Preliminary Hazard Analysis of Sell & Parker Pty Ltd Metal Recycling Facility Expansion

For Environmental Resources Management

10-March-2014

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Document History and Authorisation

Issue	Date	Changes
A	21 February 2014	Draft report for client review.
0	3 March 2014	Final report.
1	10 March 2014	Incorporating latest plant layout and changes to process description

Summary

Sell & Parker Pty Ltd (Sell & Parker), a metal recycling company, proposes to increase the capacity of its waste metal recovery facility located at 45 Tattersall Road from 90,000 tonnes per annum to 350,000 tonnes per annum. This necessitates using the adjoining site to the east (23 – 43 Tattersall Road), modifying the site layout and altering existing buildings, improving vehicular access to the site and internal roads, and constructing ancillary infrastructure.

Environmental Resource Management Pty Ltd (ERM), are preparing the Environmental Impact Statement for the expansion of the Sell & Parker facility, and have requested Arriscar Pty Limited (Arriscar) to conduct a Preliminary Hazard Analysis (PHA) of the proposed development and to identify fire and incident management measures.

Hazardous scenarios were identified in a HAZID session, and some representative scenarios modelled to determine the consequence distances.

While dangerous goods scenarios could have fatal impacts, the extent of these consequences is limited due to the small inventory of dangerous goods, and a semi quantitative assessment of risk appropriate for the site.

It was found that there was no significant offsite impact from the use of dangerous goods on site due to the small inventories involved. The NSW criteria for injury were not reached at sensitive or residential land use zones. The potential for offsite fatality and property damage was limited to the scenario of a 45 kg LPG cylinder rupture in the dangerous goods store. The NSW criteria for offsite fatality and property damage are considered satisfied due to the rarity of LPG cylinder ruptures.

The assessment found that qualitative criteria for potentially hazardous development was satisfied, and the development is not considered a hazardous industry, as defined in State Environmental Planning Policy (SEPP) No. 33.

A number of recommendations were made in regard to fire protection requirements:

1. At least one hose reel and one fire extinguisher be provided for the oxygen and LPG cylinder storage (AS 4332-2004, Table 7.2). This is based upon the 3,000 L of oxygen in the store.
2. Provide one powder type extinguisher and one foam extinguisher for all bulk class 3 dangerous goods on site. This includes the storage of fuel and oil removed from vehicles prior to shredding. This recommendation assumes the recovered liquids are stored in intermediate bulk containers.
3. Maintain the height of the floc stockpile to less than 4 m, or the total volume to less than 1000 m^3. This ensures the warehouse in which the floc is stored will not be a high hazard occupancy.
4. Continue with the practice of providing water cannons to provide reach to feed and processed stockpiles in the event of a fire in any stockpile.

These recommendations are in addition to fire-fighting requirements contained in the “deemed to comply” provisions of the Building code of Australia.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Notation

Abbreviation	Description
Floc	Non-metallic waste left behind after shredding/processing of both Ferrous and Non Ferrous material received.
HIPAP	Hazardous Industry Planning Advisory Paper
Kg/s	kilograms per second
kPa	kilo Pascal
kW/m^2	Kilo Watts per square metre
LFL	Lower Flammable Limit
LPG	Liquefied Petroleum Gas
m	metre
mm	millimetre
UFL	Upper Flammable Limit
VCE	Vapour Cloud Explosion

1 INTRODUCTION

1.1 Background

Sell & Parker Pty Ltd (Sell & Parker), a metal recycling company, proposes to increase the capacity of its waste metal recovery facility located at 45 Tattersall Road from 90,000 tonnes per annum to 350,000 tonnes per annum. This expansion includes:

- Using the adjoining lot to the east (23 – 43 Tattersall Road),
- Modifying the site layout and altering existing buildings on both lots,
- Improving vehicular access to the site and internal roads, and
- Constructing ancillary infrastructure.

Environmental Resource Management Pty Ltd (ERM), are preparing the Environmental Impact Statement for the expansion of the Sell & Parker facility, and have requested Arriscar Pty Limited (Arriscar) to conduct a Preliminary Hazard Analysis (PHA) of the proposed development and to identify fire and incident management measures.

The Environmental Assessment (EA) for the proposed modification must address the following Director General's Requirements for Hazards and Risks:

- Updating the risk assessment for the subject site to include the proposed modification. The level risk assessment should be consistent with *Multi-level Risk Assessment* (2011) (1).
- The risk assessment needs to be assessed against and shown to comply with criteria contained within *HIPAP 4: Risk Criteria for Land Use Safety Planning* (2).

This PHA has been undertaken in accordance with the guidance provided by the NSW Department of Planning and Infrastructure (DP&I) in *Multi-level Risk Assessment* (2011) (1). A semi qualitative assessment of the risk has been undertaken.

1.2 Scope

The study scope includes a semi-quantitative analysis and assessment of off-site fatality, injury and property damage risk, in accordance with the NSW Hazardous Industry Planning Advisory Paper (HIPAP) guidelines. The risk assessment does not include an assessment of the following risks:

- Environmental risks on-site;
- Risk of property damage on-site and
- Fatality or injury risks for personnel on-site.

The study scope includes a PHA of the proposed modification.

2 FACILITY DESCRIPTION

2.1 Site Description

Sell & Parker proposes to expand its operations onto land adjacent to its current operation in Kings Park. After the expansion, Sell & Parker will occupy 23 – 45 Tattersall Road, Kings Park, New South Wales. This is shown on Figure 2-1.

The following buildings will occupy the site at the completion of the development.

Table 2-1 Buildings

Building	Area (m^2)
Office/Admin	952
Non Ferrous Shed	1,372
Non Ferrous processing	4,201
Post Shedder processing	2,952
Truck Wash	500
Storage/Work shed	450
Shedder Non Ferrous Recovery	680

2.2 Location

The location, 23 -45 Tattersall Road, Kings Park and the surrounding area is zoned for industrial use. The nearest residential zone is approximately 300 m to the East.

