Metal Recycling Facility Expansion

Preliminary Hazard Analysis

For Sell & Parker Pty Ltd

16 July 2021

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Summary

Sell &Parker Pty Ltd (Sell & Parker) has submitted an Environmental Impact Statement (EIS) to the NSW Department of Planning, Industry and Environment (DPIE) for expansion of the throughput at an existing Resource Recovery Facility (RRF) at 23-43 and 45 Tattersall Road, Kings Park.

Under the proposed expansion, the throughput limit of scrap metal at the existing RRF would increase from 350,000 to 600,000 tonnes per annum (tpa).

Arriscar Pty Ltd (Arriscar) was engaged by Sell & Parker to undertake a preliminary risk screening and Preliminary Hazard Analysis (PHA) for the RRF. Based on the preliminary risk screening, a PHA was determined to be required due to the inventory of liquid oxygen exceeding the SEPP 33 threshold quantity.

Potential hazards were identified, and some representative scenarios were modelled to determine the potential consequence distances. While some potential incidents could cause injury or fatality on site, the extent of the consequences is generally limited due to the small inventory of DGs, and a semi-quantitative assessment of risk was considered appropriate for the risk assessment.

Based on the findings of the semi-quantitative risk assessment, the proposed RRF expansion would comply with the DPIE's quantitative and qualitative risk criteria for land use safety planning.

The following recommendations are included based on the findings of the risk assessment:

1. The safety requirements for unloading liquid oxygen to the on-site bulk storage tank should be specified in an appropriate document / procedure (e.g. maintenance of exclusion zone for materials contaminated with oil etc., ensuring clear access to tank, prohibiting oxy-cutting operations during tanker unloading, etc.). Operations should be periodically reviewed to ensure compliance with these requirements.
2. A review and audit of the bulk liquid oxygen storage tank installation should be undertaken to ensure compliance with the requirements of the relevant Australian Standard/s.
3. It should be ensured that the steel enclosure surrounding the liquid storage tank is structurally secure should there be a release of low temperature liquid oxygen (which may lead to low temperature embrittlement and potential structural failure of the enclosure). This should include consultation with Coregas and a suitably qualified structural engineer.
4. A specific emergency response procedure should be included in the Emergency Response Plan to cover a release of liquid oxygen at the RRF.

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Notation

Abbreviation	Description
DPIE	Department of Planning, Industry and Environment
ELV	End-of-Life Vehicle
Floc	Non-metallic waste left behind after shredding/processing of both Ferrous and Non-Ferrous material
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
p.a.	per annum
PHA	Preliminary Hazard Analysis
pmpy	per million per year
SEPP	State Environmental Planning Policy
tpa	tonnes per annum
UFL	Upper Flammable Limit
ULAB	Used Lead Acid Battery
VCE	Vapour Cloud Explosion

1 INTRODUCTION

1.1 Background

Sell &Parker Pty Ltd (Sell & Parker) has submitted an Environmental Impact Statement (EIS) to the NSW Department of Planning, Industry and Environment (DPIE) for expansion of the throughput at an existing Resource Recovery Facility (RRF) at 23-43 and 45 Tattersall Road, Kings Park.

Under the proposed expansion, the throughput limit of scrap metal at the existing RRF would increase from 350,000 to 600,000 tonnes per annum (tpa).

To comply with the SEARs for the proposed expansion:

> *The EIS must include a preliminary risk screening completed in accordance with State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and Applying SEPP 33 (DoP, 2011), with a clear indication of class, quantity and location of all dangerous goods and hazardous materials associated with the development. Should preliminary screening indicate that the project is "potentially hazardous" a Preliminary Hazard Analysis (PHA) must be prepared in accordance with Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis (DoP, 2011) and Multi-Level Risk Assessment (DoP, 2011).*

Arriscar Pty Ltd (Arriscar) was engaged by Sell & Parker to undertake the preliminary risk screening and the Preliminary Hazard Analysis (PHA).

This PHA has been undertaken in accordance with the guidance provided by the NSW Department of Planning 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 preliminary risk screening, as described in DPIE's Applying SEPP 33 guidelines [2], and a semi-quantitative analysis and assessment (PHA) of off-site fatality, injury and property damage risk, in accordance with the NSW Hazardous Industry Planning Advisory Paper (HIPAP) guidelines. The PHA does not include an assessment of the following risks:

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

The study scope includes a PHA of the proposed RRF expansion.

2 FACILITY DESCRIPTION

2.1 Site Location

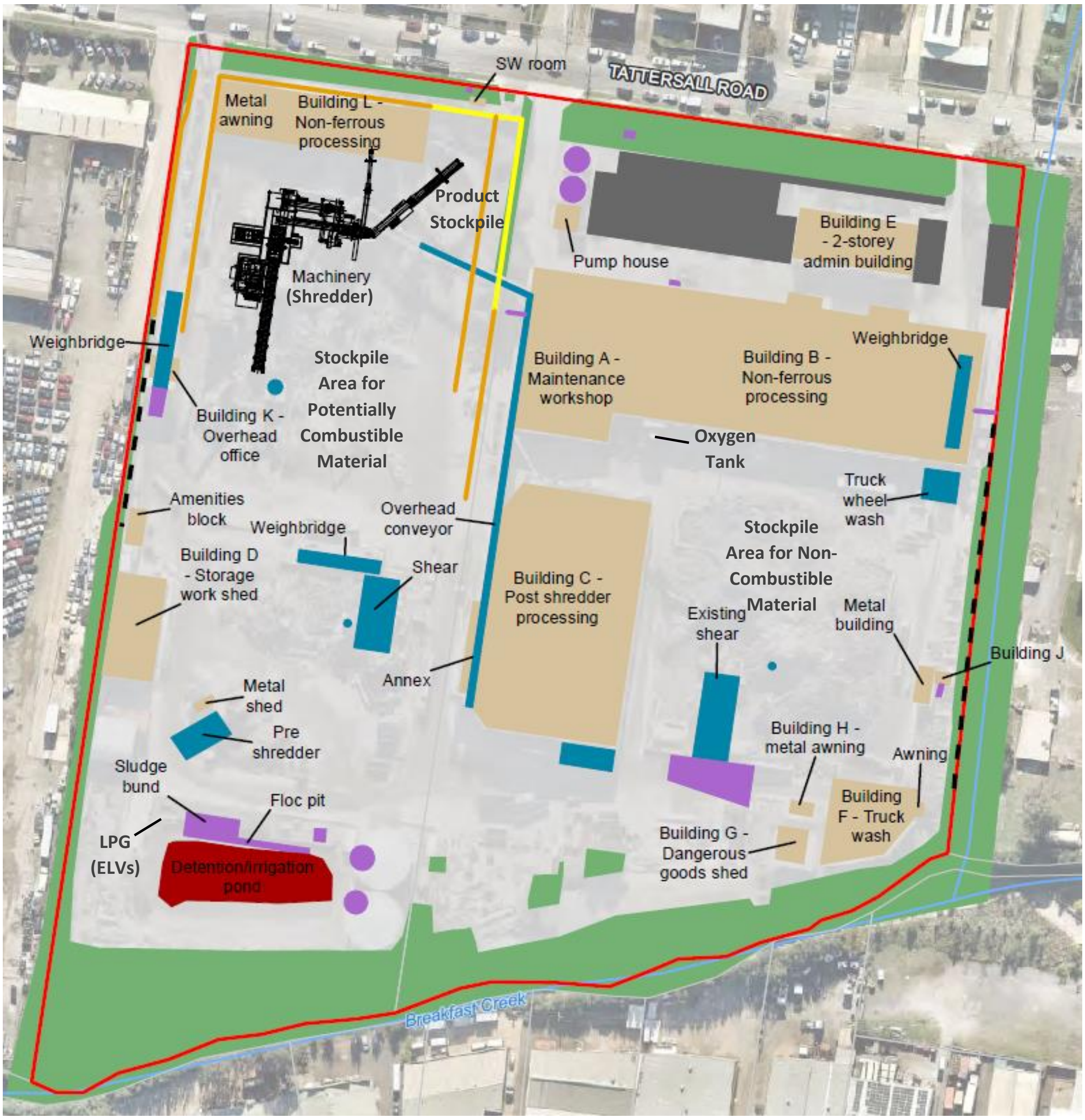
Sell & Parker's RRF is located at 23 – 45 Tattersall Road, Kings Park, New South Wales (refer to Figure 1). The surrounding area is zoned for industrial use and the nearest residential zone is approximately 300 m to the east.

