Pinnacle
Risk Management Pty Ltd

FIRE AND INCIDENT MANAGEMENT, BATTERY RECYCLING FACILITY, 10 LANCASTER STREET, INGLEBURN, NSW

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Fire and Incident Management, Battery Recycling Facility, Ingleburn

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A	2/2/16	Draft for Comment	JBA Planning
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EXECUTIVE SUMMARY

Ledox Australia Pty Ltd (Ledox) is proposing use of an existing industrial building at 10 Lancaster Street, Ingleburn, NSW, as a battery recycling facility.

As part of the Secretary's Environmental Assessment Requirements from the NSW Department of Planning and Environment, a Fire and Incident Management Plan is required. This report details the proposed measures to control potential fires and significant process incidents at the facility.

The proposed control measures include what is considered to be good practice, e.g. compliance with standards and safety data sheets.

If the facility is approved and built then a detailed emergency response plan to the Department of Planning's Hazardous Industry Planning Advisory Paper No. 1 is expected.

Given the proposed control measures detailed in this report, there are no other recommendations made.

GLOSSARY

CPR	Cardo-Pulmonary Resuscitation
DoPE	NSW Department of Planning and Environment
EPA	Environmental Protection Authority
HEPA	High Efficiency Particulate Arrester
HIPAP	Hazardous Industry Planning Advisory Paper
PHA	Preliminary Hazard Analysis
PPE	Personal Protective Equipment
SEAR	Secretary's Environmental Assessment Requirements
SOx	Sulphur Oxides
WHS	Work Health and Safety

REPORT

1 INTRODUCTION

1.1 BACKGROUND

Ledox Australia Pty Ltd (Ledox) is proposing use of an existing industrial building at 10 Lancaster Street, Ingleburn, NSW, as a battery recycling facility.

The plant is proposed to be designed for an average production capacity of 8 ton/hr (including the battery acid). The facility will process only car batteries.

As part of the Secretary's Environmental Assessment Requirements (SEARs) from the NSW Department of Planning and Environment (DoPE), a Fire and Incident Management Plan is required and is to include information on the equipment to be installed on the premises such as spill clean-up equipment and fire management and containment measures.

JBA Planning (acting on behalf of Ledox) has appointed Pinnacle Risk Management Pty Ltd (Pinnacle Risk Management) to prepare this Fire and Incident Management Plan.

As the final facility design is yet to be determined, a detailed emergency response plan complying with the requirements of the Department of Planning's Hazardous Industry Planning Advisory Paper (HIPAP) No. 1 (Ref 1) is not possible. This is expected to be developed if the project is approved and progresses. The fire and significant incidents are taken from the Preliminary Hazard Analysis (PHA) for this project (Ref 2). This report contains the proposed fire and incident management measures including what is considered to be good practice, e.g. compliance with standards and safety data sheets.

2 SITE DESCRIPTION

The site at 10 Lancaster Street, Ingleburn (see Figure 1), is approximately 3,800 m^2 in area and is located within the Ingleburn Industrial Estate in the Campbelltown City Council Local Government Area.

The battery recycling facility will utilise the existing building on the site. The building on the site is single storey in height with an internal mezzanine level. Car parking is provided towards the southern end of the property. Two driveway accesses off Lancaster Street are provided to either edge of the southern frontage. The building contains a mezzanine office component at the front with the remainder being a double height warehouse. Roller doors at either end provide vehicle access into the building. The building covers approximately 52% of the total site area.

The site is surrounded on all sides by existing industrial development. The Ingleburn industrial estate continues to the south-west of the site for some 2.5 km.

West of the site is an existing metal fabricating facility, beyond which is the Bunbury Curan Creek canal, then further industrial development leading to the Hume Motorway (M31) approximately 1 km away.

South of the site, beyond the immediate industrial development, is the Ingleburn Memorial Park approximately 350 m away. Further afield is the Main South Railway connecting Campbelltown and Liverpool. Ingleburn Station is located approximately 700 m south of the site, with the retail centre of Ingleburn immediately east of the train station. There are a number of residential houses in Aero Road approximately 300 m south of the site.

