PRELIMINARY HAZARD ANALYSIS
FOR AUTO RECYCLERS PTY LTD
57-69 TATTERSALL ROAD, KINGS PARK

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EXECUTIVE SUMMARY

Benbow Environmental (BE) was commissioned by Auto Recyclers Pty Ltd to prepare a Preliminary Hazard Analysis (PHA) for the State Significant Development (SSD 8375) located at 57-69 Tattersall Road, Kings Park NSW. This assessment addresses the risks of fire or explosion presented by the use of the hammermill in motor vehicle recycling site operations, stockpile fires and diesel storage.

The assessment has been carried out in accordance with the DoPI guidelines and has determined that the operation of the proposed development meets the criteria outlined in the HIPAP No. 4 *Risk Criteria for Land Use Safety Planning* and would not cause any risk, significant or minor, to the community, with the recommended safeguards in place.

The chemical storage on site does not exceed the State Environmental Planning Policy No. 33 screening thresholds.

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1. INTRODUCTION

Benbow Environmental has been commissioned by Auto Recyclers Pty Ltd to prepare a Preliminary Hazard Analysis (PHA) for the State Significant Development (SSD 8375) located at 57-69 Tattersall Road, Kings Park NSW. This assessment addresses the risks of fire or explosion presented by the use of the shredder/hammermill in site operations, the onsite metal stockpiles and the diesel storage.

The dangerous goods that would be stored on site do not exceed the State Environmental Planning Policy No. 33 screening thresholds.

The development will process 130,000 tonnes per year of metal scrap and motor vehicles.

1.1 Scope of Works

The scope of this report is limited to the following:

- Conduct the Preliminary Hazard Analysis (PHA) assessment by:
  - Review of the proposed development's activities and site operations;
  - Identifying, analysing and quantifying the risks associated with the development in accordance with the Department of Planning and Infrastructure's SEPP33 and HIPAP guidelines; and
- Preparation of a Preliminary Hazard Analysis (PHA) report outlining the methodology and outcomes of the assessment.

2. SITE AND PROJECT INFORMATION

The subject site is located at 57 Tattersall Road, Kings Park NSW 2148. Site identification and land use information are summarised in Table 2-1. The site and lot boundaries are shown in Figure 2-1.

Table 2-1: Site Identification

Lot/Plan No.	100 DP792731
Coordinates MGA56	306338.9, 6263584.7
Local Government Area	Blacktown
Approximate site area	60,000 m^2
Current Land Zoning	IN1 – General Industrial

Notes: Source: https://www.planningportal.nsw.gov.au/; https://maps.six.nsw.gov.au/

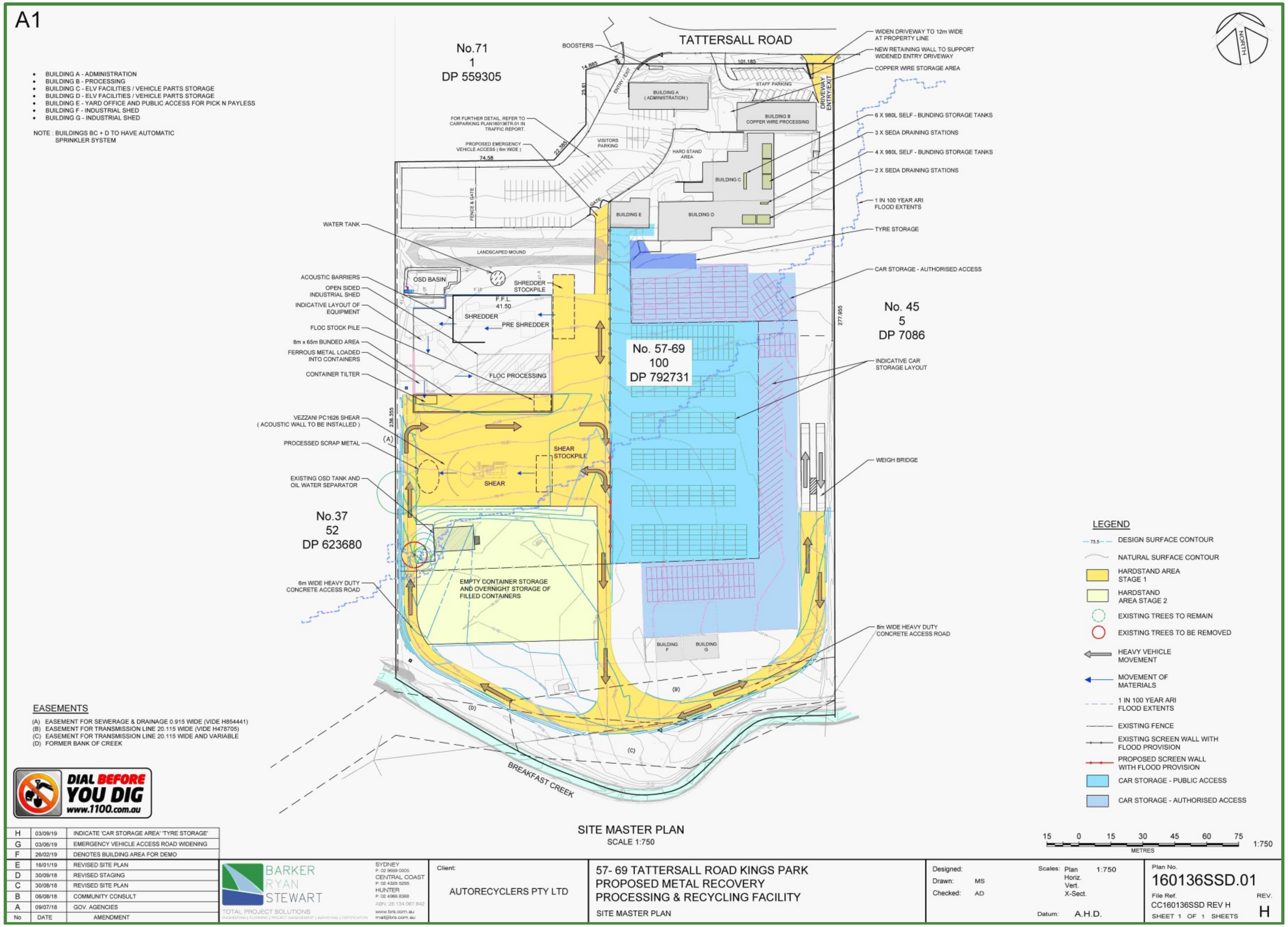
The operations and type and quantities of chemicals and fuels stored at the site have been inspected, recorded and as they reflect the nature of chemical storage that will be in place for the proposed development.

The aerial photograph of the site is show in Figure 2-1.

Figure 2-1: Site Aerial

Source: SixMaps 2018

Figure 2-2: Site Plan



2.1 Site Location

The subject site is located at 57-69 Tattersall Road, Kings Park NSW, legally described as Lot 100 DP792731.

The northern boundary is bounded by Tattersall Road and the adjacent plot of address 71-77 Tattersall Road, the east bounded by the adjacent plot of address 45 Tattersall Road, the west is bounded by the adjacent plot of address 37 Bessemer Street, Blacktown and the south is bounded by Breakfast Creek.