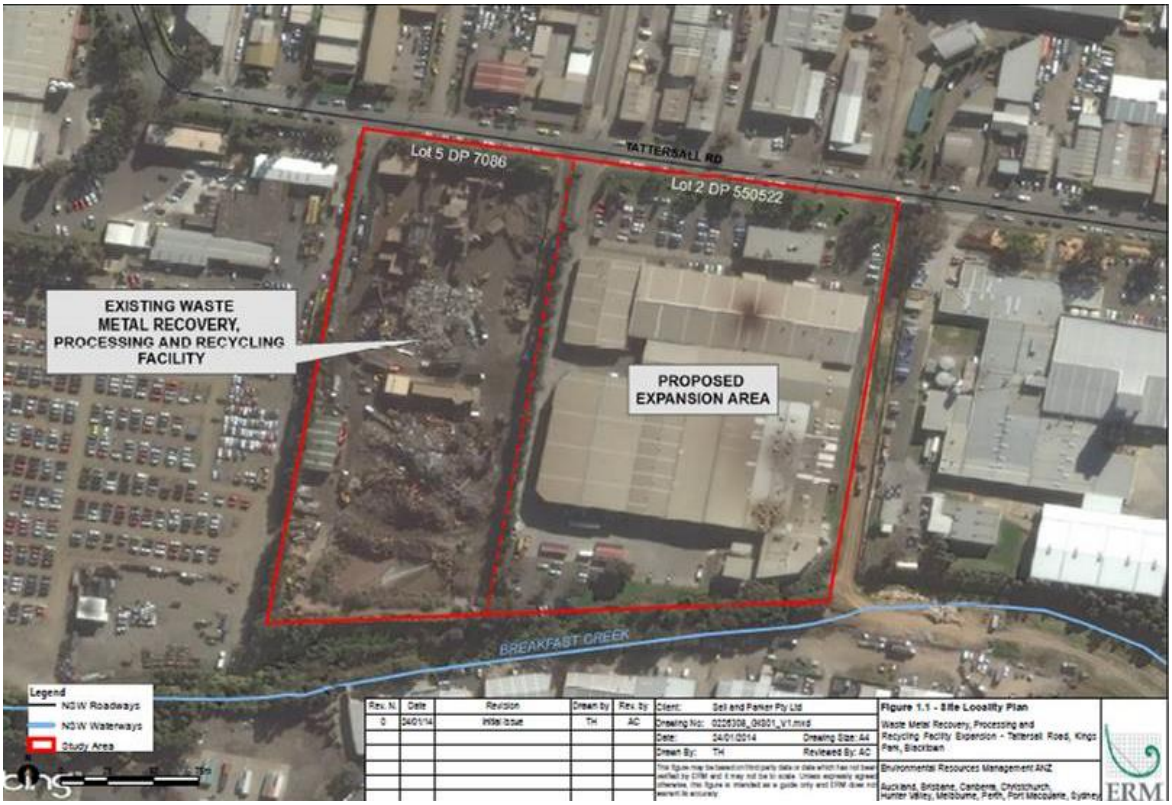

Figure 2-1 Current Site and Expansion in Relation to Surrounding Land Use

2.3 Site Activities

The activities of will not significantly change from those currently undertaken at 45 Tattersall Road, being:

1. Shredding
2. Shearing
3. Non-Ferrous collection and sorting
4. Office and other activities.

The location of these activities is shown in Figure 2-2.

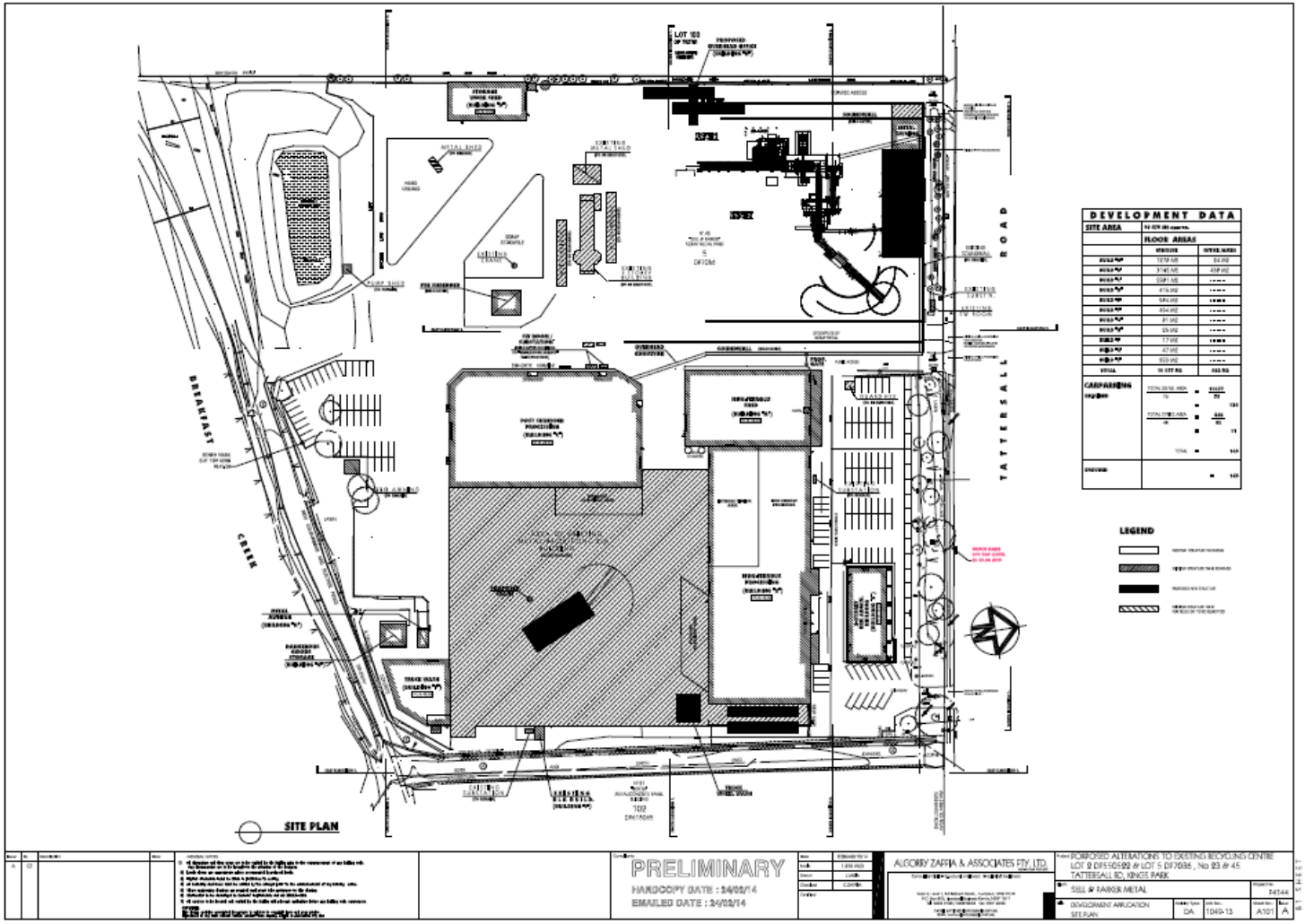

Figure 2-2 Proposed Layout of Expanded Site

2.3.1 Shredding

The shredder processes light scrap metal including car bodies, but not larger steel items such as rail or structural steel.