Figure 1 Aerial Photograph of S&P's Kings Park Resource Recovery Facility [3]

2.2 On-Site Buildings and Facilities

The buildings and facilities at the site are shown on Figure 2.

Figure 2 On-Site Buildings and Facilities [3]



2.3 Site Activities

Activities at the RRF include:

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

2.3.1 Shredding

The shredder processes light scrap metal including white goods, roof sheeting and car bodies (generally referred to as light gauge or black iron), but not larger steel items such as rail or structural steel (generally referred to as Heavy).

If petrol tanks or liquefied petroleum gas (LPG) cylinders are present on end-of-life vehicles (ELVs), these are removed and emptied before the ELV is fed through the shredder. LPG cylinders are stored in a quarantined area before being removed offsite for decommissioning and disposal. Petrol and oil are drained from tanks and collected in above ground storage tanks and removed offsite for processing.

Scrap metal (black iron including ELVs) is lifted onto a heavy-duty feed conveyor by an electric material handler. The operator of the mobile material handler checks the feed material while loading it onto the conveyor. The materials pass the control cabin, where an operator also checks incoming materials. The control cabin is an enclosed reinforced 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 material is carried upwards by an incline conveyor (IC) and then dropped into a 'cascade' chute, hitting against its corners and therefore loosening any dirt and dust. Air from the cascade is extracted by an induced draft fan and passes into a cascade cyclone to drop out particulates. Cleaned air then passes through a wet scrubber to remove fine dust.

The cleaned fragmented material passes under drum magnets, which pick up ferrous metals and drop them onto the picking conveyor (C2), where operators remove remaining non-ferrous materials. The ferrous metals continue up a conveyor (C3) which offloads the ferrous product into the product stockpile.

The non-ferrous materials 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. This 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 continue through a pan feeder and trommel, which separates 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 separate any remaining aluminium.

After passing through these stages, the remaining materials are waste products, which are conveyed to the Floc Shed, where after further processing the ultimate remaining waste (Floc) is disposed of at appropriately licensed facility.

Some materials, such as ELVs and baled scrap, are pre-processed in a “pre-shredder”, which allows potential contaminants hidden in the 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 Oxycutting

Oversized items that are too large or heavy to shear, are reduced into more manageable sized pieces via oxycutting. Oxycutting is performed using an oxygen & LPG fuelled torch. Oxycutting is carried out on scrap metal known as 'heavy'.

2.3.4 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, cables and used lead acid batteries (ULABs).

ULABs are spent batteries commonly found in End-of-Life Vehicles (ELV's). ULABs are generally only received by smaller providers as a single or bulk product and therefore are not mixed in with other scrap metal. ULABs are almost 100% recyclable and the materials have a commercial value. Sell & Parker receive, store and sell ULABs on-site as licenced under the EPL 11555 and in accordance with manufacturer and SafeWork NSW's guidelines, but do not undertake any processing of ULABs.

The non-ferrous goods 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 non-ferrous products may be baled (compressed into cubes).

2.3.5 Office and Other Activities

Offices and other activities at the RRF include:

- Maintenance workshop.
- Weigh bridges.
- Truck washing.
- Wastewater treatment and storage.

2.3.6 Potentially Hazardous Materials and Dangerous Goods

Relatively small quantities of potentially hazardous materials and Dangerous Goods (DGs) are handled and stored on site. These are mostly required for maintenance or utility purposes (e.g. oxygen for oxy-cutting). The largest single inventory of DGs is liquid oxygen in an above ground tank (refer to Table 1).

Some potentially hazardous materials and DGs (e.g. residual waste fuel) are also removed from the scrap metal before processing, storage and disposal through waste contractors. As metal for recycling may be contaminated with DGs, this has been considered in the hazard identification process.

The following materials are typically present at the RRF:

- Oxygen and LPG for torch cutting.
- Fuel for refuelling of vehicles, equipment and machinery.
- Oils and greases for lubrication of equipment and machinery.
- Operational batteries for equipment and machinery.
- Waste oil and fuel (including LPG) from ELVs.
- Other by-products of processing operations (e.g. ULABs, non-ferrous items).

The types, locations and quantities of potentially hazardous materials and DGs stored at the RRF are listed in Table 1.

2.4 Fire Detection and Protection Systems

2.4.1 Overview

The fire protection systems consist of:

- Fire detection systems,
- Fire hydrant systems,
- Hose reel systems,
- Sprinkler systems, and
- First aid fire-fighting response measures (fire extinguishers).

The description of the system has been informed by a site visit and documents [4] and [5].

2.4.2 Fire Water Supply and Storage

Water is provided to the fire hydrant system from two (2) 451 kL capacity tanks, providing a total of 902 kL storage. Make up to these tanks is via a 300 mm connection to the 300 mm Sydney Water main running along Tattersall Road. Backflow to the main is prevented by both an air gap between the Sydney Water supply and water level in each of the tanks, and a 300 mm testable double check valve.

The flowrate available to fill the tanks 95% of the time is approximately 60 L/s at 63 m head.

2.4.3 Fire Brigade Booster Assembly

Three "Tank Suction" booster assemblies located at the landscaped area in front of the site. The suction points of each booster assembly consist of a single 300 mm large bore suction and two 150 mm suction points from the two storage tanks. The western most booster also has four 150 mm suction points supplied directly from the Sydney Water main. Each booster connection has four inlet points connected to the fire pump discharge.

2.4.4 Fire Hydrant Pumps

The hydrant and sprinkler systems are supplied using two diesel pumps housed in an external pump room, each providing 120 L/s @ 1100 kPa. An electric pump is also within the pump room with the capacity to provide flow to three water cannons.

2.4.5 Fire Hydrant System

The site is served by a ring main system comprising of sub ring mains with inground and above ground isolation valves. The fire hydrant system incorporates external fire hydrants, foam hydrants, fixed and mobile water cannons, as well as a fire monitoring system consisting of thermal and flame cameras for fire detection in addition to a water deluge system for the stockpiles in accordance with AS2419.1-2005 and/or discussions with FRNSW. There is also a manual water deluge system as well as smoke detection and alarm system within the buildings.

There are 13 double outlet hydrants and a further 10 single outlet hydrants around the site protecting both buildings and open yard. Yard stockpiles are further protected by water cannons.

The hydrant system performance requirement of 120 L/s @ 700 kPa is based on the requirements of AS 2419.1, plus additional performance for the special hazard nature of the site [4], [6].

2.4.6 Sprinkler Systems

Buildings A, B, and C are sprinkler protected. The valve sets providing water to the sprinklers are located on the north side of buildings A and B.

Building A is sprinkler protected through sprinkler installation valve No. 1 at a system design performance of 1350 L/m @ 140 kPa.