The site is located within land zoned under the Blacktown Local Environment Plan (2015) land zoning map (Sheet LZN_013) as IN1 – General Industrial. Located within the western Sydney metropolitan area, Kings Park is considered to be urban. As such, the site is situated within an industrial area which is surrounded by a low density of residential properties. A scrap metal recycling facility is located immediately adjacent to the east, a plastic moulding and container manufacturing facility is adjacent to the north. To the immediate west is a tile warehouse facility with office and a logistics business. To the south is a place of worship approximately 50 m from the southern border across Breakfast Creek.

2.2 Nearest Identified Sensitive Receptors

The location of the nearest residents to the proposed site are presented in Table 2-2 below, and shown in Figure 2-3 as Receptors R1 to R23.

Table 2-2: Identified Sensitive Receptors

Receptor ID	Address	Receptor type	Lot & DP	Direction from Site	Approx. Distance
R1	33 Camorta Close, Kings Park	Residential	24 DP 250566	N	650 m
R2	277 Madagascar Drive, Kings Park	Residential	190 DP 250071	NNE	800 m
R3	12 Elsom Street, Kings Langley	Residential	31 DP 1089417	NE	665 m
R4	1 Anthony Street, Blacktown	Residential	4 DP 26979	E	560 m
R5	189 Sunnyholt Road, Blacktown	Residential	23 DP 1063300	ESE	570 m
R6	5 Chedley Place, Marayong	Residential	11 DP 202506	WSW	590 m
R7	7 Cobham Street, Kings Park	Residential	167 DP 635194	NW	730 m
R8	65 Faulkland Crescent, Kings Park	Residential	1825 DP 261082	NNW	760 m
R9	Shree Swaminarayan Mandir, ISSO – Sydney Temple 1/44 Bessemer Street, Blacktown	Place of Worship	SP 70801	S	70 m
R10	Amber Tiles 37 Bessemer St, Blacktown	Industrial	52 DP623680	W	Adjacent

Table 2-2: Identified Sensitive Receptors

Receptor ID	Address	Receptor type	Lot & DP	Direction from Site	Approx. Distance
R11	Concrete Pty Ltd 77A Tattersall Rd, Kings Park	Industrial	2 DP1001383	NW	Adjacent
R12	Power Plastics 71-77A Tattersall Road, Kings Park	Industrial	1 DP559305	N	Adjacent
R13	Artisan 72-78 Tattersall Road, Kings Park	Industrial	6 DP657014	N	20 m
R14	Holcim 70 Tattersall Road, Kings Park	Industrial	7 DP220004	N	18 m
R15	Blacktown Container Return 66 Tattersall Road, Kings Park	Industrial	8 DP220004	N	20 m
R16	62 Tattersall Road, Kings Park	Industrial	9 DP220004	N	20 m
R17	Llandilo AutoRepairs 58 Tattersall Road, Kings Park	Industrial	10 DP 220004	N	20 m
R18	Bethel Car Care 3/54 Tattersall Road, Kings Park	Industrial	12 DP 220004	N	30 m
R19	Sell and Parker 45 Tattersall Road, Kings Park	Industrial	5 DP 7086	E	Adjacent
R20	Hardware & General Supplies Limited Blacktown 24-32 Forge Street, Blacktown	Industrial	62 DP 566051	S	45 m
R21	Rheem Solar Specialist Blacktown 34 Forge St, Blacktown	Industrial	38 DP 243920	SW	50 m
R22	Parramatta Exhaust 29 Forge St, Blacktown	Industrial	33 DP243920	SE	110 m
R23	46 Bessemer St, Blacktown	Industrial	501 DP1027448	S	20 m

Figure 2-3: Nearest Sensitive Receptors

↑N

Legend:
Lot boundaries: Subject site
Sensitive Receptors: **+ R1**

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2.3 NEAREST WATERWAY

The nearest waterway to the site is breakfast creek, which is located at the rear of the subject site.

2.4 DESCRIPTION OF OPERATIONS

Scrap car bodies would be complete cars or vans, with or without engines with fuel tanks and any other enclosed containers which might contain flammable or explosive material. Upon receipt of vehicles and prior to shredding, fuel and oil filler caps are removed and hazardous materials drained or removed, including fuels, lubricating oils, transmission fluids, brake and steering fluids, coolant fluids, refrigerants, windshield washer fluid, lead acid batteries or other batteries, oil filters, mercury-containing parts, tires, lead battery cable connectors and tire weights.

The quantities of materials proposed to be processed at the site will be a maximum annual tonnage throughput of 130,000 tonnes.

Site equipment used will include operation of SEDA draining stations, shredder (hammermill), dust buster, a preshredder, and non-ferrous downstream processing equipment and separate shearing operations.

There will be no building wastes, or putrescible wastes stored on site. Used lead acid batteries will be temporarily stored on site before being removed off site for recycling.

The site will store waste tyres externally near building E and building D.

The site will recycle copper wire in building B using a copper wire granulator.

The following sections present the metal recycling process.

2.4.1 Pre-shredding

The pre-shredding process shreds materials that are difficult or considered too risky to process in the shredder due to the potential for explosion, fire or damage to the equipment in the shredding process, such as:

- Complete car bodies in “as received” condition, with or without engines or in flattened condition;
- Iron and steel scrap up to a thickness of 8 mm; and
- Hard packed bales of scrap metal.

2.4.2 Shredder Feed

Coarse metal pieces are loaded into the shredder. Pre-shredded car bodies and other waste steel pieces are placed onto the steel conveyor and transported to the top of the in-feed chute. The incline chute directs the waste items to the shredder via a set of double feed rollers (DFR). The DFR has triangular shaped spikes and horizontal ridges that render and flatten scrap to a thickness to allow entry into the shredder. The speed of the incoming feed is controlled by a programmed logic controller (PLC) software.

2.4.3 Shredding

The shredder is the core part of the plant and is a THOR 2121K mobile hammer mill with a horizontal shaft, swing hammer machine and side feed design. The shredder accepts waste material up to 2.6 m in width. This is decomposed into even-sized scraps. Within the rotor are wear-resistant caps and hammers that continually grind, strike and compress the metal pieces. When the metal pieces have broken down into small enough sizes, they fall through the grate opening at the bottom of the shredder and onto a vibratory conveyor beneath. The system allows the operator to manually eject pieces that are too hard to be ground preventing damage to the rotor. Other items that are unable to be shredded can pass around the rotor and discharged from the shredder through the reject door at the rear of the shredder.

A dust suppression system would be installed to remove and collect dust and other small particles during the shredding process. The cyclonic dust suppression system would have two (2) air ducts:

- One air duct would be connected to the upper part of the shredder to remove larger particles and dust. The dust would be removed by a high efficiency cyclonic wet scrubber unit and conveyed to the ASR (auto shredder residue) area.
- The other air duct connects to the Z-Box just before the separation system where it collects fine substances such as fibre, plastics and glass chips. These substances are also ejected onto the ASR conveyor.

Water is required for dust suppression in this system. Outgoing air is ducted into a wet scrubber where dust and fine particles are trapped in a water tank. Heavy ASR precipitates at the bottom of the tank. A scraper removes the ASR precipitate to the ASR conveyor and the remaining water is treated and then pumped back to the dust suppression system forming a loop. Clean air is discharged through a stack. The flame proof design would offer additional safety from potential fire and explosion risk of the system.