Petrol tanks and liquefied petroleum gas (LPG) cylinders will be removed from cars and emptied before they are fed through the facility. LPG cylinders will be stored in a quarantined area before being removed offsite for decommissioning and disposal. Petrol and oil will be drained from tanks and collected in above ground storage tanks and removed offsite for processing.

Cars and scrap metal are lifted onto a heavy-duty feed conveyor (Cl) by an electric slot handler. The operator of the mobile material handler will also check the feed material while loading it onto the conveyor. The materials will pass the control cabin, where an operator will also check incoming materials. The control cabin is an enclosed structure with sound proofing and air conditioning for operator comfort and health and safety requirements.

The feed conveyor transports raw material into the hammer mill which shreds the metal into fist-sized pieces.

The fragmented raw material is carried upwards by an incline conveyor and will then be dropped into a 'cascade' chute, hitting against its corners and therefore loosening any dirt and dust. Air from the cascade will be extracted by an induced draft fan and passed into the cascade cyclone, which will drop out particulates. Cleaned air will then pass through a wet scrubber to remove fine dust.

The cleaned fragmented material will then pass under drum magnets, which will pick up ferrous metals and drop them onto the picking conveyor (C2), where operators will remove remaining non-ferrous materials. The ferrous metals ·will continue up a conveyor (C3) which offloads the ferrous product into the product stockpile, that is contained in a designated area.

The non-ferrous materials will drop beneath the drum magnets to a conveyor which runs perpendicular to the ferrous product. This conveyor carries non-ferrous metals and wastes such as plastic and glass. The material is conveyed beneath another magnet, which picks up any small remaining quantities of ferrous metals and drops them into a skip for collection. Non-ferrous materials will continue through a pan feeder and trommel which will separate the materials into appropriate size streams for sorting.

The streams pass through an eddy-current separator, which collects aluminium, copper and brass into a skip. The streams then join and pass beneath a final eddy-current separator to win any remaining aluminium.

After passing through these stages, the remaining materials are waste products, which will be conveyed to a brick bunker

Some material is processed in a “pre-shredder”, which will allow potential contaminants hidden in compacted scrap to be identified before entering the hammer mill (shredder).

2.3.2 Shearing

Larger ferrous items such as structural beams or rails undergo a different treatment from that of lighter material. Material is inspected, stockpiled, and then reduced in size using large hydraulic

shears. The processed ferrous material is stockpiled before being loaded and transported off site after sale.

2.3.3 Non-ferrous Processing

Non-ferrous processing refers to items that do not contain substantial amounts of iron. These items include aluminium cans, copper and brass. These are either received in bulk or are brought on site by members of the public in light vehicles.

Non-ferrous material is inspected, sorted and stored in skip bins or containers, awaiting transport. Some aluminium products may be baled (compressed into cubes).

2.3.4 Office and other activities

This represents activities that would not generally present major hazards outside the site. The activities include maintenance, office administration and truck washing.

2.3.5 Hazardous Materials

Small quantities of dangerous goods are stored on site. These are mostly required for maintenance or utility purposes. Some dangerous goods are removed from the metal before processing, stored and disposed through waste contractors.

Table 2-2 List of Dangerous Goods and Quantities

Material	Quantity (L/Kg)	DG Class	UN No	Type of Store
Oxygen	3,000 L	2.2, sub5.1	1072	6 man-packs (15 bottles)
LPG - LP Gas	540 L	2.1	1075	12 x 45 L Cylinders
Argonshield - Argon	135 L	2.2	1956	3 x 45 L Cylinders
Petrol - Petroleum	2,000 L	3	1075	Tank
Diesel - Diesel	1,000 L	3	1202	Tank
Batteries - Sulphuric acid, spent	30,000 kg	8	1832	
Hydraulic oil – hydraulic fluid	2,000 L	9	3082	Tank
Engine oil & Gear oil – crude oil	6,000 L	3	1267	Tank
Grease	160 L	N/A	N/A	

Material	Quantity (L/Kg)	DG Class	UN No	Type of Store
Degreaser - Kerosene	100 L	3	1223	Packaged goods

In addition to the materials listed, some metal for recycling may be contaminated with dangerous goods. This has been considered in the hazard identification process.

3 HAZARD IDENTIFICATION

3.1 Methodology

A structured What-If session was used to identify hazard associated with the planned expansion. The site was split into processing areas, and prompts used to assist brainstorming potential hazardous scenarios. Once a hazardous scenario was identified, causes and the uncontrolled consequence(s) of the scenario were explored and documented. Existing safeguards, and ones that have been incorporated into the expansion plans were identified and documented.

Following the identification of the scenario, the team qualitatively assessed the risk of each scenario using the Sell & Parker risk management system. The severity of each consequence was determined (Table 3-1), and the frequency with which the consequence could occur with the existing and proposed controls estimated (Table 3-2). The result was assessed using the Sell & Parker risk matrix (Table 3-3).

Table 3-1 Sell & Parker Consequence Categories

Level of Effect	Example of each level
Insignificant/Acceptable	No effect – or so minor that effect is acceptable
Minor	First aid treatment only; spillage contained at site.
Moderate	Medical treatment; spillage contained but with outside help.
Major	Extensive injuries; loss of production
Catastrophic	Death; toxic release of chemicals

Table 3-2 Sell & Parker Frequency Categories

Criteria	Description	
Almost certain	Expected in most circumstances	Effect is a common result
Likely	Will probably occur in most circumstances	Effect is known to have occurred at this site or it has happened
Possible	Might occur at some time	Effect could occur at this site or I've heard of it happening
Unlikely	Could occur at some time	Effect is not likely to occur at the site or I have not heard of it happening
Rare	May occur in exceptional circumstances	Effect is practically impossible

Table 3-3 Sell & Parker Risk Matrix

Likelihood	Consequences				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	3 High	3 High	4 Acute	4 Acute	4 Acute
Likely	2 Medium	3 High	3 High	4 Acute	4 Acute
Possible	1 Low	2 Medium	3 High	4 Acute	4 Acute
Unlikely	1 Low	1 Low	2 Medium	3 High	4 Acute
Rare	1 Low	1 Low	2 Medium	3 High	3 High

3.2 Meeting

The hazard identification session took place from 9:00am to 11:00am on 31 January 2014 in offices at the Sell & Parker site, 45 Tattersall Road, Kings Park, NSW. The attendees are presented in Table 3-4.

