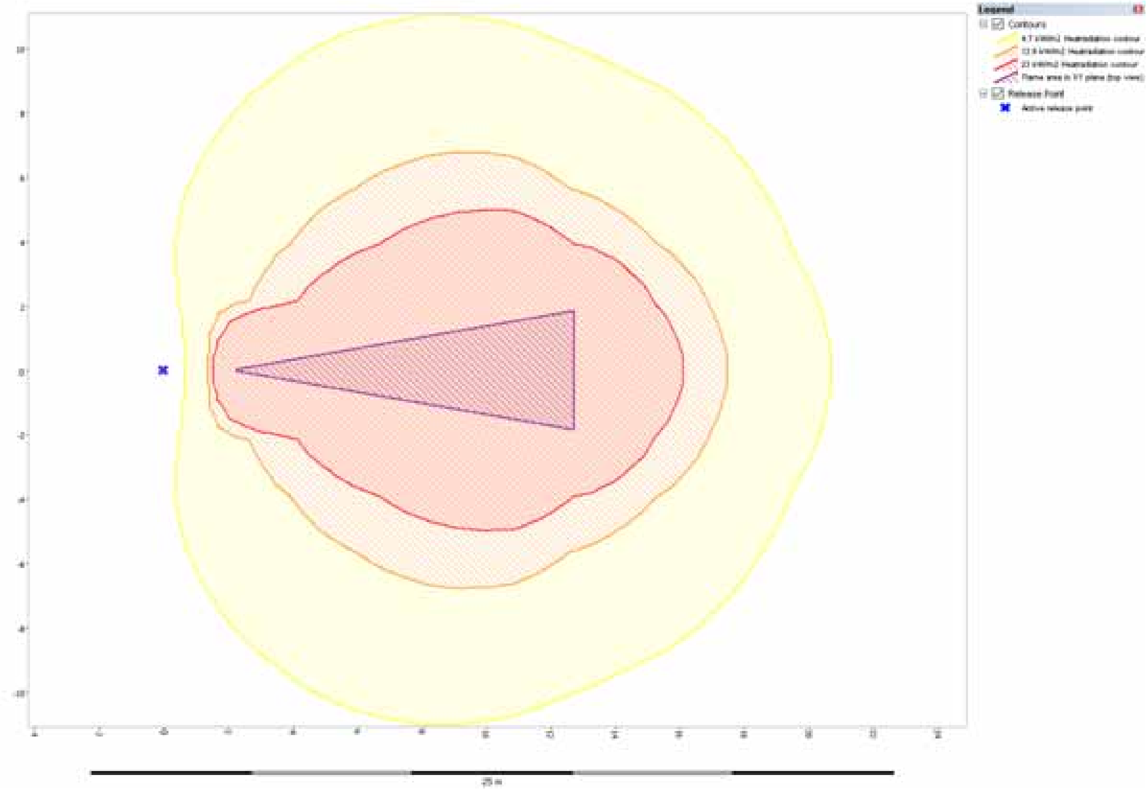
Parameter	Value
Fuel Gas Pressure	2MPag (upstream of regulator) 100kPag (downstream of regulator)
Release Height	1m
Angle of Release	Horizontal
Ambient Temperature	20°C
Relative Humidity	70%
Wind Speed	5m/s

Table E.4 summarises the consequence modelling for the fuel gas scenarios. Figure E.3 shows an example heat radiation contour for the worst case scenario (50 mm hole size, 2 MPag pressure).

Table E.4: Distance to heat radiation levels – horizontal release (fuel gas jet fire)

Hole Diameter (mm)	Release Rate (kg/s)	Flame Length (m)	Distance to Heat Radiation Levels of Interest (m)		
			23kW/m^2	12.6kW/m^2	4.7kW/m^2
Upstream Releases (2MPa gauge)					
10	0.05	3.0	3.6	3.9	4.7
25	0.33	7.0	7.0	8.7	11
50	1.25	13	16	17	21

Figure E.3: Heat radiation contour for horizontal jet fire release (50 mm hole size, 2 MPag pressure)