2.4.4 Separation

From the shredder, the fragment materials both metal and “floc” (scraps) are transferred to an electromagnetic drum via a rubber belt conveyor. Along the way, the scraps pass through a Z-Box where any dust generated is removed by the dust suppression system. The magnetic unit then separates scraps into ferrous and non-ferrous material. More than 98% of the ferrous scrap can be recovered in this process. From here, the ferrous content is ready to be discharged. The non-ferrous scrap falls back onto a conveyor and an additional electromagnetic drum is used to recover the remaining 2% ferrous material. No more than 30 tonnes of material will be removed to landfill on a daily basis.

Shredder floc is typically made up of plastic, rubber, non-ferrous metals and textiles. The average composition is shown in the table below.

Table 2-3: Average Shredder Floc Composition

Material Type	Average Composition Range (% weight)
Plastic	35-55%
Rubber	10-20%
Metals	6-13%
Textiles	7-15%
Fines (paint, glass, sand)	10-20%

(Hyder Consulting, 2014)

2.4.5 Discharging

This process removes any contaminants (non-ferrous matter) that may still be contained in the ferrous material from the separation process. Non-ferrous material is removed manually. This material then would have an ideal composition and density for refinement and would be ready for melting.

2.4.6 Sieving

Non-ferrous scraps are passed through a trommel screen where they are classified by size. The first section removes fine particles such as glass, sand and dust which would drop into the ASR bunker. The second section of the trommel screen removes medium sized scraps which would be sent to the Eddy Current Separator (ECS). The ECS classifies non-ferrous scraps by material type by separating scrap into copper, aluminium, lead, zinc, magnesium and waste.

The waste falls onto conveyors where it would be manually sorted to recover unclassified non-ferrous material. Content too large to pass through the trommel screen would also be manually sorted.

2.4.7 Storage

Shredded and separated finished recyclable metals would be stored in stockpiles both within the purposed built non-ferrous building in bunkers adjacent to this building and the recyclable steel pieces in the stockpile.

2.4.8 Shear Feed

A Vezzani PC 1626 Shearer will be located to the south of the shredding operations. Shearing operations are typically undertaken for metal plates, poles and larger metal parts.

The shearing process is considered to have negligible risk as metals used in this operation will not contain explosive LPG and fuel tanks.

2.4.9 Process Control

Process control includes hardware and software to control the system, the operator can remotely control the shredding process via touch screen or control button and make adjustments of controllable variables of individual equipment, such as the height of Double Feed Roller, feeding speed of conveyors, performance of the magnetic separators and eddy current separators.

Automatic control function is safer than the traditional operator function, by monitoring the in-feed materials, it is able to maximise driver motor performance and control the in-feed speed to increase average production, which is almost impossible when it is manually operated.

2.4.10 Chemical Storage

The chemicals required for the proposed processing of 130,000 T of scrap metal and the end of life vehicle treatment facility are detailed in Table 2-4.

The ELV treatment facility will be located within the existing buildings located in the north eastern region of the site. The ELV treatment facility will remove fuel, oil and the used lead acid batteries from the vehicles. There will be a number of 980 L tanks (ten total) to accommodate separation of fuel, oil, coolant and brake fluid at the site. The unleaded petrol removed from the vehicles will be stored in five (5) of the double walled 980 L self-bunding storage tanks. Two (2) double walled 980 L self-bunding storage tanks would be used to store diesel fuel. Three (3) double walled 980 L self-bunding storage tanks would be used to store waste oil. Details are shown in Figure 2-4. A maximum quantity of 4,900 L of unleaded petrol would be stored on site. The petrol is used as fuel for staff personal vehicles.

The LPG is removed from the ELVs and stored in LPG bottles of various sizes (88-500 L) and are removed offsite for reuse by a licenced contractor, and then returned empty to the site for further use. Used lead acid batteries (ULAB) are also removed from the ELVs and stored in wrapped pallets and removed by a licenced contractor for reuse.

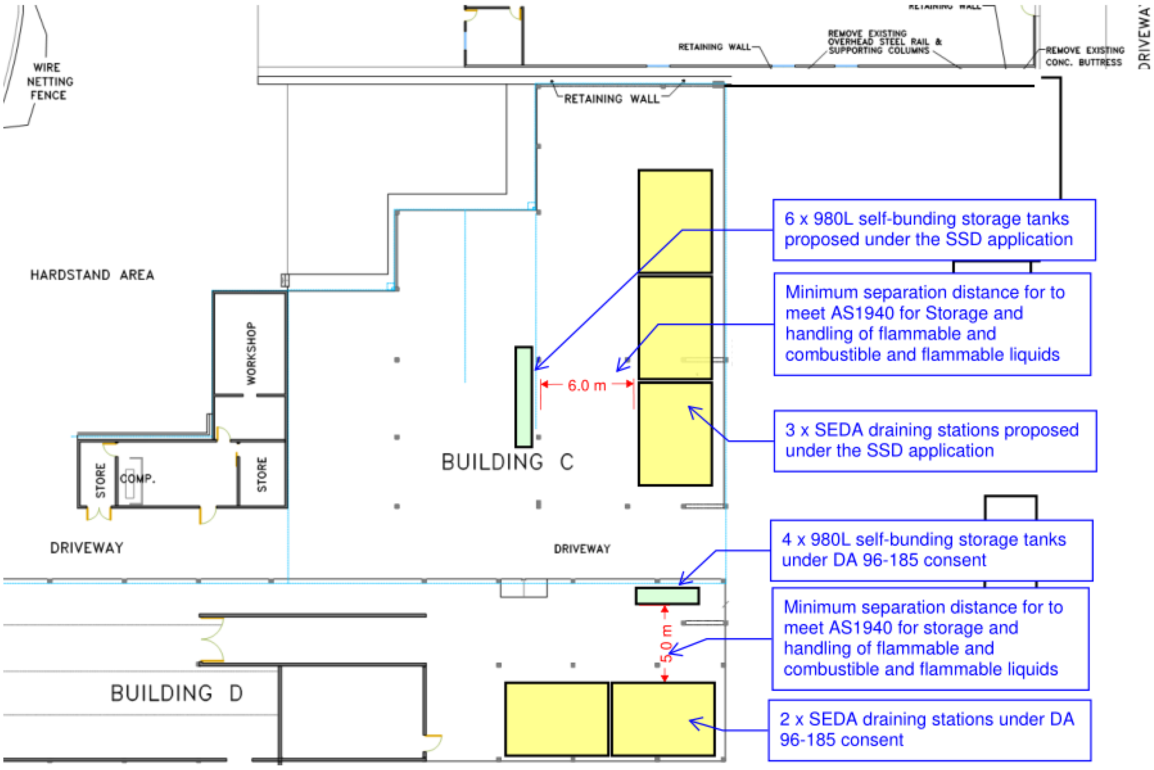
An existing 15,000 L diesel bulk storage tank will continue to be used as fuel for mobile equipment and scrap metal processing machinery. This tank will be fully bunded and will be located external to the buildings. A 1,500 L mobile tank is used to transfer diesel fuel from the 15,000 L bulk storage tank to the machinery.

1,000 L of Synthecol XL Foamer is stored on site within one IBC, this is used as a metal dust suppressant and is a non-dangerous good.