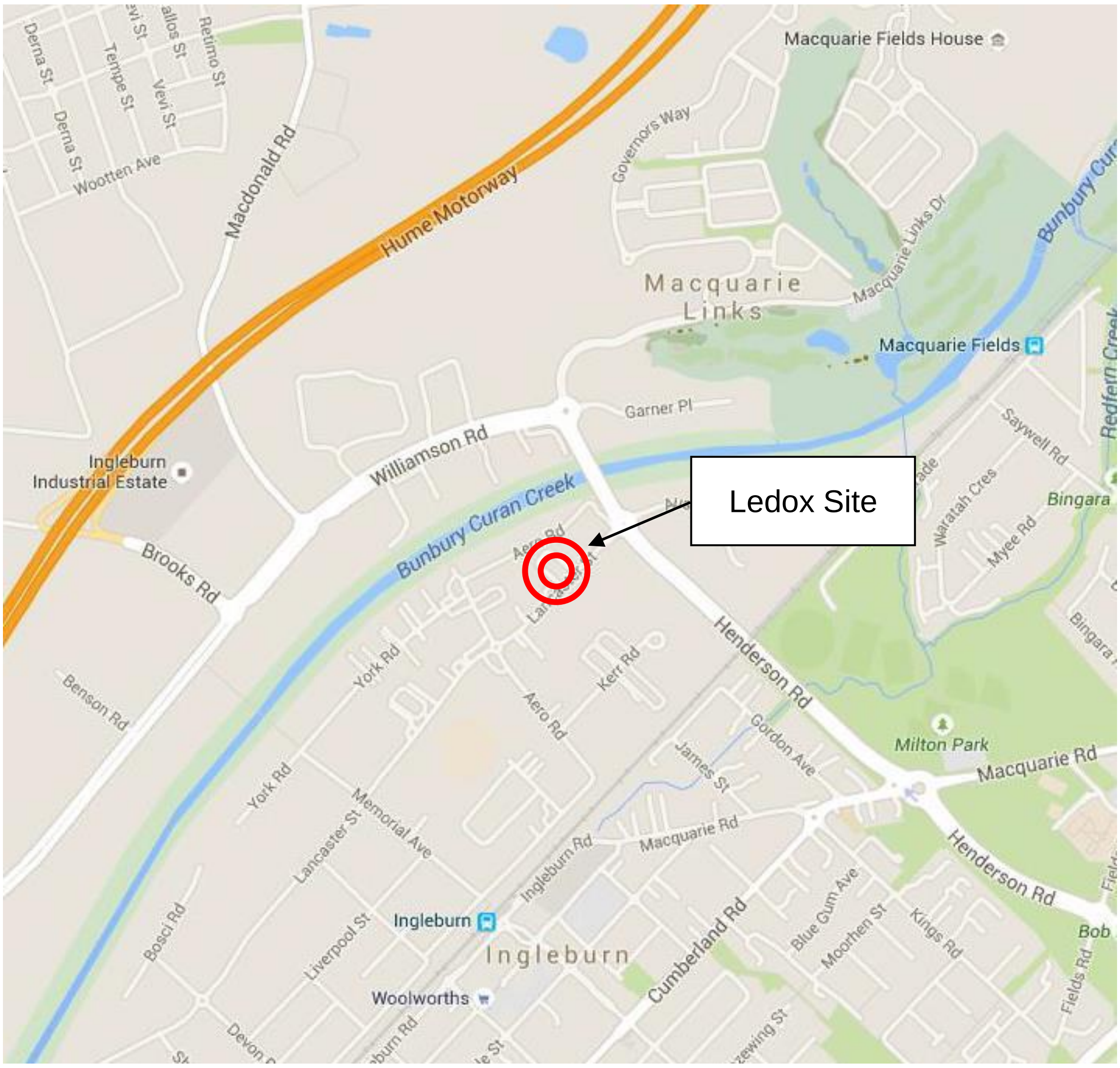
South-east of the site are existing industrial facilities leading to the Main South Railway (some 400 m away), beyond which are the residential areas of Ingleburn. These residences east of the Main South Railway are located approximately 450 m southeast of the site.

East of the site are existing industrial facilities beyond which is located Milton Park. The closest residential area east of the site is located in Macquarie Fields some 850 m away.

North of the site the closest residential area is Macquarie Links, some 750 m away.

The proposed trading hours are Monday-Friday (7am-7pm) and Saturday (9am-3pm). There will be approximately 7 people on-site.

Figure 1 - Site Location



Source: Ref 3

3 FACILITY DESCRIPTION

3.1 OVERVIEW

The proposed battery recycling facility will receive car batteries from distribution agents. The batteries will be broken down and the recoverable components will be extracted for recycling and/or re-use.

The facility intends to have the capacity to process up to 1,500 tonnes of per month. Each battery comprises of recoverable lead and plastics which will be collected for reuse and waste materials that will require disposal. The approximate breakdown of the components within batteries is shown in Table 1.