Table 3-4 Hazard Identification Participants

Name	Title	Company	Role
Joel Leonard	Principal Consultant	Arriscar Pty Limited	Facilitator
Nigel Fox	General Manager, Property & Development	Sell & Parker	Attendee
Allen Floyd	Operations	Sell & Parker	Attendee
Ian Mace	Blacktown Manager	Sell & Parker	Attendee
Luke Parker	CEO	Sell & Parker	Attendee

3.3 Results

Minutes of the hazard identification are presented on the following pages.

Processes: 1. Ferrous

Nodes	What if	Causes	Consequence	Safeguard	New Safeguards	Recommendations	After Risk Reduction		
							S	L	RR
1. Shredding	1. Chemical	1. Lead acid batteries in cars or other contamination	1. Material may leak and contaminate water courses if not suitable separated from storm water. As only small individual quantities are involved (for example, single car battery), Contamination will be almost negligible.	1. Visual inspection of material on arrival.			Minor	Unlikely	1 Low
			2. Personnel may come into contact with chemicals and receive chemical burns.	2. Car process			Moderate	Unlikely	2 Moderate
			3. If flammable and ignited, there is the potential for a small fire. No offsite impact is expected unless the fire escalates.	3. PPE			Minor	Unlikely	1 Low
				4. Bunded area					
				5. Emergency response plan (ERP)					
		2. Shredder punctures fuel tank / LPG tank	1. Fuel may be ignited in the confined space of the shredder. Potential fire or explosion within the shredder. Noise and vibration considered the only offsite impact.	1. Visual inspection of material on arrival.	1. Pre-shredder relocated further from neighbouring properties		Minor	Likely	3 High
				2. Pneumatic brass (non-sparking) spike removes and collects fuel and oil from vehicles					
				3. Pre-shredding process in an open, rather than confined area minimises the potential for explosions.					

Processes: 1. Ferrous

Nodes	What if	Causes	Consequence	Safeguard	New Safeguards	Recommendations	After Risk Reduction		
							S	L	RR
		3. Leak of hydraulic fluid from processing equipment	1. Possible contamination of water courses if not separated from storm water.	1. Regular maintenance			Minor	Possible	2 Moderate
			2. If the hole is small there is the possibility of a fine mist forming, which could ignite, resulting in a localised spray fire around the machinery involved. Potential injury to personnel	2. Oil separator in stormwater system			Major	Unlikely	3 High
				3. Oil skimmer					
				4. Emergency response plan (ERP)					
				5. Inspection, maintenance procedures					
				6. Separation from personnel					
		4. Loss of flammable material from vehicle tank fuel recovery unit (overflow or damaged container)	1. Leak of flammable material that could find its way into water courses. If ignited, a pool fire could result, leading to injuries for site personnel	1. Maintenance					
				2. Bunding					
	2. Radiation	1. Potential radiation material in incoming material (smoke detectors, hospital material)	1. Personal exposure to radiation	1. Incoming material screened for radioactive sources			Major	Rare	3 High
	3. Machinery	1. Personnel struck / caught in machinery	1. Personnel injury	1. Guarding			Major	Unlikely	3 High

Processes: 1. Ferrous

Nodes	What if	Causes	Consequence	Safeguard	New Safeguards	Recommendations	After Risk Reduction		
							S	L	RR
				2. Operator training/certification					
	4. Light	1. Refer "General"							
	5. Electricity	1. Transformer fire	1. Transformer fire resulting in smoke and possible personnel injury.	1. Annual inspection and report in line with OEM recommendations			Moderate	Unlikely	2 Moderate
				2. Emergency response plan (ERP)					
	6. Mobile plant / vehicles	1. Refer mobile plant / vehicles in "General"							
	7. Pneumatic energy	1. Overpressure of air receiver	1. Personnel struck by flying fragments - potential serious injury	1. Air receiver safety relief valve			Major	Rare	3 High
		2. Corrosion of air receiver	1. Personnel struck by flying fragments - potential serious injury	1. Vessel inspections			Major	Rare	3 High
	8. Fire	1. Potential fire in stockpiles before shredding (combustible materials such as oil and rubber)	1. Staff may receive burn injuries but unlikely as escape from fire source is relatively easy. Escalation to offsite not considered credible.	1. Emergency response plan (ERP)			Moderate	Rare	2 Moderate
			2. Air pollution through smoke from fire. Water cannon and fire	2. Fire hydrants, hoses and water cannon			Moderate	Unlikely	2 Moderate

Processes: 1. Ferrous

Nodes	What if	Causes	Consequence	Safeguard	New Safeguards	Recommendations	After Risk Reduction		
							S	L	RR
			services expected to limit extent of pollution						
	9. Lead	1. Lead is purchased by site (roof flashing etc.)	1. Lead contamination	1. No processing of lead material by plant or machinery			Minor	Unlikely	1 Low
			2. Staff exposure to lead	2. PPE			Moderate	Unlikely	2 Moderate
	10. Utilities	1. Loss of water to the wet scrubber for the cyclone	1. Loss of dust to atmosphere	1. Personnel monitoring			Moderate	Unlikely	2 Moderate
2. Shearing	1. Chemical	1. Chemical contamination of purchased scrap	1. Quantities large enough for offsite impact not considered credible as shearer typically processes heavy material such as rails, H-beams etc.	1. Visual inspection of material on arrival.			Minor	Rare	1 Low
			2. Personnel may come into contact with chemicals and receive chemical burns.	2. PPE			Minor	Rare	1 Low
			3. If flammable and ignited, there is the potential for a small fire. No offsite impact is expected unless the fire escalates, which is not considered credible.	3. Bunded area			Minor	Rare	1 Low
				4. Emergency response plan (ERP)					
		2. Leak of hydraulic fluid from processing equipment	1. Possible contamination of water courses if not separated from storm water.	1. Regular maintenance			Minor	Possible	2 Moderate