Building B is separated from Building A by a block wall. It is sprinkler protected through sprinkler installation valve set No.2, which includes valves on both the northeast and northwest corners of the building. The design performance is 1350 L/min @ 140 kPa.

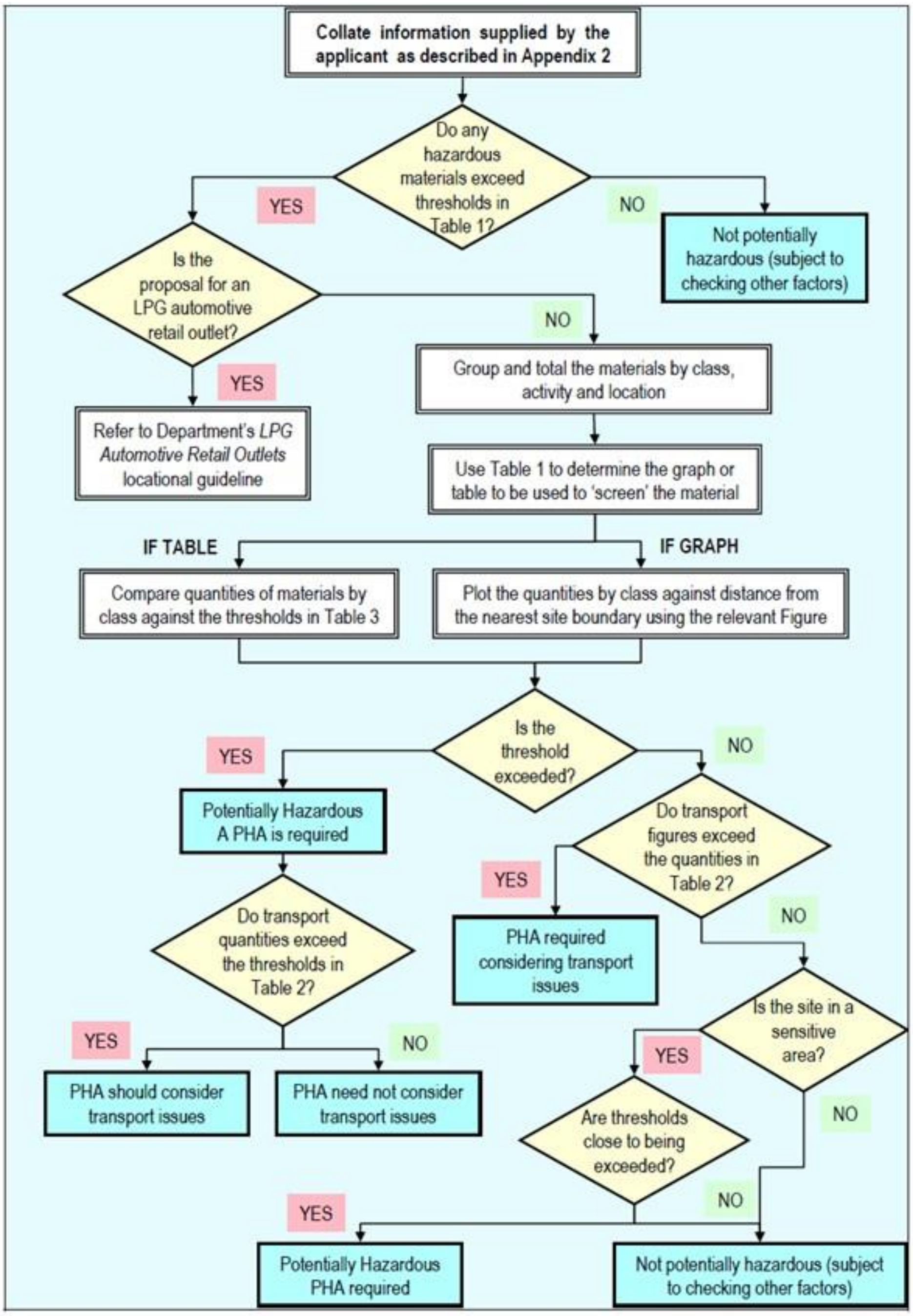
Building C (floc shed) is sprinkler protected through sprinkler installation valve No. 3 located at the front of building A. The design performance is 1350 L/min.

3 SEPP 33 Preliminary Risk Screening

3.1 Scope and Methodology

The scope of the preliminary risk screening included all existing facilities and operations at the RRF that involve the storage and transport of potentially hazardous materials / Dangerous Goods (DGs) – Refer to Figure 2 and Table 1. The methodology adopted followed the approach described in DPIE's Applying SEPP 33 guidelines [2], which is shown diagrammatically in Figure 3.

Figure 3 Risk Screening Flowchart from DPIE's Applying SEPP 33 Guidelines



3.2 SEPP 33 Screening for Stored Potentially Hazardous Materials and DGs

The locations and quantities of DGs stored at the RRF are listed in Table 1, which includes an assessment against the corresponding SEPP 33 screening threshold quantities [2].

Table 1 SEPP 33 Screening for Stored Potentially Hazardous Materials and DGs

<table>
<tr><th>Storage Location/s (refer to Figure 2)</th><th>Potentially Hazardous Material or DG</th><th>UN No. [7]</th><th>DG Class / Sub. DG Class [7]</th><th>Packing Group [7]</th><th>Max. (Estimated) Quantity Stored Onsite</th><th>Storage Type</th><th>SEPP 33 Screening Method & Threshold Quantity [2] (Note 2)</th><th>Comments</th><th>SEPP 33 Screening Threshold Exceeded? (Yes / No)</th></tr>
<tr><td>Building A (Inside - DG cabinet)</td><td>Degreaser - Kerosene</td><td>1223</td><td>3</td><td>III</td><td>100 litres</td><td>Packaged goods (20 litre pails)</td><td>GRAPH (Fig. 9 if greater than 5 tonnes)</td><td>Flammable liquid stored separately from other potentially combustible liquids (Note 3)</td><td>No</td></tr>
<tr><td>Building A (Inside)</td><td>Lead Acid Batteries (New)</td><td>2794
2800</td><td>8</td><td>III
-</td><td>300 kg</td><td>Batteries on pallets</td><td>TABLE 3
50 tonnes (PG III)</td><td>Operational lead acid batteries (i.e. Not ULABs) for site vehicles
Typically contain 10-40 wt% Acid</td><td>No</td></tr>
<tr><td>Building A (Inside)</td><td>Oils and greases</td><td colspan="3">C1 Combustible Liquid</td><td>7,500 litres</td><td>3 x double-walled above ground tanks:
• Hydraulic 100: 3150 litres
• Hydraulic 68: 4400 litres
• HTO CJ-4 15W40: 1270 litres</td><td></td><td>Hydraulic oil and engine oil.
Potentially combustible liquids stored separately from other flammable liquids (Note 3)</td><td>No</td></tr>
<tr><td>Building A</td><td>Coregas 16/3 Shield Gas</td><td>1956</td><td>2.2</td><td>-</td><td>240 kg</td><td>3 x 10.8 m^3 bottles</td><td>NA</td><td>Not Applicable – There is no SEPP 33 threshold quantity for this DG Class</td><td>NA</td></tr>
<tr><td rowspan="2">Building A (Outside)</td><td>LPG (Note 1)</td><td>1075</td><td>2.1</td><td>-</td><td rowspan="2">45 kg (LPG) plus 1,207 kg (Oxygen) per gas cutting kit</td><td rowspan="2">1 x 45 kg LPG cylinder and 1 x oxygen man-pack (12 bottles) per gas cutting kit</td><td rowspan="2">TABLE 3
16 m^3 or 10 tonnes (LPG)
5 tonnes (Oxygen)</td><td rowspan="2">1 x gas cutting kit (static) at west side and 1 x gas cutting kit (mobile) at south side of building</td><td rowspan="2">No</td></tr>
<tr><td>Oxygen, compressed</td><td>1072</td><td>2.2 / 5.1</td><td>-</td></tr>
</table>