Table 1 – Battery Composition

Material:	Weight%
Electrolyte (sulphuric acid)	15
Lead Sulphate	10
Lead Oxide	40
Lead Grid or Metal	30
Polypropylene	3
Heavy Plastics, Paper, Fibres etc	2

It is intended to recover the lead plates and lead sludge and transport these to South Korea for re-processing into new car batteries.

The residual waste materials are the sulphuric acid, waste water and waste polyethylene (known as separators). These will be removed from site by a suitably licenced contractor for disposal. Residual plastics may also be recycled if appropriate recycling schemes are available.

The battery recycling machine will be almost entirely within the building. External components will be limited to a scrubber and a sodium carbonate tank (400 L capacity).

3.2 PROCESS DESCRIPTION

The overall process contains five main operational areas:

- Unit 100: Battery transportation, sulphuric acid collection;
- Unit 200: Shredding and separation unit;

- Unit 300: Lead paste desulfurization unit;
- Unit 400: Automated soda ash supply unit; and
- Unit 500 Scrubber System.

These areas are shown on the Site Layout (Figure 2) and Process Flow Diagram (Appendix 1).

3.2.1 Process Inputs and Outputs:

The following are the process inputs to the battery recycling facility:

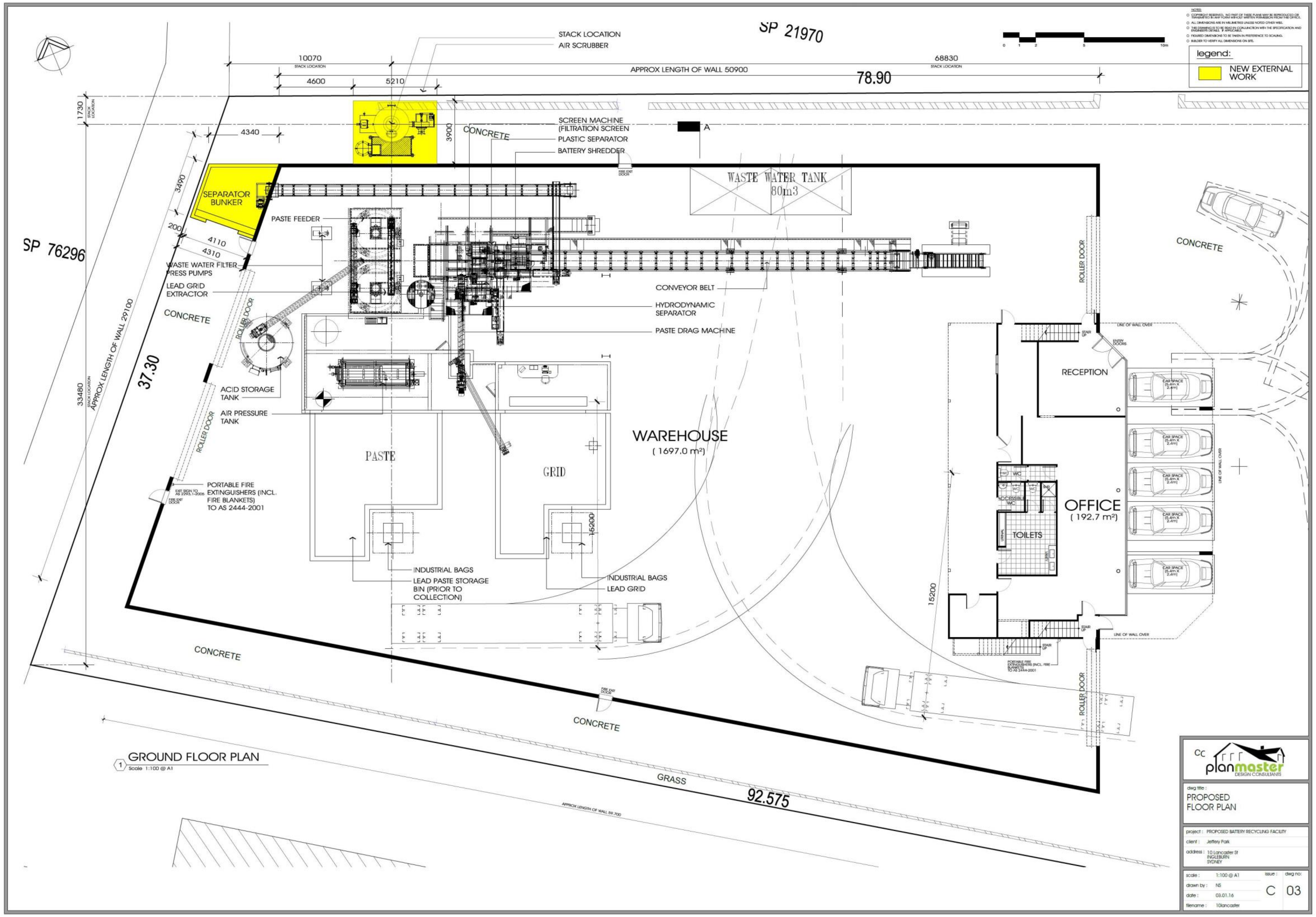
- The car batteries;
- Sodium carbonate (stored as a powder in a 50 te silo);
- Polymer (supplied in 20 kg or 25 kg bags);
- Potable water;
- Instrument air; and
- Power.