Table 2-4: Chemical Storage

Chemical Name	DG Class	UN Number	Onsite Maximum Quantity	Storage Type
Unleaded Petrol	Class 3 PGII	1203	4,900 L	5 x 980 L tanks
Oil/Coolant	C2 Combustible Liquid (Non-Dangerous Goods)	-	2,940 L	3 x 980 L tanks
LPG	Class 2.1	1075	5,000 L	Bottles/Cylinders
ULAB	Class 8 PG III	2794	5 Tonnes	5 × 1 Tonne Pallets
Diesel	C1 combustible liquid / Class 9 PG III	3082	16,960 L	One 15,000 L bulk storage tank; and Two 980 L tank
Synthecol XL Foamer	Non-Dangerous Goods	–	1,000 L	IBCs

Figure 2-4: SEDA Locations



3. ASSESSING THE POTENTIAL AS A HAZARDOUS / OFFENSIVE DEVELOPMENT OR INDUSTRY

The potential for a site or a development to be considered as potentially hazardous or offensive industry are assessed by considering the amount of hazardous materials stored on site, often to be dangerous goods. However in this particular case, in addition to storage of diesel fuel on site, the LPG and petrol fuel tanks from scrapped cars were considered to be the additional hazardous materials of concern that could potentially cause the proposed development to be hazardous or offensive.

The following list provides the relevant guidelines published by the NSW Department of Planning and Infrastructure (DoPI) that are required to be referenced (including referencing for the purpose of discussion) or be adhered with as part of preparing this assessment:

- "Hazardous and Offensive Development Application Guidelines, Applying SEPP 33";
- "Assessment Guideline, Multi-Level Risk Assessment";
- "Hazardous Industry Planning Advisory Paper No. 4 – Risk Criteria for Land Use Planning";
- "Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis"; and
- "Hazardous Industry Planning Advisory Paper No. 10 – Land Use Safety Planning".

3.1 SEPP33 SCREENING

3.1.1 Onsite Storage

A preliminary risk screening of the proposed development in accordance *with State Environment Planning Policy No. 33 – Hazardous and Offensive Development* (SEPP 33) has been undertaken, with results provided below. The quantities of dangerous goods do not exceed the threshold quantities for applying SEPP 33. Therefore, a Preliminary Hazard Analysis (PHA) is not required.

Table 3-1: SEPP 33 Preliminary Risk Screening

Class	Screening Threshold	Description	Site Specific Description	Quantity to be stored	Triggers SEPP 33
Class 1.2	5 tonne	Explosives	None	None	No
Class 1.3	10 tonne	Explosives	None	None	No
Class 2.1	10 tonne or 16 m^3 if stored above ground 40 tonnes or 64 m^3 if stored underground or mounded	Flammable Gases	LPG	5,000 kg	No
Class 2.2	Not Relevant	Non-flammable, non-toxic gases	None	None	Not relevant
Combustible Liquid C1	Not relevant	Combustible liquid with flashpoint of 150°C or less	Diesel	16,960 L	Not Applicable

Table 3-1: SEPP 33 Preliminary Risk Screening

Class	Screening Threshold	Description	Site Specific Description	Quantity to be stored	Triggers SEPP 33
Combustible Liquid C2	Not relevant	Combustible liquid with flashpoint exceeding 150°C	Waste oil (hydraulic oil, engine oil, lubricant oil, drained diesel fuel)	2940 L	Not Applicable
Class 2.3	5 tonne	Anhydrous ammonia	None	None	No
	1 tonne	Chlorine and sulphur dioxide stored as liquefied gas in contains <100 kg	None	None	No
	2.5 tonne	Chlorine and sulphur dioxide stored as liquefied gas in containers >100 kg	None	None	No
	100 kg	Liquefied gas kept in or on premises	None	None	No
	100 kg	Other toxic gases	None	None	No
Class 3	Assessed by reference to figures 8 & 9 of applying Sepp 33	Flammable liquids PG I, II and III	Petrol (Class 3 PGII)	4,900 L	No
Class 4.1	5 tonne	Flammable Solids	None	None	No
Class 4.2	1 tonne	Substances liable to spontaneous combustion	None	None	No
Class 4.3	1 tonne	Substances which, in contact with water, emit flammable gases	None	None	No
Class 5.1	25 tonne	Ammonium nitrate – high density fertiliser grade	None	None	No
Class 5.1	5 tonne	Oxidising substances	None	None	No
Class 5.1	2.5 tonne	Dry pool chlorine – in containers <30 kg	None	None	No
Class 5.1	1 tonne	Dry pool chlorine – in containers >30 kg	None	None	No
Class 5.1	5 tonne	Any other Class 5.1	None	None	No
Class 5.2	10 tonne	Organic peroxides	None	None	No
Class 6.1 PGI	0.5 tonne	Toxic substances	None	None	No

Table 3-1: SEPP 33 Preliminary Risk Screening

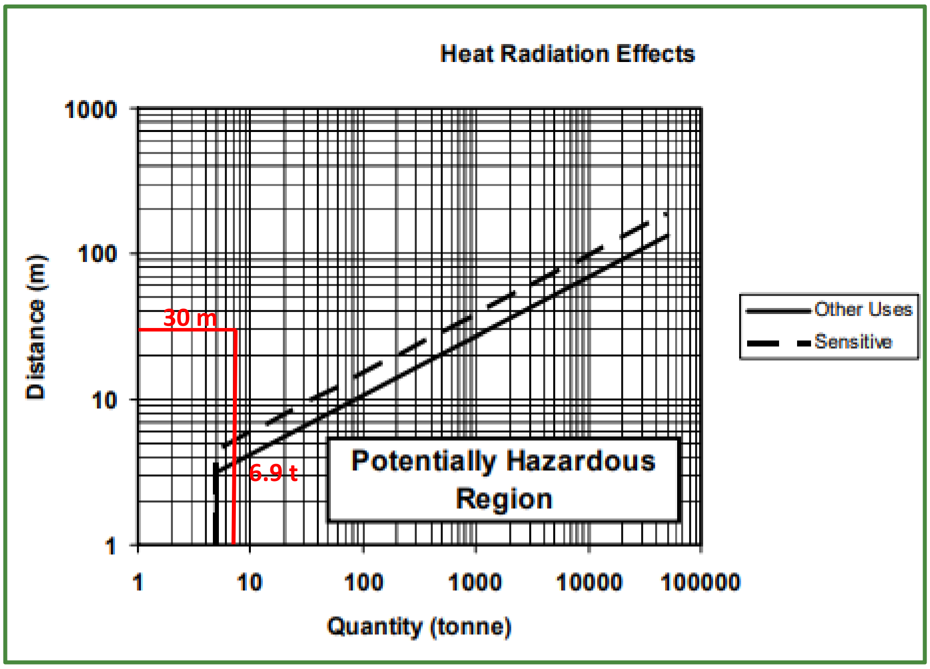
Class	Screening Threshold	Description	Site Specific Description	Quantity to be stored	Triggers SEPP 33
Class 6.1 PGII & III	2.5 tonne	Toxic substances	None	None	No
Class 6.2	0.5 tonne	Infectious substances	None	None	No
Class 7	All	Radioactive Material	None	None	No
Class 8 PGI	5 tonne	Corrosive substance	None	None	No
Class 8 PGII	25 tonne	Corrosive substance	None	None	No
Class 8 PGIII	50 tonne	Corrosive substance	ULAB	5 Tonnes	No

The Applying SEPP 33 Guidelines states the following in relation to Class C1 storage:

> *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, class 3PGI, II or III, then they are to be treated as class 3PGIII, because under these circumstances they may contribute fuel to a fire.*

The majority of the diesel stored at the site will be within a separate 15,000 L self bunded tank and therefore is not considered to be potentially hazardous. The 980 L tanks of diesel to be located within the ELV facility has been considered with the unleaded petrol as a Class 3PGIII. This results in a total of 6,860 L of Class 3 PGII and PGIII flammable liquids stored on site. This quantity is considered in the following figure.