Storage Location/s (refer to Figure 2)	Potentially Hazardous Material or DG	UN No. [7]	DG Class / Sub. DG Class [7]	Packing Group [7]	Max. (Estimated) Quantity Stored Onsite	Storage Type	SEPP 33 Screening Method & Threshold Quantity [2] (Note 2)	Comments	SEPP 33 Screening Threshold Exceeded? (Yes / No)
Building A (Outside)	Diesel fuel	C1 Combustible Liquid			2,000 litres	2 x double-walled above ground tanks (1 x 1000 litres for clean diesel and 1 x 1,000 litres for diesel mixed with oil for lubrication of chains)		Potentially combustible liquids stored separately from other flammable liquids (Note 3)	No
Building B (Inside)	Lead	-	-	-	30,000 kg	Loose pieces (e.g. foil, sheets, shot, strips) in dedicated storage bay	NA	Lead is not a DG	NA
Building B (Inside - DG cabinet)	Petrol	1203	3	II	20 litres	2 x 10 litre drums	GRAPH (Fig. 9 if greater than 5 tonnes)	Fuel for demolition saw	No
Building B (Inside)	Spent Lead Acid Batteries (ULABs)	2794 2800	8	III -	30,000 kg	Batteries on pallets	TABLE 3 50 tonnes (PG III)	Typically contain 10-40 wt% Acid	No
Building B (Outside)	Oxygen, refrigerated	1073	2.2 / 5.1	-	13,000 litres [8]	Vertical bulk storage tank	TABLE 3 5 tonnes	At the typical storage conditions (viz. 10 barg and c. -150 deg. C), the max. (estimated) storage quantity is 12.5 tonnes, which exceeds the 5 tonne threshold quantity limit for Subsidiary DG Class 5.1	Yes
Building D (Outside)	LPG (Note 1)	1075	2.1	-	45 kg (LPG) plus 1,207 kg (Oxygen) per gas cutting kit	1 x 45 kg LPG cylinder and 1 x oxygen man-pack (12 bottles) per gas cutting kit	TABLE 3 16 m^3 or 10 tonnes (LPG) 5 tonnes (Oxygen)	1 x gas cutting kit (Static) at east side of building	No
	Oxygen, compressed	1072	2.2 / 5.1	-					

Storage Location/s (refer to Figure 2)	Potentially Hazardous Material or DG	UN No. [7]	DG Class / Sub. DG Class [7]	Packing Group [7]	Max. (Estimated) Quantity Stored Onsite	Storage Type	SEPP 33 Screening Method & Threshold Quantity [2] (Note 2)	Comments	SEPP 33 Screening Threshold Exceeded? (Yes / No)
Building D	Coregas 16/3 Shield Gas	1956	2.2	-	160 kg	2 x 10.8 m^3 bottles	NA	Not Applicable – There is no SEPP 33 threshold quantity for this DG Class	NA
Building D (Outside - Near pre-shredder structure)	Mixed fuels (By-product of waste processing)	1203	3	II	3,000 litres	1 x double-walled above ground tank	GRAPH (Fig. 9 if greater than 5 tonnes)	Waste fuel from end-of-life vehicles (petrol, diesel, oil, etc.) Worst case waste fuel (petrol) assumed for screening purposes	No
Building F (Inside)	LPG (Note 1)	1075	2.1	-	540 kg	12 x 45 kg cylinders	TABLE 3 16 m^3 or 10 tonnes		No
Building F (Inside)	Oxygen, compressed	1072	2.2 / 5.1	-	3,621 kg	3 x man-packs (12 bottles) 156 m^3 (1207 kg) per pack	TABLE 3 5 tonnes	Based on threshold quantity limit for Subsidiary DG Class 5.1	No
Building F (Inside)	Argon	1006	2.2	-	78.8 kg	5 x 10.6 m^3 bottles	NA	Not Applicable – There is no SEPP 33 threshold quantity for this DG Class	NA
Building G (Inside)	Oils and greases	C1 Combustible Liquid			10,000 litres	1,000 litre IBCs and 200 litre drums		Potentially combustible liquids stored separately from other flammable liquids (Note 3)	No
Building L	Diesel and oil mix used as a lubricant	C1 Combustible Liquid			1,000 litres	Double-walled above ground storage tank		Potentially combustible liquid stored separately from other flammable liquids (Note 3)	No

Storage Location/s (refer to Figure 2)	Potentially Hazardous Material or DG	UN No. [7]	DG Class / Sub. DG Class [7]	Packing Group [7]	Max. (Estimated) Quantity Stored Onsite	Storage Type	SEPP 33 Screening Method & Threshold Quantity [2] (Note 2)	Comments	SEPP 33 Screening Threshold Exceeded? (Yes / No)
West of machinery parallel to the western driveway	Diesel and oil mix used as a lubricant	C1 Combustible Liquid			1,000 litres	Double-walled above ground storage tank		Potentially combustible liquid stored separately from other flammable liquids (Note 3)	No
West of sludge bund	LPG (Note 1)	1075	2.1	-	500 litres	In end-of-life LPG vehicle	TABLE 3 16 m^3 or 10 tonnes	The max. (estimated) quantity is based on the approx. volume of an LPG tank on an EOV.	No

Note 1: LPG, as defined in AS1596 — LP Gas Storage and Handling, though classified as a flammable gas (2.1), is treated separately for screening purposes and is not grouped with the other class 2.1 flammable gases [2].

Note 2: Where several hazardous materials of the same class are kept on site in the same general location, total the quantities by class and activity (that is, total all quantities of each class stored in bulk then separately total the quantities of each class stored in packages/containers). Table 1 in Applying SEPP 33 [2] provides the basis for grouping and indicates the screening method to be used.

Underground and above ground storage is not added together — these are always treated separately [2]. There are no underground storage tanks at the RRF.

Note 3: If combustible liquids of class C1 are present on site and are stored in a separate bund or within a storage area where there are no flammable materials stored they are not considered to be potentially hazardous. If, however, they are stored with other flammable liquids, that is, DG Class 3 PGI, II or III, then they are to be treated as DG Class 3 PGIII, because under these circumstances they may contribute fuel to a fire [2].

3.3 Transport of Potentially Hazardous Materials and DGs

The relevant screening thresholds (movements per year or per week and minimum load sizes) from the Applying SEPP 33 guidelines [2] are reproduced below in Table 2. Most of the DGs handled at the site are stored in small quantities and/or package sizes and consequently do not require transport in quantities above the SEPP 33 minimum load sizes. Similarly, the DGs are transported at significantly lower frequencies than the relevant screening thresholds for movements per year or per week (also see below).

Table 2 SEPP 33 Transport Screening Thresholds

Class	Vehicle Movements		Minimum quantity* per load (tonne)	
	Cumulative Annual	Peak Weekly	Bulk	Packages
2.1	>500	>30	2	5
3 PGII	>750	>45	3	10
5	>500	>30	2	5
8	>500	>30	2	5

* If quantities are below this level, the potential risk is unlikely to be significant unless the number of traffic movements is high.