The following are the process outputs:

- Plastics, i.e. polyethylene and polypropylene. These will be cleaned and sold for recycling;
- Waste water. This is the water used for cleaning the warehouse plus some of the sulphuric acid. The pH is expected to be 3 to 4. The waste water is stored in the waste water tank (80 m^3). The waste water will be collected by a licenced waste water contractor in a tanker and taken for off-site re-processing;
- Sulphuric acid. This will be stored in a 30 m^3 tank;
- Lead carbonate ($PbCO_3$), i.e. the filter cake (sludge) or paste. The sludge will be collected in bins, loaded into containers and taken for re-processing into new batteries at another site; and
- The recovered lead plates, i.e. also known as grid or lead scrap (recycled to new batteries).

The solid outputs, i.e. lead plates, lead sludge and plastics, will be packaged into industrial bags ready to be exported in shipping containers.

Figure 2 – Site Layout



3.2.2 Unit 100: Battery Transportation and Sulphuric Acid Collection

The objective for Unit 100 is to ensure that Unit 200 is supplied with batteries that do not contain any electrolyte, i.e. sulphuric acid.

Waste storage batteries are unloaded inside of the factory from trucks. The batteries are transported by forklift truck onto BC-101 (belt conveyer) where they are fed to a cutting machine (CT-101). The cutting machine breaks open the batteries which allows the sulphuric acid to drain into a sump and trench. The sulphuric acid flows to an underground collection tank for either reuse or off-site disposal (i.e. by pumping into a road tanker). The sulphuric acid tank capacity is proposed to be 30 m^3.

3.2.3 Unit 200: Shredding and Separation Unit

The battery pieces from the cutting machine are then fed into the shredder machine. The battery pieces are then shredded prior to subsequent component separation and sorting.

The shredder machine is to be supplied with recycled water for cooling, screen cleaning and material transport purposes.

The battery scrap and the water spray from the shredder machine pass through the screen machine (VS-201) where the water and a fine powder paste of less than 0.2 mm (lead oxides and lead sulphate) discharge to the paste drag machine. Large pieces from the screen machine, i.e. the lead and plastics, are to be discharged into the hydrodynamic separator (H-200).

The hydrodynamic separator will separate the plastics and lead onto their respective conveyor belts. This water filled vessel uses the differences in weight and density for material separation. The three main outputs from the hydrodynamic separator are:

- The separators (e.g. polyethylene) and water from the hydrodynamic separator will be transported to the vibrating screen (VS-206) where they will be separated. The separators will be stored in a bin and the water is sent to the paste drag machine;
- The polypropylene and water from the hydrodynamic separator will be transported to screw conveyors SC-209 and SC-210 where they will be separated. The polypropylene will be washed and stored in a collection bin; and
- The lead (grid) from the hydrodynamic separator will be dried using air and then transported to screw conveyors SC-211 and SC-212 for storage in bins.

When the paste and metallic powder enter the paste drag machine (DG-230), it will be mixed with flocculant, i.e. polymer. This will create flocs, i.e. sludge in the water, for ease of neutralisation in Unit 300 and separation in the filter press.

3.2.4 Unit 300: Lead Paste Desulphurisation Unit and Filter Press

The lead sludge within the recycled batteries is sulphate based, primarily compromising lead sulphate ($PbSO_4$), which is a toxic substance. This requires treatment via chemical reaction to convert the sludge into a carbonate-based material, i.e. lead carbonate ($PbCO_3$), which is a more stable form of lead and more suitable for handling and shipment.