Processes: 1. Ferrous

Nodes	What if	Causes	Consequence	Safeguard	New Safeguards	Recommendations	After Risk Reduction		
							S	L	RR
			2. If the hole is small there is the possibility of a fine mist forming, which could ignite, resulting in a localised spray fire around the machinery involved. Potential injury to personnel	2. Oil separator in stormwater system			Major	Unlikely	3 High
				3. Oil skimmer					
				4. Emergency response plan (ERP)					
				5. Inspection, maintenance procedures					
				6. Separation from personnel					
	2. Radiation	1. Potential radiation material in incoming material (smoke detectors, hospital material)	1. Personal exposure to radiation	1. Incoming material screened for radioactive sources			Major	Rare	3 High
	3. Machinery	1. Personnel struck / caught in machinery	1. Personnel injury	1. Guarding			Major	Unlikely	3 High
				2. Operator training/certification					
	4. Light	1. Refer "General"							
	5. Electricity	1. Refer "General"							
	6. Mobile plant / vehicles	1. Refer "General"							

Processes: 1. Ferrous

Nodes	What if	Causes	Consequence	Safeguard	New Safeguards	Recommendations	After Risk Reduction		
							S	L	RR
3. Waste processing	1. Fire	1. Floc spontaneously ignites due to moisture content (damp floc)	1. Fire - potential personnel injury considered rare due to ease of escape. Escalation to neighbouring sites not considered credible.	1. Limited inventory	1. Fire detection and protection system	1. Limit floc stockpile to less than 1000 m3 or 4 m in height to prevent the building where floc is stockpiled being considered a high hazard occupancy.	Moderate	Rare	2 Moderate
			2. Smoke pollution to nearby areas	2. Emergency response plan (ERP)	2. Separation from site boundary / protected places		Moderate	Unlikely	2 Moderate
				3. Fire detection and protection system	3. Floc stockpile indoors				
	2. Electromagnetic radiation	1. Emissions from equipment used to recover metal from floc	1. Potential injury to personnel with pacemakers		1. Restricted access		Moderate	Unlikely	2 Moderate
					2. Signage				

Processes: 2. Non-ferrous

Nodes	What if	Causes	Consequence	Safeguard	New Safeguards	Recommendations	After Risk Reduction		
							S	L	RR
1. All	1. Chemical	1. Contamination of material brought in site	1. Personnel exposure	1. Visual inspection of material on arrival			Minor	Unlikely	1 Low
				2. non-ferrous processing limited to baling of aluminium cans					

Processes: 2. Non-ferrous

Nodes	What if	Causes	Consequence	Safeguard	New Safeguards	Recommendations	After Risk Reduction		
							S	L	RR
	2. Radiation	1. Radioactive sources brought in with scrap	1. Personnel exposure to radiation	1. Incoming material screened for radioactive sources			Major	Rare	3 High
	3. Machinery	1. Personnel struck / caught in machinery	1. Personnel injury	1. Guarding			Major	Unlikely	3 High
				2. Operator training/certification					
	4. Light	1. Refer "General"							
	5. Electricity	1. Refer "General"							
	6. Mobile plant / vehicles	1. Refer "General"							
	7. Pneumatic energy	1. Not applicable							
	8. Fire	1. Refer "General"							
	9. Lead	1. Lead is purchased by site (roof flashing etc.)	1. Lead contamination	1. No processing of lead material by plant or machinery			Minor	Unlikely	1 Low
			2. Staff exposure to lead	2. PPE			Moderate	Unlikely	2 Moderate

Processes: 3. General

Nodes	What if	Causes	Consequence	Safeguard	New Safeguards	Recommendations	After Risk Reduction		
							S	L	RR
1. All	1. Chemical	1. Fire involving dangerous goods in maintenance building	1. Fire - personnel injury	1. Stored as per Australian Standards	1. Utilising larger permanent DG store, but not increasing inventory (increasing separation distance)		Major	Rare	3 High
			2. Air contamination	2. Moving DG store away from adjoining property / protected place.	2. Moving DG store away from adjoining property / protected place.		Moderate	Unlikely	2 Moderate
				3. Emergency response plan (ERP)					
		2. Diesel leak	1. Potential contamination of storm water	1. No diesel stored on site - forklifts fuelled daily from tanker that visit site.			Minor	Rare	1 Low
		3. Oxyacetylene cylinder (maintenance equipment) leaks	1. Leak could find an ignition source, leading to a flash fire or spray fire.	1. Operator training/certification			Major	Unlikely	3 High
				2. Emergency response plan (ERP)					
				3. Stored as per Australian Standards					
	2. Radiation	1. Refer to Ferrous and Non-Ferrous processes.							
	3. Machinery	1. Refer Shredding and Shearing							
	4. Light	1. Welding	1. Personnel injury - vision impairment	1. Operator training/certification			Moderate	Unlikely	2 Moderate
				2. Emergency response plan (ERP)					
				3. PPE					
	5. Electricity	1. Transformer fire	1. Transformer fire resulting in smoke and possible personnel injury.	1. Annual inspection and report			Moderate	Unlikely	2 Moderate
				2. Emergency response plan (ERP)					

	6. Mobile plant / vehicles	1. Pedestrian / vehicle interaction	1. Pedestrian fatality	1. PPE	1. Designated walkways		Catastrophic	Rare	3 High
				2. Emergency response plan (ERP)	2. Relocating office, limiting personnel in operating areas				
				3. Traffic flow is one-directional	3. Weighbridge activities removed from operating area				
					4. Increased on-site area leading to less congestion				
		2. Heavy vehicle / light vehicle collision	1. Potential fatality	1. Emergency response plan (ERP)	1. Increased on-site area leading to less congestion		Catastrophic	Rare	3 High
					2. Separate light vehicles from heavy vehicles (separate entrances) / separate service areas				
					3. Additional weighbridges and new layout eliminate the need for trucks to circle back out to public roads to weigh out.				
		3. Run-off from truck wash	1. Potential contamination of storm water	1. Storm water catchment	1. Truck washing water recovery system		Moderate	Unlikely	2 Moderate
	7. Pneumatic energy	1. Refer to Shredder							
	8. Fire	1. Numerous causes of office or other fires - electrical fault, hot work etc.	1. Potential injury to workers.	1. Infra-red heat sensitive cameras with automatic warning			Major	Rare	3 High
			2. Smoke pollution to nearby areas	2. Fire protection system (firewater main, hydrants and water cannon)			Moderate	Unlikely	2 Moderate
				3. Facility maintenance					
				4. Emergency response plan (ERP)					