The liquid oxygen storage tank is refilled approximately once every two weeks to once every c. 20 days and the maximum delivery quantity is typically approximately 6,000 to 7,000 litres (c. 5.7 to 6.7 tonnes). With increased throughput at the RRF, the number of vehicle movements will not exceed the SEPP 33 transport screening threshold for DG Class 5 oxidising agents.

Waste fuel from end-of-life vehicles (petrol, diesel, oil, etc.) is collected by Cleanaway approximately once per 6 to 12 months. With increased throughput at the RRF, the number of vehicle movements will not exceed the SEPP 33 transport screening threshold for DG Class 3 PG II flammable liquids.

3.4 Findings

Based on the preliminary risk screening, a PHA is required due to the inventory of liquid oxygen exceeding the SEPP 33 threshold quantity. All other DGs at the RRF are below the corresponding SEPP 33 threshold quantities.

None of the DGs exceed the SEPP 33 threshold limits for transport; therefore, the RRF is not potentially hazardous with respect to transportation and a route evaluation study is not required.

4 Hazard Identification and Qualitative Risk Assessment

A site inspection was undertaken on 16 June 2021. Following this inspection, the hazard register and qualitative risk assessment from the PHA undertaken in 2014 [9] was reviewed and amended for the proposed expansion (refer to Table 6). As a result of this review, some additional incidents (e.g. release of liquid oxygen) and new safeguards were added to the register.

As per the 2014 PHA, the severity of each consequence was estimated qualitatively (refer to Table 3) and the frequency with which the consequence could occur with was estimated qualitatively (refer to Table 4). The result was qualitatively assessed using the Sell & Parker risk matrix (refer to Table 5).

Table 3 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 4 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 5 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

Table 6 Hazard Register and Qualitative Risk Assessment

1. Ferrous Processing

Nodes	What if	Causes	Consequence	Safeguards	Assessment		
					Severity	Likelihood	Risk
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. 2. Visual inspection of material during vehicle unloading. 3. Visual inspection of material during sorting. 4. Visual inspection of material during loading into processing equipment. 5. Car process. 6. Vehicles are processed in the pre-shredder in an area isolated from people and other equipment. 7. PPE. 8. Bunded area. 9. Site is bunded, all flows go the treatment system. 10. Emergency response plan (ERP). 11. Firefighting systems. 12. Spill containment systems.	Minor	Unlikely	1 Low
			2. Personnel may come into contact with chemicals and receive chemical burns.		Moderate	Unlikely	2 Medium
			3. If flammable and ignited, there is the potential for a small fire. No offsite impact is expected unless the fire escalates.		Minor	Unlikely	1 Low
		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. 2. Visual inspection of material during vehicle unloading. 3. Visual inspection of material during sorting. 4. Visual inspection of material during loading into processing equipment. 5. Pneumatic brass (non-sparking) spike removes and collects fuel and oil from vehicles 6. Pre-shredding process in an open, rather than confined area minimises the potential for explosions. 7. Fire systems inside the shredder and on the pre-shredder.	Minor	Possible	2 Medium

Nodes	What if	Causes	Consequence	Safeguards	Assessment		
					Severity	Likelihood	Risk
		3. Leak of hydraulic fluid from processing equipment	1. Possible contamination of water courses if not separated from storm water.	1. Regular maintenance 2. Site is contained all site waters go to treatment systems and storage. Only roof water and front carpark goes to stormwater. 3. Shredder hydraulic room is enclosed and has a collection pit. 4. Oil separator in stormwater system 5. Oil skimmer 6. Hydrocarbon collection is part of the water treatment system. 7. Emergency response plan (ERP) 8. Inspection, maintenance procedures 9. Separation from personnel	Minor	Possible	2 Medium
			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		Major	Rare	3 High
		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. Site is contained all site waters go to treatment systems and storage. Only roof water and front carpark goes to stormwater. 3. Double-walled tank, which is located behind a 10mm steel plate wall. 4. Collection area bunded.	Minor	Possible	2 Medium
	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. 2. Radiation sources are low level.	Major	Rare	3 High
	3. Machinery	1. Personnel struck / caught in machinery	1. Personnel injury	1. Guarding. 2. Area isolations. 3. Operator training/certification. 4. Visitors wear identifying pink helmets.	Major	Unlikely	3 High
	4. Light	1. Refer "General"					

Nodes	What if	Causes	Consequence	Safeguards	Assessment		
					Severity	Likelihood	Risk
	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. 2. Isolated from operational areas. 3. Emergency response plan (ERP).	Moderate	Unlikely	2 Medium
	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 light gauge/black iron stockpiles before shredding (e.g. combustible materials such as oil and rubber, ignition due to presence of unidentified lithium polymer batteries in received material)	1. Staff may receive burn injuries or injuries from collapse of stockpile, but unlikely as escape from fire source is relatively easy. Escalation to offsite not considered credible.	1. Visual inspection of material on arrival. 2. Visual inspection of material during vehicle unloading. 3. Visual inspection of material during sorting. 2. Separation of stockpiles. 3. Fire hydrants, hoses and water cannon. 4. Portable AFFF firefighting platforms. 5. Emergency response plan (ERP).	Moderate	Rare	2 Medium
			2. Air pollution through smoke from fire. Water cannon and fire services expected to limit extent of pollution.		Moderate	Unlikely	2 Medium
	9. Lead	1. Lead is purchased by site (roof flashing etc.)	1. Lead contamination	1. No processing of lead material by plant or machinery. 2. Isolated in bunker. 3. PPE.	Minor	Unlikely	1 Low
			2. Staff exposure to lead		Moderate	Unlikely	2 Medium
	10. Utilities	1. Loss of water to the wet scrubber for the cyclone	1. Loss of dust to atmosphere	1. Personnel monitoring. 2. Water systems are alarmed.	Moderate	Unlikely	2 Medium

Nodes	What if	Causes	Consequence	Safeguards	Assessment		
					Severity	Likelihood	Risk
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. 2. Visual inspection of material during vehicle unloading. 3. Visual inspection of material during sorting. 4. Visual inspection of material during loading into processing equipment. 5. PPE. 6. Liquid chemicals not received on site. 7. Bunded area. 8. Isolated area. 9. Low inventory of flammables in stockpile. 10. Emergency response plan (ERP).	Minor	Rare	1 Low
			2. Personnel may come into contact with chemicals and receive chemical burns.		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.		Minor	Rare	1 Low
		2. Leak of hydraulic fluid from processing equipment	1. Possible contamination of water courses if not separated from storm water.	1. Regular maintenance. 2. Hydraulic room is bunded. 3. Self contained site. 4. Oil separator in stormwater system. 5. Oil skimmer. 6. Emergency response plan (ERP). 7. Inspection, maintenance procedures. 8. Separation from personnel.	Minor	Possible	2 Medium
			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		Major	Rare	3 High
	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. 2. Low level sources.	Major	Rare	3 High
	3. Machinery	1. Personnel struck / caught in machinery	1. Personnel injury	1. Guarding. 2. Operator training/certification.	Major	Unlikely	3 High
	4. Light	1. Refer "General"					
	5. Electricity	1. Refer "General"					
	6. Mobile plant / vehicles	1. Refer "General"					

Nodes	What if	Causes	Consequence	Safeguards	Assessment		
					Severity	Likelihood	Risk
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, which is regularly removed from site to a licensed disposal facility. 2. Enclosed building. 3. Approved firefighting systems. 4. Infrared camera. 5. Emergency response plan (ERP). 6. Fire detection and protection systems. 7. Separation from site boundary / protected places. 8. Floc stockpile indoors.	Moderate	Rare	2 Medium
			2. Smoke pollution to nearby areas		Moderate	Unlikely	2 Medium
	2. Electromagnetic	1. Emissions from equipment used to recover metal from floc	1. Potential injury to personnel with pacemakers	1. Restricted access. 2. Signage.	Moderate	Unlikely	2 Medium