The sludge from the paste drag machine will be conveyed into one of two stirred neutralisation tanks (R-310 and R-320) and soda ash (sodium carbonate) added. This is to neutralise the sludge from lead sulphate to lead carbonate and also to neutralise sulphuric acid. The reactions in the stirred tanks are as follows:

$PbSO_4$ (s)+ Na_2CO_3 (aq) = $PbCO_3$ (s) + Na_2SO_4 (aq) + heat

H_2SO_4 (aq) + Na_2CO_3 (aq) = Na_2SO_4(aq) + CO_2(g) + heat

Once the sludge has been neutralized, it will be conveyed to a filter press where the majority of the water is removed to form the filter cake. The expected percentage in the filter cake for water is approximately 20% and approximately 80% for the lead. The sulphur content is likely to be less than 0.6%.

The water from the filter press flows to a recycling water tank (10 m^3) for subsequent reuse, i.e. in the neutralisation tanks. The recycled water tank will be an underground tank. The pH will typically be 7 to 8.

3.2.5 Unit 400: Automated Soda Ash Supply Unit

The storage tank capacity for soda ash (sodium carbonate) will be approximately 50 tonne in an atmospheric silo. When required for neutralisation, the soda ash will be automatically fed to the stirred neutralisation tanks via screw conveyers SC-403 and SC-404.

3.2.6 Unit 500: Scrubber System

The scrubber system will be designed to remove odours, particulates and vapours produced during the production process (primarily SOx and trace levels of lead dust). The ducting sources that capture these odours and vapours are shown in Table 2. There is a fan on the inlet to the scrubber so the ducting operates at slight negative pressures, i.e. to avoid emissions sources affecting people within the building.

Table 2 – Odour Sources for Scrubber

Identifier:	Equipment Name:	Equipment Number:
A	Shredder Machine Inlet (Conveyor Belt Outlet)	HC-200
B	Hydrodynamic Separator Upper Body (Vibrating Screen Outlet)	VS-201
C	Paste Drag Machine	DG-230
D	Stirred Neutralisation Tanks	R-310 and R-320
E	Filter Press Upper Body	-

The scrubber will contain packing which will be sprayed with water. The water will flow over the packing and absorb any SOx and lead dust as they travel up through the bed. The scrubber stack discharge is 600 mm diameter and 9 m above ground level.

4 FIRE AND INCIDENT MANAGEMENT PLANS

The identified credible, significant incidents for the proposed facility are summarised in the Hazard Identification Word Diagram following (Table 3).

This diagram presents the causes and consequences of the potential fire and incidents, together with the proposed means to control these events should they occur.

If the facility is approved and constructed then an emergency response plan to HIPAP 1 (Ref 1) should be developed. This is to detail all incidents including:

- Natural Events;
- Civil Disturbances and Trespass;
- Bomb Threats;
- Vehicle Accident On-Site; and
- Injury Requiring Medical Treatment

However, as the proposed facility is being reviewed for approval and design details are not known then the supplied information on the proposed equipment to be installed on the premises, such as spill clean-up equipment and fire management and containment measures, is preliminary and is subject to change. The supplied information is also based on compliance with standards and good practice.

In summary, the following emergency resources equipment will be available on-site:

- Fixed fire equipment, i.e. extinguishers, hose reels and hydrants;
- First Aid cabinets;
- Respiratory protection for lead, dust and acid mist;
- Spill control, i.e. spill kits (clearly signed and labelled), absorbent material, lime or soda ash for neutralising sulphuric acid spills, brooms, shovels, and waste disposal drums;
- Rescue harness and ropes;
- Emergency lighting;
- Fire Indicator Panel;
- Pumps for emptying sumps;
- Safety shower and eyewash stations; and

- PPE (personal protective equipment), i.e. full face-piece respirators, acid resistant suits, and impervious gloves and boots.

With the exception of fire (see Table 3), the major incidents involve spills. The typical response for spills will be as follows.

- Do not touch or walk through spilled material;
- Assess the extent of the spill. If significant and hazardous, sound the alarm, call the emergency services by phoning 000 and evacuate people to the Emergency Assembly Point (head count required);
- Consider wind direction for potential impacts to people off-site;
- Use appropriate PPE for the spilt material;
- Provide First Aid if necessary;
- Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area);
- Keep combustibles (wood, paper, oil, etc.) away from spilled material;
- Prevent entry into waterways, sewers, basements or confined areas;
- Small Spills: Contain with spill kits, absorbent pads, sand or other non-combustible absorbent material and place into containers for later disposal;
- Large Spills: Install temporary bunding ahead of the liquid spill for later disposal;
- Sulphuric acid spills can be neutralised with lime or soda ash;
- Dry lead spills to be vacuumed using a HEPA (high efficiency particulate arrester) vacuum;
- Clean-up the spill area once the bulk of the material has been removed, e.g. water washing; and
- Waste material to be disposed in accordance with EPA (Environmental Protection Authority) requirements.