4 CONSEQUENCE ANALYSIS

4.1 Scenarios

The following scenarios were considered for analysis of offsite impacts

Scenario	Potential Consequence/s
1. 9 kg Propane Cylinder Rupture	Fireball Flash Fire Vapour Cloud Explosion
2. 45 kg Propane Cylinder Leak (3mm Hole)	Jet Fire Flash Fire Vapour Cloud Explosion
3. 45 kg Propane Cylinder Rupture	Fireball Flash Fire Vapour Cloud Explosion
4. 2 m^3 Petrol Fire contained in 4 m^2 Bund	Pool Fire
5. 45 l Uncontained Petrol Fire	Pool Fire

Three other potential offsite scenarios were identified, but have been considered qualitatively:

- Smoke from non-ferrous stockpile fires. The provision of water cannon enable responders to supress fires. Storing “Floc” under cover reduces the potential for fires in the non-metal post-shredder waste.
- Dust emissions should water to the scrubber fail. This is an existing risk.
- Hazardous liquids entering storm water. Interceptors are in place for non-soluble hydrocarbons. Quantities are limited and the impact of the various types of material is not expected to result in prolonged damage to the environment.

4.1.1 9 kg Propane Cylinder Rupture

The purpose of this scenario was to simulate a discarded 9 kg LPG bottle entering the pre-shredder and catastrophically failing due to the mechanical work applied in the pre-shredder.

4.1.2 45 kg Propane Cylinder 3mm Hole

The purpose of this scenario was to model the impact of minor leaks that could occur whilst using or storing LPG cylinders.

4.1.3 45 kg Propane Cylinder Rupture

While rare, the purpose of the 45 kg Propane Rupture was to examine possible escalation effects of a small LPG fire in the LPG storage area.

4.1.4 2 m^3 Petrol Fire contained in 4 m^2 Bund

This scenario examined to potential consequences of a leak from the recovered petrol storage. A 4 m^2 bund is assumed to surround the petrol containers. Petrol was modelled as N-Heptane.

4.1.5 45 l Uncontained Petrol Fire

This scenario explored the effects of a possible fire from the contents of a fuel tank from a vehicle being scrapped. Petrol was modelled as N-Heptane.

4.2 Software

The software listed in Table 4-1 was used to estimate hazard zones.

Table 4-1 Hazard Consequence Software Used in the Analysis

No.	Hazardous Consequence	Software and Model Used
1	LNG Release and dispersion	DNV PHAST 6.7 – Release Model
2	Jet Fire	DNV PHAST 6.7 – Jet Fire Model
3	Vapour Cloud Explosion	DNV PHAST 6.7 – TNO Multi-Energy Model
4	Pool Fire	DNV PHAST 6.7 – Pool Fire Model

4.3 Weather

The following generic weather conditions were used in the modelling:

Category 1.5/F

Pasquill Stability Factor	F	
Wind Speed	1.5	m/s
Atmospheric Temperature	9.85	°C
Atmospheric Humidity	0.70	fraction
Surface Roughness Length	0.18	m
Surface Roughness Parameter	0.10	
Dispersion Surface Temperature	9.85	°C

Bund Surface Temperature	9.85	°C

Category 1.5/D

Pasquill Stability Factor	D	
Wind Speed	1.5	m/s
Atmospheric Temperature	9.85	°C
Atmospheric Humidity	0.70	fraction
Surface Roughness Length	0.18	m
Surface Roughness Parameter	0.10	
Dispersion Surface Temperature	9.85	°C
Bund Surface Temperature	9.85	°C

Category 5/D

Pasquill Stability Factor	D	
Wind Speed	5.0	m/s
Atmospheric Temperature	9.85	°C
Atmospheric Humidity	0.70	fraction
Surface Roughness Length	0.18	m
Surface Roughness Parameter	0.10	
Dispersion Surface Temperature	9.85	°C
Bund Surface Temperature	9.85	°C

4.4 Jet Fires

A jet fire is the combustion of flammable material emerging significant momentum from an orifice.

Table 4-2 details the distance to various radiation intensity levels under differing weather conditions for jet fires.

Table 4-2 Distances to Radiation Intensity Levels for Jet Fires

Model	Hole size (mm)	Release Rate (kg/s)	Radiation Level (kW/m^2)	Weather		
				Category 1.5/D	Category 1.5/F	Category 5/D
45 kg LPG Cylinder Leak	3	0.12	4.7	9.3	9.3	8.0
			12.6	7.6	7.6	6.3
			23	6.7	6.7	5.4
			35	6.2	6.2	4.9
Petrol Store	25	0.96	4.7	2.0	2.0	1.8
			12.6	1.6	1.6	1.2
			23	1.3	1.2	0.8
			35	0.0	0.0	0.5

4.5 Pool Fires

A release of liquid may form a pool. The combustion of material evaporating from that pool is a pool fire. Table 4-3 details the distance to various radiation intensity levels under differing weather conditions for pool fires.

Table 4-3 Distances to Radiation Intensity Levels for Pool Fires

Model	Hole size (mm)	Release Rate (kg/s)	Radiation Level (kW/m^2)	Weather		
				Category 1.5/D	Category 1.5/F	Category 5/D
Auto Petrol Tank	25	0.96	4.7	15.7	15.7	16.9
			12.6	10.0	10.0	12.0
			23	6.4	6.4	9.1
			35	4.1	4.1	5.4
Petrol Store	25	0.96	4.7	11.8	11.8	12.7
			12.6	7.7	7.7	9.0
			23	5.1	5.1	7.2
			35	3.3	3.3	4.4

4.6 Flash Fires

The release of a volatile hydrocarbon may generate a cloud of flammable vapour and air in ratios capable of sustaining a flame. A flash fire is the combustion of flammable vapour and air mixture in which the flame passes through the mixture at less than sonic velocity, such that negligible damaging overpressure is produced.

Table 4-4 details the downwind and cross-wind distance to the lower flammable limit (LFL) under differing weather conditions for flammable gas clouds. This defines the extent of flash fires.