Figure 3-1: Class 3 PGII and 3PGIII Flammable Liquids Heat of Radiation



The quantity of Class 3 PGII and PGIII flammable liquids on site at any one time is 6,860 L or less corresponding to approximately 6.9 tonnes. The distance of the storage location to the nearest boundary is less than 30 m, which is outside of the potentially hazardous region of the heat of radiation effects graph shown in Figure 3-1.

As seen in the table above the quantities of chemicals required for both the ELV treatment facility and the processing of 130,000 T of scrap metal do not exceed the SEPP 33 threshold and therefore SEPP33 does not apply.

3.1.2 Transport Quantities

The proposal has been assessed against the transportation screening threshold stipulated in the SEPP 33 guidelines. The proposed load details and frequency of delivery for the proposed dangerous goods to be stored and used at the site is described in the following table.

Table 3-2: Transportation details of loads of dangerous goods

Dangerous Good Name	Dangerous Goods Class	Load Details		Delivery Frequency
		Quantity per load	Load Type	
Unleaded Petrol	Class 3 PGII	100 L	Bulk	<5 per week
Waste Oil	C2 Combustible Liquid (Non-Dangerous Good)	2,500 L	Bulk	1 per month
LPG	Class 2.1	5, 000 L	Package	1 per month
ULAB	Class 8 PG III	5 tonnes	Package	1 per month
Diesel	C1 combustible liquid / Class 9 PG III	15,000 L	Bulk	2 deliveries per month
Synthecol XL Foamer	Non-Dangerous Goods	1000 L	Package	1 delivery every 6 weeks

As staff members use the petrol within their personal cars, small quantities of petrol are effectively transported off site, which would be the most frequent chemical transport movement; however this quantity would be well below the minimum quantity of 3 tonnes for Class 3 PGII.

Table 3-3 is an excerpt of Table 2 – "Transportation Screening Thresholds" from *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33, NSW Government Department of Planning (2011)* and provides the transportation screening thresholds for dangerous goods classes of relevance to the site.

Table 3-3: Transportation Screening Thresholds

Dangerous Goods 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
8	>500	>30	2	5
9	>1000	>60	No limit	-

The maximum quantity per load and delivery frequency for all dangerous goods is well below the transportation screening threshold. Therefore, the transport of dangerous goods for the proposed development will not trigger SEPP33.

3.2 Risk Classification and Prioritisation

This technique has been recommended in the *Multi-level Risk Assessment* guideline (2011) published by DoPI to determine the level of assessment for potentially hazardous facilities. This technique is based on the *Manual for classification of risks due to major accidents in processes and other related industries* (IAEA rev 1, 1996).

The IAEA method was developed to produce a broad estimate of the risks due to major accidents from the production, storage, handling and transport of hazardous materials. This method relies on broad estimations of consequences and likelihood of accidents which outputs can be used to determine the appropriate level of further assessment. The technique involves three stages:

- Estimation of the consequences;
- Estimation of the probability of a major accident happening; and
- Estimation of societal risk.

In addition to this, the principles of this method rely on estimating the societal risk, rather than individual risk. Societal risk is defined in this context as the relationship between the number of people killed in a single accident and the chance or likelihood that this number be exceeded.

The risk classification and prioritisation method has been carried out by utilising broad assumptions to put a perspective on the risks associated with the development.

3.2.1 Classification of Type of Activities and Inventories

The classification of the materials stored onsite is provided in Table 3-4 in accordance to the IAEA Table II.

Table 3-4: Estimation and Assessment of the Proposed Development to the IAEA Method

Scenario	Assumptions/Figures Used	IAEA Method Criteria	Scenario Criteria Comparison & Comments
Explosion of LPG/Petrol Fuel Tank in Hammermill	Assuming maximum concentration of LPG/petrol that could ignite in the largest commercially-available fuel tank available for any vehicle.	IAEA Table IV(a) does not provide classification	Events are not considered credible for further assessment
Fire from storage of 1,500 L mobile diesel tank	Assuming 1.5 tonnes, aboveground storage, vapour pressure < 0.3 bar at 20 degrees Celsius. Storage type: other. Ref Number 3	IAEA Table IV(a) does not provide classification	Events are not considered credible for further assessment
Fire from storage of 15,000 L ground bulk storage tank	Assuming 15 tonnes, aboveground storage with tank pit, vapour pressure < 0.3 bar at 20 degrees Celsius. (Ref number 1)	IAEA Table IV(a) does not provide classification	Events are not considered credible for further assessment

The scenarios considered indicate that the risk associated with these particular incidents is minimal to negligible, according to the IAEA method.

4. HAZARD ANALYSIS

4.1 LEVEL OF ASSESSMENT

The Multi-Level Risk Assessment approach has been developed and recommended by the Department of Planning and Infrastructure (DoPI). It relies on a systematic and analytical approach to the identification and analysis of hazards and the quantification of offsite risks assessing any risk tolerability and landing use safety implications. The DoPI has advocated a merit-based approach, wherein the level and extent of analysis must be appropriate to the hazards present and therefore, need only progress to the extent necessary for the particular case.

There are three levels of assessment specified in the Multi-Level Risk Assessment (DoPI 2011c) document and they are listed below.

Level 1 – Qualitative Analysis: primarily based on the hazard identification techniques. A level 1 assessment can be justified if the analysis of the facility demonstrates Societal Risk in the *negligible zone* and there are no potential accidents with significant off-site consequences.

Level 2 – Partially Quantitative Analysis: using hazard identification and the focused quantification of key potential off-site risk contributors. A level 2 assessment can be justified when the Societal Risk estimates fall within the middle *ALARP zone* or if one or more significant risk contributors had been identified but the frequency of risk contributors having off-site consequences is relatively low.

Level 3 – Fully Quantitative Risk Analysis: based on the full and detailed quantification of risks, consistent with HIPAP No. 6. A level 3 assessment is required where the Societal Risk from the facility estimates fall within the *intolerable zone* or where there are significant off-site risk contributors, and level 2 assessments is unable to demonstrate that the risk criteria will be met.

The level of assessment required is dependent on a risk-based method which relies on broad estimations of consequences and likelihood of accidents. A risk classification and prioritisation technique is often used to determine the level of assessment. This technique provides the estimation of individual and societal fatality risk which can be compared against the given criteria. To be conservative, a Level 3 Fully Quantitative Risk Analysis has been carried out.

4.2 METHODOLOGY

The procedures adopted by this study for assessing hazardous impacts involve the following steps:

Step 1: Hazard identification;
Step 2: Risk analysis (consequence and probability estimations); and
Step 3: Risk evaluation and assessment against specific criteria.

The following sections of the report discuss the hazard identification process as prescribed by the Department of Planning and Infrastructure in the documents *Multi-Level Risk Assessment* (DoPI 2011c) and *Hazardous Industry Planning Advisory Paper No 6* (*HIPAP No. 6) – Guidelines for Hazard Analysis* (DoPI 2011b).