2. Non-Ferrous Processing

Nodes	What if	Causes	Consequence	Safeguards	Assessment		
					Severity	Likelihood	Risk
1. All	1. Chemical	1. Contamination of material brought in site	1. Personnel exposure	1. Visual inspection of material on arrival. 2. Unloading, sorting and processing. 3. Non-ferrous processing limited to baling of aluminium cans and cables.	Minor	Unlikely	1 Low
		2. Leak from used lead acid batteries (ULABs).	1. Personnel may come into contact with chemicals and receive chemical burns.	1. Visual inspection of material on arrival. 2. Visual inspection of material during vehicle unloading. 3. Visual inspection of material during sorting. 4. No processing of ULABs on site. 5. PPE. 6. Spill kits. 7. ULABs stored in accordance with manufacturer's guidelines. 8. If a battery leaks, it is stored on a spill pallet. 9. Containment of storage area.	Minor	Unlikely	1 Low
	2. Radiation	1. Radioactive sources brought in with scrap	1. Personnel exposure to radiation	1. Incoming material screened for radioactive sources. 2. Low level sources.	Major	Rare	3 High
	3. Machinery	1. Personnel struck / caught in machinery	1. Personnel injury	1. Guarding. 2. Isolations. 3. Operator training/certification.	Major	Unlikely	3 High
	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 contamination		Minor	Unlikely	1 Low

Nodes	What if	Causes	Consequence	Safeguards	Assessment		
					Severity	Likelihood	Risk
		1. Lead is purchased by site (roof flashing etc.)	2. Staff exposure to lead	1. No processing of lead material by plant or machinery. 2. Stored in isolated area. 3. PPE.	Moderate	Unlikely	2 Medium

3. Other Facilities and Activities

Nodes	What if	Causes	Consequence	Safeguards	Assessment		
					Severity	Likelihood	Risk
1. All	1. Chemical	1. Fire involving dangerous goods in maintenance building	1. Fire - personnel injury	1. Stored as per Australian Standards. 2. DGs stored away from adjoining property / protected place. 3. Stored in packaged quantities. 4. Emergency response plan (ERP).	Major	Rare	3 High
			2. Air contamination		Moderate	Unlikely	2 Medium
		2. Diesel leak	1. Potential contamination of storm water	1. Vehicles fuelled daily from tanker that visit site. 2. 1000 litres AS twin skin tank back up tank. 3. Self contained site.	Minor	Rare	1 Low
		3. Acetylene or LPG cylinder (maintenance equipment) leaks.	1. Leak could find an ignition source, leading to a flash fire or spray fire.	1. Operator training/certification. 2. Hot work permits. 3. Emergency response plan (ERP). 4. Stored as per Australian Standards.	Major	Unlikely	3 High
		4. Release of liquid oxygen from storage tank or delivery tanker.	1. Exposure to cryogenic liquid - personnel injury (cold burns).	1. Operator training/certification (Tanker unloading is undertaken by Coregas personnel). 2. Tank refilling is generally undertaken during early morning before commencement of oxy-cutting operations. 3. PPE. 4. Steel enclosure for storage tank. 5. Exclusion zone surrounding storage tank. 6. Bollards outside doorway to steel enclosure for storage tank. 7. Emergency response plan (ERP).	Moderate	Unlikely	2 Medium
			2. Fire if liquid oxygen contacts organic material (particularly if this material is hot) or due to exposure to oxygen enriched atmosphere (including saturation of clothing).		Major	Unlikely	3 High
	2. Radiation	1. Refer to Ferrous and Non-Ferrous processing.					
	3. Machinery	1. Refer to Shredding and Shearing.					

Nodes	What if	Causes	Consequence	Safeguards	Assessment		
					Severity	Likelihood	Risk
1. All	4. Light	1. Welding	1. Personnel injury - vision impairment	1. Operator training/certification. 2. Hot work permit. 3. Emergency response plan (ERP). 4. PPE.	Moderate	Unlikely	2 Medium
	5. Electricity	1. Transformer fire	1. Transformer fire resulting in smoke and possible personnel injury.	1. Annual inspection and report. 2. Isolation from operational areas. 3. Emergency response plan (ERP).	Moderate	Unlikely	2 Medium
	6. Mobile plant / vehicles	1. Pedestrian / vehicle interaction	1. Pedestrian fatality	1. Designated walkways. 2. PPE. 3. Office location limits personnel in operating areas. 4. Emergency response plan (ERP). 5. Traffic flow is one-directional. 6. Weighbridge activities separated from operating areas. 7. Reversing beepers. 8. Flashing lights. 9. Horn use. 10. Traffic controllers.	Catastrophic	Rare	3 High
		2. Heavy vehicle / light vehicle collision	1. Potential fatality	1. Emergency response plan (ERP). 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. 4. Traffic controllers.	Catastrophic	Rare	3 High
		3. Run-off from truck wash	1. Potential contamination of storm water	1. Storm water catchment. 2. Truck washing water recovery system. 3. Self contained site. 4. Water treatment system.	Moderate	Unlikely	2 Medium

Nodes	What if	Causes	Consequence	Safeguards	Assessment		
					Severity	Likelihood	Risk
1. All	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. 2. Fire protection system (firewater main, hydrants and water cannon). 3. Mobile plant to pull potentially combustible stockpiles apart. 4. Mobile firefighting platforms with AFFF. 5. Facility maintenance. 6. Emergency response plan (ERP).	Major	Rare	3 High
			2. Smoke pollution to nearby areas		Moderate	Unlikely	2 Medium
	9. Potential energy	1. Material falls from stockpile during processing	1. Potential injury to workers.	1. Designated walkways. 2. PPE. 3. Office location limits personnel in operating areas.	Moderate	Unlikely	2 Medium

5 CONSEQUENCE ANALYSIS

5.1 Representative Potentially Hazardous Incidents Selected for Analysis

The following representative potentially hazardous incidents were considered for analysis of potential consequences.

Table 7 Potentially Hazardous Incidents for Consequence Analysis

Incident	Potential Consequence/s	Comments
1. 9 kg Propane Cylinder Rupture	Fireball Flash Fire *	This scenario representative of a discarded 9 kg LPG bottle entering the pre-shredder.
2. 45 kg Propane Cylinder Leak (3mm Hole)	Jet Fire Flash Fire *	This scenario is representative of minor leaks that could occur whilst using or storing LPG cylinders.
3. 45 kg Propane Cylinder Rupture	Fireball Flash Fire *	This scenario examines the possible escalation effects of a small LPG fire in the LPG storage area.
4. Propane Leak (Vapour) from EOV fuel tank (10mm Hole)	Jet Fire Flash Fire	This scenario examines the effects of a possible fire from the residual contents of an LPG tank in an EOV that is being scrapped (typically c. 60 to 300 litres water capacity).
5. 45 litre Petrol Fire	Pool Fire	This scenario examines the effects of a possible fire from the contents of a fuel tank in an EOV that is being scrapped. A 10-minute release of 45 litres is assumed (Note: This is conservative as the tanks are normally drained prior to arriving on site). Petrol was modelled as N-Heptane.
6. 3,000 litre Petrol Fire	Pool Fire	This scenario examines the potential consequences of a leak from the recovered petrol storage tank (double-walled) or during transfer to a tanker. A 10-minute release of the entire inventory is assumed. Petrol was modelled as N-Heptane.
7. Release of liquid oxygen from storage tank or delivery tanker	Elevated oxygen levels and potential ignition of combustible materials	This scenario examines the potential consequences of a leak from the storage tank (double-walled) or during transfer from a tanker. A 10 mm liquid leak and a 10-minute release of the entire inventory in the storage tank is assumed (13,000 litres of liquid at 10 barg).