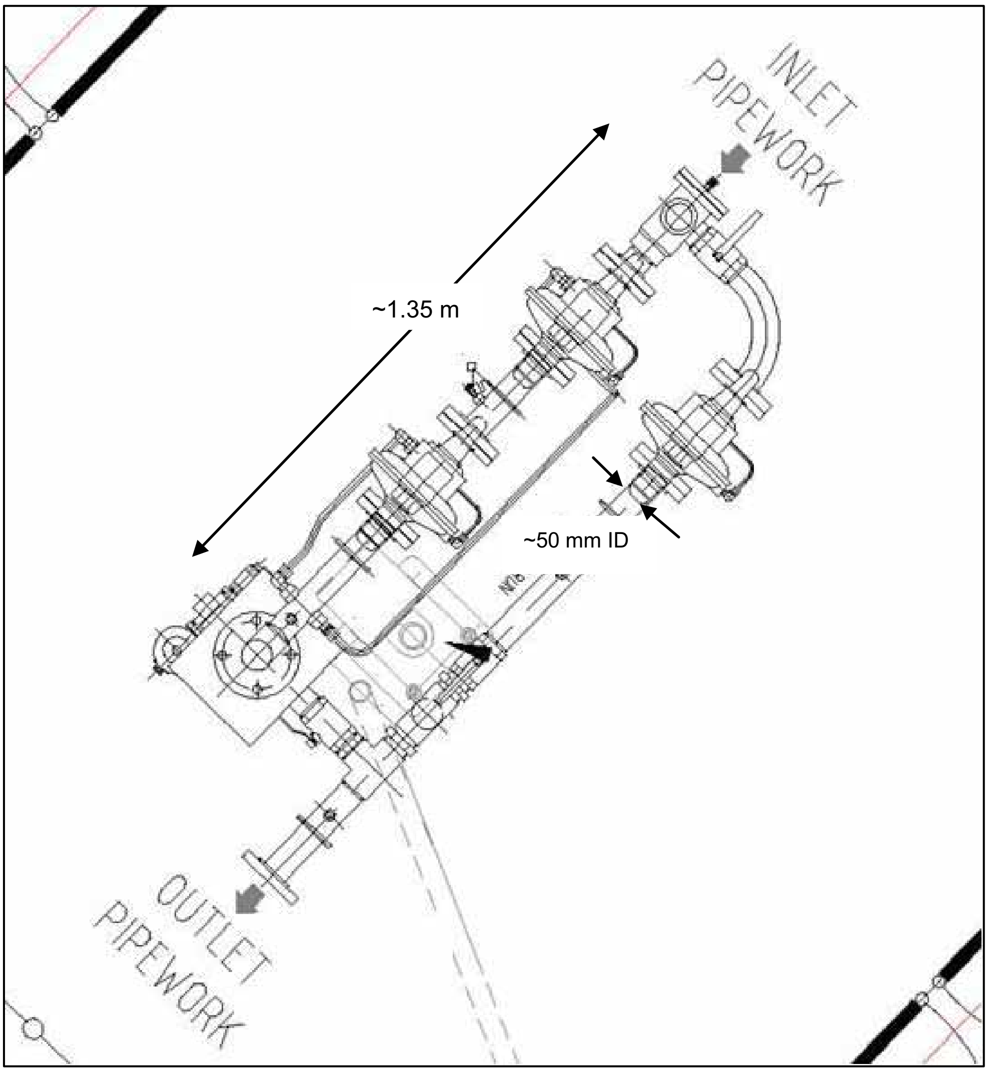
APPENDIX F. FREQUENCY ANALYSIS

F1. Overview

The fire frequency resulting from a fuel gas release was calculated based on:

- generic equipment leak frequencies
- a count of the equipment items, with reference to the metering skid layout (refer to Figure F.1
- ignition probabilities based on the leak rate
- direction adjustment, i.e. the chance that the jet fire would go offsite (to the east of the site
- No additional probabilities were used, e.g. detection and isolation.

Figure F.1: Cropped site layout diagram (metering skid only)



F2. Leak frequencies

The leak frequencies used in this study are presented in Table F.1. A representative leak frequency based on UK data, Ref (13), for all pipeline releases with pipe diameter ranging from 50 mm to 149 mm was used. The same source was used for leaks from valves and flanges.

Table F.1: Base leak frequencies used

Equipment size and type	Leak frequency by hole size			Unit	Source
	10 mm	25 mm	50 mm		
Process piping (50-149 mm pipe diameter)	2.0E-06	1.0E-06	5.00E-07	per metre-year	Ref (13)
Valve	2.0E-04	-	-	per valve-year	Ref (13)
Flange	-	5.0E-06	-	per flange-year	Ref (13)

F3. Parts count

Table F.2 shows the parts count completed for the natural gas metering skid area using the site layout diagram shown in Figure F.1. Table F.3 shows the total leak frequency for each hole size, i.e. the base leak frequency multiplied by the length or number of items identified from the parts count.

Table F.2: Parts count

Equipment size and type	Description
Length of process piping (60 mm pipe diameter)	3.5 m[(a)]
Number of valves	3
Number of flanges	9
(a) The pipe length estimate considered that the metering skid may have vertical pieces of pipework as well as the horizontal pieces apparent on the layout drawing	

Table F.3: Leak frequencies

Hole size	Leak frequency (per year)			Total leak frequency (per year)
	Process piping	Valve	Flange	
10 mm	7.00E-06	6.00E-04	-	6.07E-04
25 mm	3.50E-06	-	4.50E-05	4.85E-05
50 mm	1.75E-06	-	-	1.75E-06

F4. Ignition probabilities

Table F.4 shows the ignition probabilities that were used for this study, derived from Cox, Lees and Ang, Ref (14). Although the data contains data on immediate and delayed ignition, the overall ignition probability was used to determine the frequency of the jet fire consequence.

Table F.4: Ignition probabilities

Mass flow rate	Ignition probability of a gas or mixture.
<1 kg/s	0.01
1 - 50 kg/s	0.07
>50 kg/s	0.3

F5. Jet fire frequencies

The frequency of a jet fire in each hole size category is shown in Table F.5. This is calculated by multiplying the leak frequency by the ignition probability (based on the release rate).

Table F.5: Fire frequencies

Hole size	Total leak frequency (per year)	Mass flow rate (kg/s)	Ignition probability	Direction	Total jet fire frequency (per year)
10 mm	6.07E-04	0.05	0.01	0.5	3.04E-06
25 mm	4.85E-05	0.33	0.01	0.5	2.43E-07
50 mm	1.75E-06	1.25	0.07	0.5	6.13E-08
				Total	***3.34E-06***

APPENDIX G. REFERENCES

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