4.2.1 Hazard Identification

This is the first step in the risk assessment. It involves the identification of all theoretically possible hazardous events as the basis for further quantification and analysis. This does not in any way imply that the hazard identified or its theoretically possible impact will occur in practice. Essentially, it identifies the particular characteristics and nature of hazards to be further evaluated in order to quantify potential risks.

To identify hazards, a survey of operations was carried out to isolate the events which are outside normal operating conditions and which have the potential to impact outside the boundaries of the site. In accordance with HIPAP No. 6, these events do not include occurrences that are a normal part of the operation cycles of the site but rather the atypical and abnormal, such as the occurrence of a significant liquid spill during product transfer operations.

A qualitative approach in accordance with the Australian/New Zealand Standard 31000:2009 – "*Risk Management – Principles and Guidelines*" has been established to assist in the identification, selection and prioritisation of hazardous scenarios for further investigation and analysis.

4.2.2 Risk Analysis

After a review of the events identified, selected and prioritised in the hazard identification phase and the identification of prevention/protection measures incorporated into the design of the site, events considered to have the potential to result in significant off-site impacts or which have the potential to escalate to larger incidents are carried over to the next stage of analysis. Discussions are also made at this phase of this assessment to determine whether some of the identified hazardous scenarios warrant further analysis. The next phase involves conducting a consequence and a frequency estimation exercise.

4.2.2.1 Consequence Estimation

This aspect involves the analysis and modelling of the credible events carried forward from the hazard identification process in order to quantify their impacts outside the boundaries of the site. In this case, these events typically include fire and the potential effects on people and/or damage to property.

4.2.2.2 Probability Likelihood Estimation

If necessary, the likelihood of incidents are quantified by adopting probability and likelihood factors derived from published data.

4.2.3 Risk Evaluation and Assessment against Specific Criteria

The risk analysis includes the assessment of consequences for each hazardous event and the frequencies of each initiating failure. The results of these consequence calculations together with the probabilities and likelihood figures estimated were then compared against the accepted criteria, as specified by DoPI. Whether it is considered necessary to conduct the predictions would depend on the probability figures, likelihood estimations, and if the risk criteria are exceeded.

4.3 Hazard Analysis Assessment Criteria

The risk criteria applied by Department of Planning and Infrastructure are published in the document *Hazardous Industry Planning Advisory Paper No 4* (HIPAP No. 4) – *Risk Criteria for Land Use Safety Planning* (DoPI 2011a). The following is a general discussion of the criteria that is used to assess the risk of a development on the surrounding community and environment.

4.3.1 Individual Fatality Risk Levels

The following paragraphs have been reproduced from HIPAP No. 4 to describe individual fatality risk levels:

> *"People in hospitals, children at school or old-aged people are more vulnerable to hazards and less able to take evasive action, if need be, relative to the average residential population. A lower risk than the one in a million criteria (applicable for residential areas) may be more appropriate for such cases. On the other hand, land uses such as commercial and open space do not involve continuous occupancy by the same people.*
>
> *The individual's occupancy of these areas is on an intermittent basis and the people present are generally mobile. As such, a higher level of risk (relative to the permanent housing occupancy exposure) may be tolerated. A higher level of risk still is generally considered acceptable in industrial areas."* (DoPI 2011a)

The risk assessment criteria for individual fatality risk are presented below.

Table 4-1: Individual Fatality Risk Criteria (HIPAP No. 4)

Land Use	Risk Criteria x 10^{-6} (per year)
Hospitals, schools, childcare facilities, old age housing	0.5
Residential, hotels, motels, tourist resorts	1
Commercial developments including retail centres, offices and entertainment centres	5
Sporting complexes and active open space	10
Industrial	50

Figures in the table above have been utilised in the assessment.

4.3.2 Injury Risk Levels

HIPAP No. 4 provides guideline criteria for heat of radiation, explosion overpressure and toxic exposure. The quoted requirements from the referenced document have been summarised as follows:

- Guideline criteria for heat of radiation:

> *"Incident heat flux radiation at residential and sensitive use areas should not exceed 4.7 kW/m^2, at frequencies of more than 50 chances in a million per year."*

- Guideline criteria for 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."

- Guideline criteria for toxic exposure:

  "Toxic concentrations in residential areas should not exceed a level that would be seriously injurious to sensitive members of the community following a relatively short period of exposure at maximum frequency of 10 in a million per year."

  and

  "Toxic concentrations in residential areas should not cause irritation to the eyes or throat, coughing or other acute physiological responses in sensitive members of the community over a maximum frequency of 50 in a million per year."

Please note that a risk hazard assessment only examines events that are considered to have the potential for significant off-site consequences and may not entirely reflect all variations in people's vulnerability to risk.

4.3.3 Risk of Property Damage and Accident Propagation

HIPAP No. 4 indicates that siting of a hazardous installation must account for the potential for propagation of an accident, causing a "domino" effect on adjoining premises. This risk would be expected within an industrial estate where siting of hazardous materials on one site may potentially cause hazardous materials on an adjoining premises to further develop the size of the accident.

The criteria for risk of damage to property and of accident propagation are stated as follows:

"Incident heat flux at neighbouring potentially hazardous installations or at land zones 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."

and

"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."

4.3.4 Criteria for Risk Assessment to the Biophysical Environment

The assessment of the ultimate effects from toxic releases into the natural ecosystem is difficult, particularly in the case of atypical accidental releases. Consequence data is limited and factors influencing the outcome variable and complex. In many cases, it may not be possible or practical to establish the final impact of any particular release. Because of such complexity, it is inappropriate to provide generalised criteria to cover any scenario. The acceptability of the risk will depend upon the value of the potentially affected zone or ecosystem to the local community and wider society.

The suggested criteria for sensitive environmental areas relate to the potential effects of an accidental release or an emission on the long-term viability of the ecosystem or any species within it and are expressed as follows:

> *"Industrial developments should not be sited in proximity to sensitive natural environmental areas where the effects or consequences of the more likely accidental emissions may threaten the long-term viability of the ecosystem or any species within it."*
>
> and
>
> *"Industrial developments should not be sited in proximity to sensitive natural environmental areas where the likelihood or probability of impacts that may threaten the long-term viability of the ecosystem or any species within it is not substantially lower than the existing background level threat to the ecosystem."*

4.4 Assessment Criteria Applicable to the Proposed Development Application

In accordance with *HIPAP No 4 Risk Criteria for Land Use Safety Planning*, the following discussion of the risk assessment criteria considered applicable to the proposed development has been provided.

4.4.1 Heat-Flux Radiation Criteria

The effects of various heat fluxes (radiation) as a result of a fire incident are given in Table 4-2. The HIPAP No 4 paper (DoPI 2011a) suggests a heat flux of 4.7 kW/m^2 and a frequency of 50 in a million per year to be used as the risk injury criterion for thermal effects at residential and sensitive use areas.

Table 4-2: Heat Radiation Impact (DoPI HIPAP No. 4)

Heat Flux Level	Effect
4.7 kW/m^2	Heat radiation level for possibility of injury to persons exposed. This heat radiation level is regarded to be high enough to potentially cause pain in 15-20 seconds and injury after 30 seconds of exposure.
12.6 kW/m^2	Heat radiation level for possibility of fatality at extended exposure and structural failure of nearby affected structures. At this level, injury is highly probable with a significant possibility for fatality to occur. Thin steel may undergo structural failure due to thermal stress and the temperature of wooden structures may increase to a heat where exposure to a naked flame can trigger ignition.
23 kW/m^2	Heat radiation level for possibility of fatality at instantaneous exposure and definite structural failure of nearby unprotected structures. The possibility for fatality is likely at this level, with spontaneous ignition of wood after long exposure and structural failure of unprotected steel due to thermal stress.