Table 4-4 Extent of Gas Dispersion (Flash Fires)

Model	Hole size (mm)	Release Rate (kg/s)	Weather					
			Category 1.5/D		Category 1.5/F		Category 5/D	
			Down-wind Distance (m)	Max Width (m)	Down-wind Distance (m)	Max Width (m)	Down-wind Distance (m)	Max Width (m)
45 kg LPG Cylinder Leak	3	0.12	3.9	0.3	3.9	0.3	3.2	0.3
45 kg LPG Cylinder Rupture	N/A	45	6.9	10.0	5.8	10.0	16.1	10.0
9kg LPG Cylinder Rupture	N/A	9	4.0	5.6	3.1	5.6	9.2	5.6

4.7 Vapour Cloud Explosion

The combustion of flammable vapour and air mixture in which the flame passes through the mixture at sonic velocity, creating damaging overpressure. This phenomena arises from a flash fire and usually some congestion is needed to accelerate the flame front. While vapour cloud explosions have been modelled to demonstrate the small hazard zones, the quantities involved would not normally be expected to lead to VCE.

Table 4-5 details the distance to various overpressure levels under differing weather conditions for vapour cloud explosions.

Table 4-5 Distance to Overpressures for Vapour Cloud Explosions.

Scenario	Over-Pressure (kPag)	1.5/F		1.5/D		5/D	
		Radius (m)	Mass (kg)	Radius (m)	Mass (kg)	Radius (m)	Mass (kg)
	7	27.1	8.2	27.1	8.2	27.1	8.2

9kg Cylinder Rupture	14	17.1	8.2	17.1	8.2	17.1	8.2
	35	9.7	8.2	9.7	8.2	9.7	8.2
45 kg Cylinder Rupture	7	46.3	40.9	46.3	40.9	46.3	40.9
	14	29.2	40.9	29.2	40.9	29.2	40.9
	35	16.6	40.9	16.6	40.9	16.6	40.9

4.8 Fireballs

A fireball is a fire burning sufficiently rapidly for the burning mass to rise into the air as a cloud or ball. Due to the short duration of fireballs, the radiation intensity required for the onset of injury is less than that for long duration fires.

Table 4-6 details the distance to various radiation intensity levels for fireballs. Fireballs are not dependent upon weather stability or wind speed.

Table 4-6 Distances to Radiation Intensity Levels for Fireballs

Scenario	Radiation (kW/m^2)	Radius (m)
9kg Cylinder Rupture	4.7	27.0
	23	5.8
	35	Not reached
45 kg Cylinder Rupture	4.7	48.4
	23	12.5
	35	Not reached

5 DISCUSSION

5.1 Criteria

The following quantitative criteria as specified by the NSW Department of Planning (2) was used for this assessment:

Table 5-1: Quantitative Risk Criteria

Risk Type	Impact type / Land use	Criteria
Injury Risk	Heat radiation	Incident heat flux radiation at residential and sensitive use areas should not exceed 4.7 kW/m^2 at a frequency of more than 50 chances in a million per year.
	Explosion overpressure	Incident explosion overpressure at residential and sensitive use areas should not exceed 7 kPa at frequencies of more than 50 chances in a million per year.
Property Damage and Accident Propagation	Heat radiation	Incident heat flux radiation at neighbouring potentially hazardous installations or at land zoned to accommodate such installations should not exceed a risk of 50 in a million per year for the 23 kW/m^2 heat flux level.
	Explosion overpressure	Incident explosion overpressure at neighbouring potentially hazardous installations, at land zoned to accommodate such installations or at nearest public buildings should not exceed a risk of 50 in a million per year for the 14 kPa explosion overpressure level.
Fatality Risk	Hospitals, schools, child-care facilities, old age housing	Hospitals, schools, child-care facilities and old age housing development should not be exposed to individual fatality risk levels in excess of half in one million per year
	Residential, hotels, motels, tourist resorts	Residential developments and places of continuous occupancy, such as hotels and tourist resorts, should not be exposed to individual fatality risk levels in excess of one in a million per year
	Commercial developments including retail centres, offices and entertainment centres	Commercial developments, including offices, retail centres, warehouses with showrooms, restaurants and entertainment centres, should not be exposed to individual fatality risk levels in excess of five in a million per year
	Sporting complexes and active open space	Sporting complexes and active open space areas should not be exposed to individual fatality risk levels in excess of ten in a million per year
	Industrial	Individual fatality risk levels for industrial sites at levels of 50 in a million per year (50 x 10^{-6} per year) should, as a target, be contained within the boundaries of the site where applicable.

5.2 Impairment Levels

Table 5-2 details the levels at which injury, property damage and fatality are considered to occur. These levels are sourced from the NSW Department of Planning (2).

Table 5-2: Impairment Levels

Impact	Impairment Level	Comment
Long duration heat radiation injury	4.7 kW/m^2	Will cause pain in 15-20 seconds and injury after 30 seconds' exposure (at least second degree burns will occur).
Long duration heat radiation fatality	12.6 kW/m^2	Significant chance of fatality for extended exposure. High chance of injury.
Instantaneous heat radiation fatality	35 kW/m^2	Significant chance of fatality for people exposed instantaneously.
Explosion overpressure injury	7 kPa	10% chance of injury in the open.
Explosion overpressure fatality	35 kPa	5% chance of fatality in the open.
Long duration heat radiation property damage	23 kW/m^2	Unprotected steel will reach thermal stress temperatures which can cause failure.
Explosion overpressure property damage	14 kPa	House uninhabitable and badly cracked, consistent with property risk criteria.

5.3 Jet Fire

The maximum jet fire distance at which an injury could be received is 9.3 m (Jet for from 45 kg LPG cylinder). From the dangerous goods store, this could extend slightly beyond the fence, but would not extend beyond an easement located on the property north of eastern creek. Similarly, fatality impacts from these vents would not extend beyond the property boundary.

Property damage impairment levels do not extend beyond the property boundary.

5.4 Pool Fire

The maximum pool fire injury distance is 15.7 m. The location of the pneumatic spike and storage is within the processing area, more than 15.7 m from the property boundary. Criteria for injury, property damage and fatality risks will be satisfied.

5.5 Flash Fire

The maximum extent of a flash fire is 16.1 m based upon a 45 kg LPG cylinder rupture. This would extend to Breakfast creek, not to an adjoining property. This risk this poses is minimal as LPG tank ruptures are rare, and this would also need to coincide with a northerly wind.