Table 3 – Hazard Identification Word Diagram

Event ID No.	Hazardous Event	Causes	Possible Consequences	Fire and Incident Management Measures
1.	Fire within the building	Conveyor belt fire. Forklift truck fire. Plastics fire. Electrical fire. Office fire that propagates to the process equipment. Arson. Source of ignition include: 1. Hot work. 2. Smoking. 3. Electrical fault. 4. Conveyor belt slip.	Fire involving the lead compounds. Given the limited fire load in the building and the wet process, the fire is likely to be a local event. However, toxic products of combustion including lead oxides and SOx can be emitted. Also, batteries can explode in a fire. Therefore, there can be impact to people (radiant heat and/or exposure to toxic combustion products), property (radiant heat) and the environment (toxic combustion products as well as contaminated fire water)	If a fire occurs, the emergency response is to dial 000. Ledox employees will not be trained in advanced firefighting techniques involving lead. Fire extinguishers (water spray, alcohol-resistant foam, dry chemical or carbon dioxide) and hose reels inside the building. Hydrants around the facility. Water spray will be used to keep fire-exposed containers cool. Firefighters to wear self-contained breathing apparatus for firefighting given there is a risk of lead inhalation plus full protective equipment. PPE including impervious boots to prevent lead contaminated firewater absorbing into the skin. Emergency / fire warning alarm to allow people to evacuate to the Emergency Assembly Point. Emergency response plan (copy provided to local fire brigade(s)). Safety Data Sheets for all on-site chemicals to be available. For people suspected or known to have inhaled lead: The person is to be removed to fresh air and kept comfortable for breathing. Seek immediate medical attention. If breathing has stopped, artificial respiration will be applied. Direct mouth-to-mouth

Event ID No.	Hazardous Event	Causes	Possible Consequences	Fire and Incident Management Measures
				will not be used given the risk of lead poisoning. If the person's breathing is difficult, oxygen will be given. Discharge into the environment is to be avoided, e.g. stormwater drains to be blocked with sandbags. As per the PHA recommendations, include in the facility design containment for the design quantity of firewater. As per the PHA recommendations, the building floor is to be impervious. There will be a requirement in the emergency response plan to maintain a safe distance from the batteries in case of rupture in a fire. Emergency response will include control of people downwind of the fire, e.g. stay indoors or evacuate the area

Event ID No.	Hazardous Event	Causes	Possible Consequences	Fire and Incident Management Measures
2.	Exposure to lead	Loss of the scrubber extraction fan and lead dust accumulates within the building. Manual handling of lead and its compounds, e.g. during operation or maintenance	Lead is a toxic metal which leads to lead poisoning	Eye contact: Immediately flush eyes with copious quantities of water for at least 15 minutes holding lids apart to ensure flushing of the entire surface. Seek immediate medical attention. Safety showers and eyewash stations are to be located throughout the facility. First Aid cabinets are also to be provided. Skin contact: Immediately flush skin with plenty of water and soap for at least 15 minutes while removing contaminated clothing and shoes. Seek immediate medical attention. Discard contaminated clothing and shoes. Showers to be provided at the facility for decontamination. Waste disposal containers will also be provided to dispose of contaminated clothing via a licensed waste disposal company. Inhalation: The person is to be removed to fresh air and kept comfortable for breathing. Seek immediate medical attention. If breathing has stopped, artificial respiration will be applied. Direct mouth-to-mouth will not be used given the risk of lead poisoning. If the person's breathing is difficult, oxygen will be

Event ID No.	Hazardous Event	Causes	Possible Consequences	Fire and Incident Management Measures
				given Ingestion: If conscious, wash out mouth with water. DO NOT induce vomiting. Seek immediate medical attention. Any lead waste is to be picked up and disposed of without creating dust. A HEPA vacuum, broom and/or shovel to be used. The lead waste is to be kept in suitable, closed containers for disposal. PPE (personal protective equipment) for workers as per Regulations and Safety Data Sheets including impervious gloves and boots, and respiratory protection.