4.4.2 Explosion Overpressure Criteria

HIPAP No. 4 stipulates the following criteria for explosion overpressures:

> "*Incident explosion overpressures at residential and sensitive land use areas should not exceed 7 kPa at frequencies of more than 50 chances in a million per year.*"
>
> and
>
> "*Incident explosion overpressures 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.*"

4.4.3 Toxic Criteria

The toxic exposure criteria can be deemed applicable if unnecessary toxic emission releases are caused as a result of the operations on site. HIPAP No. 4 indicates that citing of potentially hazardous developments also needs to consider the risk from accidental releases into the biophysical environment.

The National Institute for Occupational Safety and Health (NIOSH) and the American Industrial Hygiene Association (AIHA) provides the following 4 categories of health impact criteria which are of relevance during an emergency event:

- Immediately Dangerous to Life or Health (IDLH).
- Emergency Response Planning Guideline 1 (ERPG1).
- Emergency Response Planning Guideline 2 (ERPG2).
- Emergency Response Planning Guideline 3 (ERPG3).

The purpose of the values given for each of these limits for a particular chemical is to assess the capabilities of mitigation safeguards and emergency or accident response plans for the workplace.

The IDLH limit is defined by the Occupational Safety and Health Administration (OSHA) as:

> *"An atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere."*

The following are definitions for each ERPG level as defined by American Industrial Hygiene Association, 2011 Emergency Response Planning Guidelines (ERPG) and Workplace Environmental Exposure Levels (WEEL) Handbook:

> *"The ERPG-1 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing more than mild, transient adverse health effects or without perceiving a clearly defined objectionable odour.*

The ERPG-2 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action.

The ERPG-3 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects."

The ERPG-2 level can be considered synonymous to the IDLH limit, although it has been observed that both slightly vary from each when comparing values for each contaminant. For this reason, both IDLH and ERPG limits were required to be compared with in this assessment.

The above needs to comply with the following risk criteria:

- 10 in a million per year at dwellings; and
- 50 in a million per year at industrial premises.

4.4.4 Biophysical Environment Risk Criteria

The site is located within an established industrial area. The operational area would be fully paved. The diesel storage is located near the entrance to the site, away from the operational area and is bunded in accordance with AS1940.

Any leaks/spills resulting from incidents would be captured within the corresponding bund provided. Spill kits would be provided at all areas that are identified to be prone to spills. A housekeeping inspection would be undertaken regularly to ensure that leaks and spills do not cause any releases to the biophysical environment or provide a load that could initiate an unnecessary hazardous event.

Best practice in housekeeping and operational procedures would be implemented on site. Given this consideration, the proposed development would not introduce any additional risk that may threaten the long-term viability of the development and its effect to the local environment. Consequently, the DoPI-based criteria have been determined to be readily satisfied and no further analyses or discussions were considered necessary.

4.5 Hazard Identification

It has been identified in Section 3.2.1 that the diesel storage quantities and the LPG/petrol tank explosions are minimal using the IAEA method, and are not required to be further assessed.

Although identified by the IAEA assessment method that the risk are minimal, further investigation was carried out with due diligence to demonstrate that risks associated with the LPG and fuel tank explosions as well as the metal stockpiles are minimal.

Those identified to require further investigation would require additional frequency and consequence estimations established. The outcomes from this investigation are compared with the criteria outlined within the relevant Hazardous Industry Planning Advisory Papers.

4.5.1 Hazardous Materials

Included in this section is a summary of the hazardous materials, which is included to outline the information utilised in the assessment classified as hazardous according to WHS Regulations 2017.

4.5.1.1 LPG

Liquefied Petroleum Gas is a Class 2.1 Flammable Gas Dangerous Goods. It is a colourless, odourless gas (typically with added odour) in compressed liquid form in a pressure container and is mainly composed of:

- Ethane (typically 0-10%);
- Propane (typically 50-90%);
- Propene (typically 0-20%);
- Butane (typically 0-50%);
- Butane (typically 0-5%); and
- Ethyl Mercaptan (odorant - typically 25 mg/kg).

The flammability limit range is typically between 1.5% and 9.6% in air (v/v). Ignition sources including flames and static discharges should be kept away. In the event of a fire, do not extinguish the fire but cut off the gas supply and allow the gas to burn out. Use water to keep vessels cool or tank metal may weaken and result in explosion.

Hazardous combustion products include traces of carbon monoxide and nitrogen oxides while smoke, fumes, carbon monoxide and aldehydes may be generated during incomplete combustion.

For the proposed development, potential interactions with LPG would only occur when LPG fuel tanks are crushed or cut open.

Within the shredder, water sprays are provided and foam injection would be included in the fire services design of this part of the proposed facility.

4.5.1.2 Diesel

Diesel fuel is a C1 combustible liquid consisting of a mixture of hydrocarbons with carbon numbers in the range of C9 and higher. Vapours emitted can ignite rapidly when exposed to ignition sources such as heat, static accumulation, spark or open flame. These vapours, being heavier than air, can travel long distances to an ignition source and flash back causing fire and/or explosion. Appropriate separation distances from ignition sources and electrical equipment should be enforced. Electrostatic charges may be generated during pumping, transfer activities, tank cleaning, mixing and product agitation. If diesel is mixed with air and exposed to an ignition source, the flammable vapours can burn in open or explode in confined spaces.

In Australia, storage tanks containing diesel can be exposed to high temperatures, especially when exposed to direct sunlight. Diesel has a flash point of 63^{o}C, which is attainable under extreme conditions, and therefore presents a possibility that diesel contained within the storage tank can combust readily similar to petrol. Despite diesel achieving its flash point being attainable within its storage containment, it does not necessarily auto-ignite as its auto-ignition temperature is approximately 220°C or greater. Therefore, no risks are associated with this material under these conditions, so long as appropriate segregation of ignition sources and precautionary measures are provided.

Diesel fuel is an environmentally hazardous substance and for transport has UN No. 3082 and belongs to Class PGIII.

The inhalation of vapours and/or combustion products should be avoided as it may cause significant health effects. Hazardous combustion products of this substance may include smoke, carbon monoxide, oxides or sulphur and unidentified organic and inorganic compounds.

4.5.1.3 Petroleum

Petroleum or gasoline is a Class 3 PG II material, containing a complex mixture of hydrocarbons consisting of paraffins, cycloparaffins, aromatic and olefinic hydrocarbons (including benzene at 1.0% v/v maximum), with carbon numbers predominantly in the C4 to C12 range. It is noted as outlined in the respective data sheets that several additives at <0.1% v/v may be contained within this material.

The typical flash point of this substance is less than 40°C, with vapour pressures ranging between 620 to 800 hPa (at 37.8°C).

It is expected that under certain pressurised conditions (such as being trapped in a fuel tank, and be crushed/grinded/cut open), this material can potentially initiate a localised explosion.