* Note: Combustion of a flammable vapour and air mixture can result in a vapour cloud explosion with damaging overpressure. This usually requires some congestion to accelerate the flame front. In this case, the quantities of LPG are insufficient to cause to VCE.

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

- Heat radiation and smoke from potentially combustible stockpile fires. The provision of water cannons enables responders to suppress 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.

5.2 Weather Conditions

The following generic weather conditions were used in the modelling:

Table 8 Generic Weather Conditions

Pasquill Stability Factor		D	D	F
Wind Speed	m/s	1.5	5.0	1.5
Atmospheric Temperature	°C	20	20	20
Atmospheric Humidity	fraction	0.70	0.70	0.70
Surface Roughness Length	m	0.18	0.18	0.18
Surface Roughness Parameter		0.10	0.10	0.10
Dispersion Surface Temperature	°C	20	20	20

5.3 Jet Fires

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

Table 9 details the distance to various radiation intensity levels under differing weather conditions for jet fires.

Table 9 Distances to Radiation Intensity Levels for Jet Fires

Incident	Hole size (mm)	Release Rate (kg/s)	Radiation Level (kW/m²)	Weather		
				Category 1.5/D	Category 5/D	Category 1.5/F
45 kg LPG Cylinder Leak	3	0.12	4.7	9.3	8.0	9.3
			12.6	7.6	6.3	7.6
			23	6.8	5.4	6.8
			35	6.2	4.9	6.2
Propane Leak (Vapour) from EOV fuel tank	10	0.16	4.7	9.2	7.9	9.2
			12.6	7.6	6.2	7.6
			23	6.7	5.4	6.8
			35	6.2	4.9	6.2

5.4 Pool Fires

A release of liquid may form a pool. The combustion of material evaporating from that pool is a pool fire. Table 10 details the distance to various radiation intensity levels under differing weather conditions for pool fires.

Table 10 Distances to Radiation Intensity Levels for Late Pool Fires

Incident	Release Rate (kg/s)	Radiation Level (kW/m^2)	Weather		
			Category 1.5/D	Category 5/D	Category 1.5/F
45 litre Petrol Fire	0.05	4.7	17.0	18.8	16.9
		12.6	11.2	14.0	11.1
		23	7.5	10.8	7.4
		35	5.3	7.4	5.2
3,000 litre Petrol Fire	3.4	4.7	42.1	53.1	42.1
		12.6	18.7	21.9	18.7
		23	16.7	16.2	16.7
		35	Not Reached		

5.5 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 11 details the downwind and crosswind distance to the lower flammable limit (LFL) under differing weather conditions for flammable gas clouds. This defines the extent of flash fires.

Table 11 Downwind Distance to LFL Concentration (Flash Fires)

Incident	Hole size (mm)	Release Rate (kg/s)	Weather		
			Category 1.5/D	Category 5/D	Category 1.5/F
9kg LPG Cylinder Rupture	N/A	-	2.7	3.6	2.6
45 kg LPG Cylinder Leak	3	0.12	Not Reached		
45 kg LPG Cylinder Rupture	N/A	-	4.9	9.0	4.8
Propane Leak (Vapour) from EOV fuel tank	10	0.16	Not Reached		

5.6 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 12 details the distance to various radiation intensity levels for fireballs. Fireballs are not dependent upon weather stability or wind speed.

Table 12 Distances to Radiation Intensity Levels for Fireballs

Incident	Radiation (kW/m^2)	Radius (m)
9kg LPG Cylinder Rupture	4.7	30.7
	12.6	18.6
	23	13.4
	35	10.5
45 kg LPG Cylinder Rupture	4.7	54.6
	12.6	33.5
	23	24.2
	35	19.0

5.7 Release of Liquid Oxygen

Pure oxygen at high pressure can react violently with common materials such as oil and grease. Other materials may catch fire spontaneously and nearly all materials including textiles, rubber and even metals will burn vigorously in oxygen [10].

Even a small increase in the oxygen level in the air can create a dangerous situation since it becomes easier to start a fire, which will then burn hotter and more fiercely than in normal air [10]. An oxygen-enriched atmosphere is typically defined as containing more than 23.5% oxygen by volume [11].

The distance to an oxygen-enriched atmosphere was estimated for a 10 mm liquid release and a 10-minute release of the entire inventory. In both cases, a release at 1 m above ground level and at 8 m above ground level was modelled, with the higher height release modelled as horizontally impinged to represent a leak within the steel enclosure surrounding the storage tank and the subsequent release to atmosphere from the open top of the enclosure.

Table 13 Downwind Distance to Oxygen-Enriched Atmosphere (23.5% Oxygen)

Incident	Release Height (m)	Hole size (mm)	Release Rate (kg/s)	Weather		
				Category 1.5/D	Category 5/D	Category 1.5/F
10 mm Leak (Not impinged)	1	10	2.4	18.3	14.5	19.2
10 mm Leak (Impinged)	8			Not Reached		
10 min Release (Not impinged)	1	N/A	20.4	70.1	72.8	73.5
10 min Release (Impinged)	8			98.5	Not Reached	106.8

6 Risk Assessment

6.1 Impairment Levels

Table 14 lists the levels at which injury, property damage and fatality are considered to occur due to exposure to heat radiation or an explosion overpressure [12].

Table 14 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.

6.2 Jet Fires

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 LPG storage location in Building F, this could potentially extend to the fence line, but would not extend beyond the adjacent easement / creek.

Fatality and property damage impairment levels do not extend beyond the property boundary.

6.3 Pool Fires

The maximum pool fire injury distance is 53.1 m. The location of the pneumatic spike and storage tank is approximately 32.5 m from the property boundary. Fatality and property damage impairment levels do not extend beyond the property boundary.

6.4 Flash Fires

The maximum extent of a flash fire is 9 m based upon a 45 kg LPG cylinder rupture. From the LPG storage location in Building F, this could potentially extend to the fence line, but would not extend beyond the adjacent easement / creek.

Fatality and property damage impairment levels do not extend beyond the property boundary.

6.5 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 generated by a fireball from a 45 kg LPG cylinder rupture could potentially extend beyond the fence line but would not extend beyond the adjacent easement / creek to neighbouring industrial facilities.

6.6 Release of Liquid Oxygen

The maximum distance to an oxygen-enriched atmosphere for a small liquid release (10 mm) is 19.2 m, which does not extend beyond the site boundary (viz. c. 95 m from the storage tank). A major release from the tank (10-minute release of entire inventory) has the potential, under specific wind conditions and wind directions, to extend slightly beyond the site boundary; however, the likelihood of such an event is lower than the DPIE fatality risk criterion of 50 pmpy (viz. HSE reports a catastrophic failure frequency of 22 pmpy for a single walled liquid oxygen tank [13]).

Whilst the storage and handling of liquid oxygen poses a credible risk on site, it does not appear to be a significant risk offsite (relative to the corresponding DPIE risk criteria for land use safety planning).

6.7 Heat Radiation and Smoke from Stockpile Fires

Heat radiation and smoke from a potentially combustible material (light gauge/black iron) stockpile fire has been considered qualitatively based on the observations from a previous fire that occurred in 2017.