5.6 Explosion

The maximum distance to injury level overpressure (7 kPa) is 46.3 m (45 kg LPG cylinder rupture). This would extend beyond the site boundary, but will not extend to a residential or sensitive land use, which are the subjects of the injury risk criteria.

The distance to a point at which property damage could occur is also beyond the site boundary. Due to the rarity of LPG cylinder ruptures and the need to coincide with specific wind directions, the property damage risk criteria will not be exceeded.

Fatality levels arising from explosions from 45 kg LPG cylinders will not extend beyond the property boundary (at Breakfast Creek).

The potential for LPG cylinders hidden in scrap cars or similar to exceed any of the criteria is not considered credible as these are assumed to be ruptured in the pre-shredder, located well away from the property boundary.

5.7 Fireballs

Due to the short duration of fireballs, only an intense level of radiation is considered to cause fatalities. The 35 kW / m^2 heat radiation was found not to be generated by a fireballs from the 45 kg LPG cylinders.

5.8 Smoke

Smoke has been considered qualitatively. There is the potential for stockpile fires to emit smoke into the environment. The proposal includes several measures that will limit the potential for fire developing from the most likely source – the floc stockpile:

1. The stockpile will be managed to less than 1000 m3 in volume, or less than 4 m in height. This will prevent the building becoming a high hazard occupancy.
2. The stockpile will be stored in a building, as opposed to the open. Floc is more likely to combust when it is damp, and this measure reduces the potential for damp floc significantly.

6 FIRE AND INCIDENT MANAGEMENT

Fire protection systems consist of:

- Fire hydrant systems
- Sprinkler systems
- First aid fire-fighting measures (fire extinguishers)

The hydrant systems servicing both sites will be maintained as separate systems. This consists of six hydrants at 45 Tattersall Road and eight hydrants at 23 – 43 Tattersall Road.

The building at the northeast corner of 23 – 43 Tattersall Road has an existing sprinkler system. This building will be used for non-ferrous activities.

Based on requirements in AS 1596, AS 1940 and AS-4332, the following fire protection measures are required for the dangerous goods handled on site:

1. At least one hose reel and one fire extinguisher be provided for the oxygen and LPG cylinder storage (AS 4332-2004, Table 7.2). This is based upon the 3,000 L of oxygen in the store.
2. Provide one powder type extinguisher and one foam extinguisher for all bulk class 3 dangerous goods on site. This includes the storage of fuel and oil removed from vehicles prior to shredding. This recommendation assumes the recovered liquids are stored in intermediate bulk containers.

Water cannon are also provided for the various stockpiles.

Floc has been identified as a potential source of fire. This will be managed by keeping the stockpile small, so as not to consider the warehouse in which it is kept as a high hazard occupancy.

The site will be kerbed to retain spillages or stormwater run-off, which outflow via a detention basin. The detention basin has a capacity of 1440 m^3.

Spill kits will be deployed to manage and contain minor spills.

7 FINDINGS AND RECOMMENDATIONS

The closest residentially zones property is approximately 300 m from the combined sites. None of the hazards examined are capable of creating an offsite impact that would exceed the injury criteria listed in HIPAP 4 (2). That is, 7 kPa overpressure from explosions, and 4.7 kW/m^2 heat radiation cannot be generated at residential or sensitive land use areas. This finding also extends to the potential for fatality risk at sensitive, residential, commercial and active open spaces, as fatality impacts would not occur at these locations.

The majority of property damage and all fatality impacts are contained within the site boundary. The risk of off-site property damage would not be expected to exceed 50 per million per year.

Given the small consequence distances, a qualitative risk assessment is appropriate for the expansion proposal. It also suggests the expansion does not pose a credible off-site risk.

In terms of qualitative criteria provided in (2);

a. *All 'avoidable' risks should be avoided. This necessitates the investigation of alternative locations and alternative technologies, wherever applicable, to ensure that risks are not introduced in an area where feasible alternatives are possible and justified.* The proposal is within an already classified industrial zone, suitable for the development

b. *The risk from a major hazard should be reduced wherever practicable, irrespective of the numerical value of the cumulative risk level from the whole installation. In all cases, if the consequences (effects) of an identified hazardous incident are significant to people and the environment, then all feasible measures (including alternative locations) should be adopted so that the likelihood of such an incident occurring is made very low. This necessitates the identification of all contributors to the resultant risk and the consequences of each potentially hazardous incident. The assessment process should address the adequacy and relevancy of safeguards (both technical and locational) as they relate to each risk contributor.* As part of the proposal, measures such as relocating equipment and providing undercover storage are being used to contain the impacts of events to within the new site boundary. The proposed development reduces the potential in some cases from what is an existing risk. This also covers (d)

c. *The consequences (effects) of the more likely hazardous events (i.e. those of high probability of occurrence) should, wherever possible, be contained within the boundaries of the installation.* As per item (b).

d. *Where there is an existing high risk from a hazardous installation, additional hazardous developments should not be allowed if they add significantly to that existing risk.* There are no known existing high risks.

Given the above qualitative and quantitative criteria, and an assessment against those criteria, the development is not a hazardous industry, as defined in SEPP No. 33.

While the amount of dangerous goods stored on site is small, the threshold for minor quantities as defined in various Australian standards is exceeded. The following recommendations are made with respect to fire protection requirements for dangerous goods and processing activities:

5. At least one hose reel and one fire extinguisher be provided for the oxygen and LPG cylinder storage (AS 4332-2004, Table 7.2). This is based upon the 3,000 L of oxygen in the store.

6. Provide one powder type extinguisher and one foam extinguisher for all bulk class 3 dangerous goods on site. This includes the storage of fuel and oil removed from vehicles prior to shredding. This recommendation assumes the recovered liquids are stored in intermediate bulk containers.
7. Maintain the height of the floc stockpile to less than 4m, or the total volume to less than 1000 m3. This ensures the warehouse in which the floc is stored will not be a high hazard occupancy.
8. Continue with the practice of providing water cannon to provide reach to feed and processed stockpiles in the event of a fire in any stockpile.

These recommendations are in addition to the requirements of the Building Code of Australia with respect to the proposed buildings on the development.

8 REFERENCES

1. **NSW Department of Planning.** Multi-level Risk Assessment . 2011.

2. —. HIPAP 4: Risk Criteria for Land Use Safety Planning. 2011.