Event ID No.	Hazardous Event	Causes	Possible Consequences	Fire and Incident Management Measures
3.	Lead spill	Equipment failure. Maintenance work. Forklift truck drop or impact. Container failure	Lead is a toxic metal which leads to lead poisoning. Potential to enter the environment with impact to flora and fauna	All Ledox employees to receive training in lead hazards and the recommended procedures for handling lead. Typically, the following activities are to be performed in the event of a lead spill: 1. Evacuate personnel to a safe location, e.g. up wind (isolation distance at least 10 to 15 m). 2. Secure and control the entrance to the facility. 3. Eliminate all ignition sources. 4. Collect spilled material using the correct PPE and a HEPA vacuum, broom and/or shovel and deposit into a container (avoid dust generation). 5. Ventilate and wash area after clean-up is complete. 6. Dispose of the lead in accordance with the EPA's requirements PPE: Wear self-contained breathing apparatus, rubber boots and heavy rubber gloves. Wear disposable coveralls and discard them after use. Liquids containing lead can be absorbed with earth, sand or other non-combustible material and transferred to a container. Do not allow to enter waters, waste water, or soil due to lead's environmental toxicity. Sandbags or similar to be used

Event ID No.	Hazardous Event	Causes	Possible Consequences	Fire and Incident Management Measures
4.	Sulphuric acid spill	Failure of the level control in tank with an overflow. Pipe or equipment failure. Human error, e.g. drain valve left open	Spilling sulphuric acid with the potential to cause corrosive burns to people and also impact the environment	All Ledox employees to receive training in sulphuric acid hazards and the recommended procedures for handling acid. Typically, the following activities are to be performed in the event of a sulphuric acid spill: 1. Evacuate personnel to a safe location, e.g. up wind (isolation distance at least 10 to 15 m). 2. Secure and control the entrance to the facility. 3. Eliminate all ignition sources. 4. Contain the spilled material using the correct PPE and booms, absorbent, sand or similar. Neutralise using lime or soda ash and/or pump into a suitable container for off-site disposal. 5. Ventilate and wash area after clean-up is complete. 6. Dispose of the waste acid in accordance with the EPA's requirements PPE: Wear overalls, chemical goggles, face shield, elbow-length impervious gloves, splash apron or equivalent chemical impervious outer garment and rubber boots. Do not allow to enter waters, waste water, or soil due to the environmental corrosive impact. Sandbags or similar to be used

Event ID No.	Hazardous Event	Causes	Possible Consequences	Fire and Incident Management Measures
				Ingestion: Immediately rinse mouth with water. If swallowed, do not induce vomiting. Give a glass of water. Seek immediate medical assistance. Take off immediately all contaminated clothing. Rinse skin with water/shower. Safety showers and eyewash stations are to be located throughout the facility. Inhalation: Remove person to fresh air and keep comfortable for breathing. Eye Contact: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately wash in and around the eye area with large amounts of water for at least 15 minutes. Eyelids to be held apart. Safety showers and eyewash stations are to be located throughout the facility.

Event ID No.	Hazardous Event	Causes	Possible Consequences	Fire and Incident Management Measures
5.	Polymer or sodium carbonate spill	Pipe or equipment failure. Human error, e.g. drain valve left open. Loss of containment during transfers	Irritation impact to personnel. Polymer solution is slippery	Wear protective equipment to prevent skin (coveralls and gloves) and eye contact (chemical goggles), and breathing in the dust (dust mask). Work up wind or increase ventilation. Cover with damp absorbent (inert material, sand or soil). Sweep, shovel or vacuum up, but avoid generating dust. Collect and seal in properly labelled containers or drums for disposal. Wash area down with excess water Avoid spread into the environment, e.g. stormwater drains to be blocked with sandbags. Safety showers and eyewash stations are to be located throughout the facility. Eye Contact: If in eyes, hold eyelids apart and flush the eye continuously with running water. Continue flushing until advised to stop by a Poisons Information Centre or a doctor, or for at least 15 minutes.