The key points from the 2017 incident report Sell & Parker submitted to the NSW EPA [14] include:

- The fire occurred on Monday 24th April 2017 in the black iron stockpile in front of the shredder. The fire was brought under control and officially declared to be extinguished at 11:00am on Tuesday 25th April 2017.
- Smoke was first visible at 16:41 on Monday 24th April 2017, with flames and smoke occurring within 30 seconds. The cloud of smoke impeded visibility on site during firefighting.
- Firefighting water was drawn directly from the onsite retention basin and excess water was removed by contractors (Cleanaway and Remondis).
- It was not possible to determine the cause; however, the presence of a small rechargeable battery was considered most likely since video evidence showed that the black iron stockpile was not being utilised at the time of the fire.
- Sell & Parker did not receive any complaints on their environment line.

6.8 Quantitative Risk Criteria for Land Use Safety Planning

The following table details a comparison of the risk analysis with the quantitative risk criteria in the NSW DPIE Hazardous Industry Planning Advisory Paper No. 4, 'Risk Criteria for Land Use Safety Planning' [12].

Table 15 Risk Criteria Comparison

Criterion Description	Criterion Value	Risk Assessment	Comment
Individual Fatality Risk Criteria			
Hospitals, schools, child-care facilities, old age housing.	0.5×10^{-6} p.a.	Complies	Potentially hazardous consequences, and/or fatality risks greater than the corresponding risk criterion value, are not reached at these land uses.
Residential, hotels, motels, tourist resorts.	1×10^{-6} p.a.	Complies	
Commercial developments including retail centres, offices, and entertainment centres.	5×10^{-6} p.a.	Complies	
Sporting complexes and active open space.	10×10^{-6} p.a.	Complies	
Industrial.	50×10^{-6} p.a.	Complies	
Injury Risk			
Incident heat flux radiation at residential and sensitive use areas should not exceed 4.7 kW/m^2.	50×10^{-6} p.a.	Complies	Potentially hazardous consequences (viz. >4.7 kW/m^2 or >7 kPa) are not reached at these land uses.
Incident explosion overpressure at residential and sensitive use areas should not exceed 7 kPa.	50×10^{-6} p.a.	Complies	
Toxic concentrations in residential and sensitive use areas should not exceed a level which would be seriously injurious to sensitive members of the community following a relatively short period of exposure.	10×10^{-6} p.a.	Complies	Potentially hazardous consequences are not reached at these land uses for fire hazards associated with the RRF (refer to Section 6.7).
Toxic concentrations in residential and sensitive use areas should not cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community.	50×10^{-6} p.a.	Complies	

Criterion Description	Criterion Value	Risk Assessment	Comment
Risk of Property Damage and Accident Propagation			
Incident heat flux radiation at neighbouring potentially hazardous installations or at land zoned to accommodate such installations should not exceed the 23 kW/m^2 heat flux level.	50 x 10^{-6} p.a.	Complies	Potentially hazardous consequences (viz. >23 kW/m^2 or >14 kPa) are not reached at these land uses.
Incident explosion overpressure at neighbouring potentially hazardous installations, at land zoned to accommodate such installations or at nearest public buildings should not exceed the 14 kPa explosion overpressure level.	50 x 10^{-6} p.a.	Complies	
Societal Fatality Risk	Refer to HIPAP No. 4, Figure 3: 'Indicative Societal Risk Criteria'	Complies	Potentially fatal consequences are not reached at residential areas (300+ m from RRF). This ensures compliance with the 'Indicative Societal Risk Criteria'.

6.9 Qualitative Risk Criteria

In terms of the DPIE's qualitative criteria in Hazardous Industry Planning Advisory Paper No. 4, 'Risk Criteria for Land Use Safety Planning' [12];

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.

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.*

   The consequences (effects) of the more likely hazardous events appear to be predominantly contained within the boundaries of the installation (refer to Section 5 and item c below). A release of liquid oxygen appears to be the most significant hazard associated with DGs at the RRF – Recommendations relating to the storage and handling of liquid oxygen have been included in Section 7.

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.*

   The consequences (effects) of the more likely hazardous events appear to be predominantly contained within the boundaries of the installation (refer to Section 5). Smoke from a fire in a potentially combustible stockpile area may extend off-site; however, this does not appear to pose a significant injury / fatality hazard based on observations from a fire that occurred in 2017.

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.*

   The RRF does not appear to present an existing high risk such that it would significantly add to the cumulative risk for the local industrial area.

7 FINDINGS AND RECOMMENDATIONS

A semi-quantitative risk assessment was undertaken for the expansion proposal. The key findings of this assessment are:

- None of the hazards examined exceed the injury risk impairment levels listed in HIPAP No. 4 [12] at the closest residential property (approximately 300 m from the RRF). That is, 7 kPa overpressure from explosions, and 4.7 kW/m^2 heat radiation would not be reached at residential or sensitive land use areas. This finding also extends to the potential for fatality risk at commercial and active open spaces, as fatality impacts would also not occur at these locations.
- The property damage and fatality impacts are predominantly contained within the site boundary. Therefore, the risk of off-site property damage or fatality at an adjacent industrial land use is not expected to exceed 50 per million per year.
- Based on a semi-quantitative risk assessment, the proposed RRF appears to comply with the DPIE's quantitative and qualitative risk criteria for land use safety planning.

The following recommendations are included based on the findings of the risk assessment:

1. The safety requirements for unloading liquid oxygen to the on-site bulk storage tank should be specified in an appropriate document / procedure (e.g. maintenance of exclusion zone for materials contaminated with oil etc., ensuring clear access to tank, prohibiting oxy-cutting operations during tanker unloading, etc.). Operations should be periodically reviewed to ensure compliance with these requirements.
2. A review and audit of the bulk liquid oxygen storage tank installation should be undertaken to ensure compliance with the requirements of the relevant Australian Standard/s.
3. It should be ensured that the steel enclosure surrounding the liquid storage tank is structurally secure should there be a release of low temperature liquid oxygen (which may lead to low temperature embrittlement and potential structural failure of the enclosure). This should include consultation with Coregas and a suitably qualified structural engineer.
4. A specific emergency response procedure should be included in the Emergency Response Plan to cover a release of liquid oxygen at the RRF.

8 REFERENCES

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

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[3] Arcadis Australia Pacific Pty Limited, “Environmental Impact Statement, Sell & Parker Kings Park Metal Recovery and Recycling Facility Expansion,” 2020.

[4] M.J. Harvey & Associates Pty Ltd, “Fire Proection Measures Report for Metal Recycling Facitlity 23 - 45 Tattersall Road Kings Park NSW 2148,” 2017.

[5] Sparks & Partners, “Fire Hydrant Assessment Report - Sell & Parker Blacktown, 45 Tattersall Rd, Kings Park, NSW 2148,” 2020.

[6] Fire and Rescue NSW, “Fire Safety Guidelines - Fire Safety in Waste Facilities,” 2020.

[7] National Transport Commission, Australian Code for the Transport of Dangerous Goods by Road & Rail, Edition 7.6, 2018.

[8] SafeWork NSW, “Notification of Hazardous Materials on Premises, NDG005193,” 7 March 2021.

[9] Arriscar Pty Ltd, “Preliminary Hazard Analysis of Sell & Parker Pty Ltd Metal Recycling Facility Expansion,” 2014.

[10] Health and Safety Executive, “Fire and explosion hazards in the use of oxygen,” 2008.

[11] SafeWork Australia, “Confined Spaces, Code of Practice,” 2011.

[12] NSW Department of Planning, *HIPAP 4: Risk Criteria for Land Use Safety Planning,* 2011.

[13] UK HSE, “Failure Rate and Event Data for use within Risk Assessments,” 2019.

[14] Sell & Parker, “Investigation Report, 24th April 2017”.