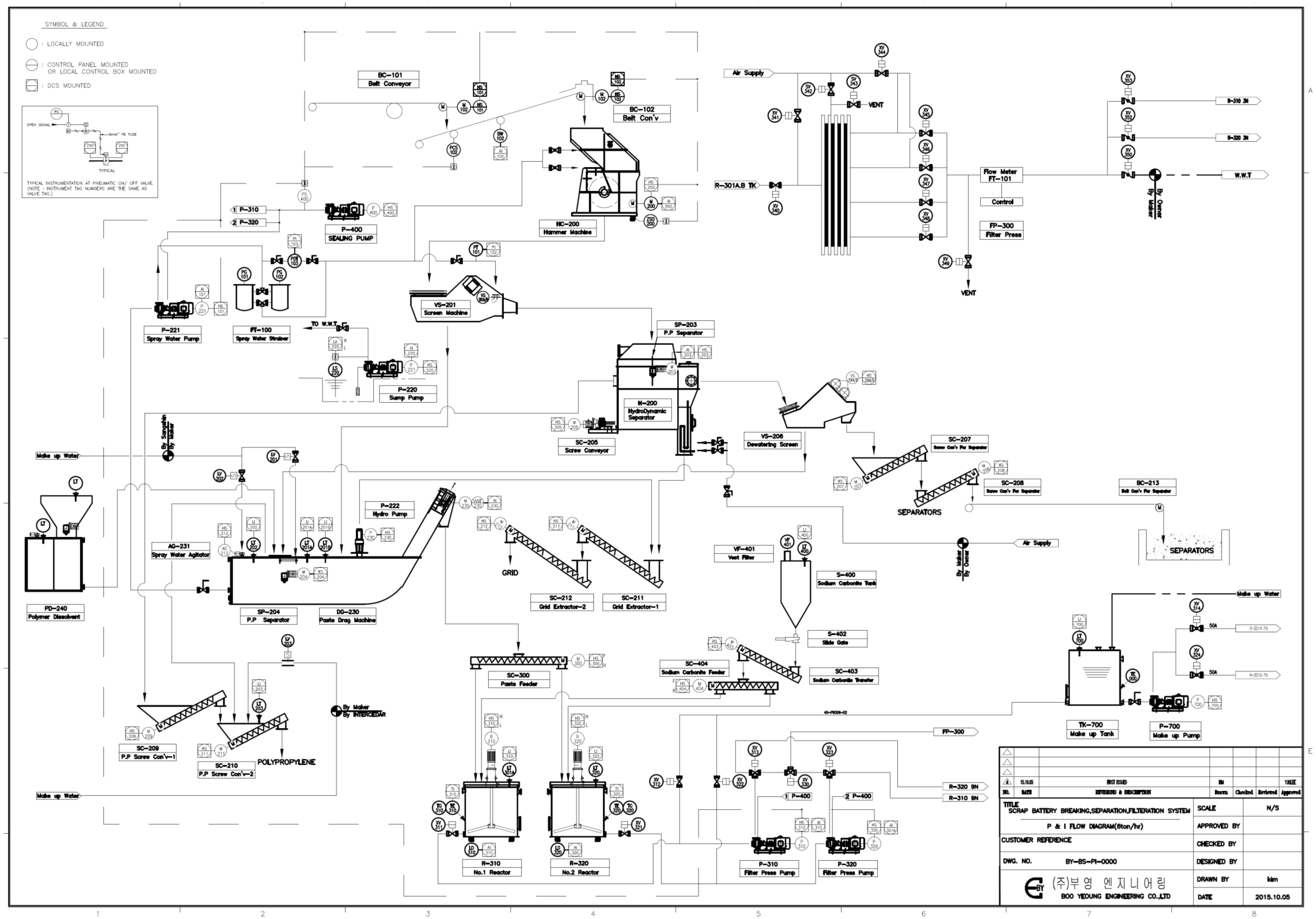
Event ID No.	**Hazardous Event**	**Causes**	**Possible Consequences**	**Fire and Incident Management Measures**
6.	Carbon dioxide exposure	Person enters a confined space containing high levels of carbon dioxide	Asphyxiation	All confined spaces on site to be identified. All confined space entries to have a risk assessment and permit as per the WHS (Work Health and Safety) Regulations 2011. Confined space entry permit issuers to be confined space trained. Rescue equipment to include harness, tripod and ropes. Use of gas detector when entering a confined space. First Aid trained personnel to commence CPR (cardo-pulmonary resuscitation) until an ambulance arrives

Appendix 1

Process Flow Diagram

Fire and Incident Management, Battery Recycling Facility, Ingleburn

Appendix 1 – Process Flow Diagram.



5 REFERENCES

1 Department of Planning, **Hazardous Industry Planning Advisory Paper No 1, Emergency Planning**, 2011

2 Pinnacle Risk Management, **Preliminary Hazard Analysis, Battery Recycling Facility, 10 Lancaster Street, Ingleburn, NSW**, 2 February 2016

3 JBA Planning, **Preliminary Environmental Assessment Report, Request for Secretary's Environmental Assessment Requirements**, June 2015