4.5.2 Hazardous Events

The identification of possible hazardous events for this facility has been prepared with reference to available literature. A comprehensive list of credible and significant incidents identified is summarised in a Hazard Identification Chart provided in the following section.

4.5.2.1 Hazard Identification Chart

A Hazard Identification Chart has been prepared for the proposed site based on operating scenarios that are relevant to the proposed development.

The chart consists of six (6) columns, which are described as follows:

<u>Column 1</u>
Heading: Functional/Operation Area
The area of the site involved with the potential event is listed. If the entire site is involved, the source of risk is also identified.

<u>Column 2</u>
Heading: Possible Initiating Event
The individual events that are considered to be theoretically possible, likely or realistic are then listed. Where the possible consequences are similar the events are listed together.

<u>Column 3</u>

Heading: Possible Consequences

The outcomes of an event or events if it / these occurred are listed.

<u>Column 4</u>

Heading: Preliminary Scores for the Consequence, Likelihood and the Overall Risk

Using the modified consequence and likelihood qualitative analysis matrix from Australian/New Zealand Standard 31000:2009 – "Risk Management", scores are allocated for each event based on the descriptions in Columns 2 and 3. This modified 6×6 analysis matrix has been prepared by Pinnacle Risk Management.

<u>Column 5</u>

Heading: Prevention/Protection Measures

The measures designed into the functional/operation area and the site are listed. These measures may include for example safeguards, design features, management methods and/or operator training.

<u>Column 6</u>

Heading: Residual Scores for the Consequence, Likelihood and the Overall Risk

With consideration to the scores from Column 4, the adjusted scores according to the prevention and protection measures in Column 5. These scores illustrate the overall risk of the specific scenario.

The referenced analysis matrix for the consequence and likelihood qualitative analysis has been provided as Table 4-3. This matrix is accompanied by table containing a list of descriptions for consequence ratings, which has been provided as Table 4-4.

The Hazard Identification Chart is presented in Table 4-5.

Table 4-3: Modified Consequence and Likelihood Matrix for Qualitative Analysis

Frequent >1/yr	II	II	I	I	I	I
Probable $>10^{-1}$ to 1/yr	III	II	II	I	I	I
Possible $>10^{-2}$ to 10^{-1}/yr	III	III	II	II	I	I
Unlikely $>10^{-4}$ to 10^{-2}/yr	III	III	III	III	II	I
Very Unlikely $>10^{-6}$ to 10^{-4}/yr	III	III	III	III	III	II
Extremely Unlikely $<=10^{-6}$/yr	III	III	III	III	III	III
Likelihood **Consequence**	Minor	Significant	Severe	Serious	Extremely Serious	Catastrophic

Note: This matrix is a modified version of the qualitative analysis matrix published in the Australian/New Zealand Standard 31000:2009 – "*Risk Management*".

Region **I** High, synonymous to the Intolerable Region as per HIPAP

Region **II** Medium Risk, or beginning of ALARP or As Low As Reasonably Practicable as per HIPAP

Region **III** Low, synonymous to Negligible as per HIPAP

Table 4-4: Matrix Based Assessment Consequence Definitions

	Minor	Significant	Severe	Serious	Extremely Serious	Catastrophic
Safety and Health	One minor injury, First Aid	Recordable or single MTI	Multiple MTI or one LTI	Permanent disability casualty or multiple LTI	Multiple permanent disabilities or one fatality	Multiple fatalities
Environment	Very minor pollution. No offsite escape of material (contained within the operational areas). On site nuisance value only.	Minor local pollution. Nuisance offsite effect, typically of short duration, e.g. noise, odours, dust and/or visible plumes for less than one hour.	Evident pollution, local concern. Minimal duration offsite effects (e.g. waterway slightly discoloured, turbid etc around the point of release with no or very few fish killed).	Significant local pollution. For example, waterways discoloured 10s of metres, fire or smoke affecting people near to the site.	Major local pollution. Observable offsite effect (e.g. waterways discoloured 10s to 100s of metres for a few weeks with a significant number of aquatic life adversely affected).	Extremely severe pollution. Ecosystems at high risk of destruction. Only resolved via long term solutions (potentially taking years).
Public Relations	Minor issue, one complaint	Local issue, 10 complaints	Local media, 100 complaints	Regional or state media	Wide media national coverage	Headlines, corporate damage
Financial Impact	<$25,000	$25,000 to $100,000	>$100,000 to $1 million	>$1 million to $20 million	>$20 million to $100 million	>$100 million

Table 4-5: Event/Consequence Analysis Table

Functional / Operational Area	Possible Initiating and Chain of Events	Possible Consequence(s)	Preliminary Scores for Consequence, Likelihood & Risk	Prevention/Protection Measures and Controls	Residual Scores for Consequence, Likelihood & Risk
Hammermill / Shredder	• LPG or petrol fuel tank enters the hammermill without being pre-shredded by the pre-shredder • Hammermill crushes the fuel tank • Explosion occurs due to the pressurised condition in the fuel tank and contact with friction as the source of ignition	Flammable Vapour Explosion	Unlikely, Severe, Region III	• Pre-shredder would be installed and maintained to ensure that all metal parts entering the hammermill would be sufficiently pre-shredded • The enclosure of the hammermill is capable of withstanding and containing the overpressure from the explosion of the LPG / petrol fuel tank • Visual inspection by staff on site to inspect and remove unfavourable materials in the hammermill before its operation.	Very Unlikely, Significant, Region III
	• Explosion/fire of airborne dust particles and contact with friction as a source of ignition	Dust cloud explosion	Unlikely. Severe, Region III	• Use of dust suppressant (Synthecol XL Foamer) sprayed over shredding area • Ignition control • Shredder designed to withstand dust explosion • Trained fire crew	Very Unlikely, Significant, Region III

Table 4-5: Event/Consequence Analysis Table

Functional / Operational Area	Possible Initiating and Chain of Events	Possible Consequence(s)	Preliminary Scores for Consequence, Likelihood & Risk	Prevention/Protection Measures and Controls	Residual Scores for Consequence, Likelihood & Risk
Metal Stockpiles	• Materials in the metal pile oxidized and the resulting heat from that chemical reaction became trapped; finally storing up enough heat to catch fire. Fire can potentially occur due to lithium ion battery ignition, or from oils and other fibrous materials.	Stockpile Fire, Spread of fire to other areas	Possible, Severe, Region II	• Stockpile temperature monitoring (infrared camera/sensor cables) • Hydrant coverage of main stockpile from two directions (preferably monitor hydrants) • Material screening to remove batteries/flammable materials.	Unlikely, Severe, Region III
Diesel Storage Tank	• Hot weather and/or other particular weather conditions allow diesel contained in tank to reach flash point • Ignition of diesel during maintenance • Tank roof collapse, allowing exposure of liquid/vapours to exceed flash point and to contact a source of ignition (e.g. static electricity, machinery) • Lightning strike.	Combustible Liquid Release, Pool Fire, Spread of Fire to Other Areas	Possible, Severe, Region II	• Storage tank is painted in light colour to reflect heat • Storage tank is bunded to contain and isolate spills and leaks • Routine inspection by staff and management • Visual inspection by staff on site during operation of other equipment on site.	Unlikely, Severe, Region III

Table 4-5: Event/Consequence Analysis Table

Functional / Operational Area	Possible Initiating and Chain of Events	Possible Consequence(s)	Preliminary Scores for Consequence, Likelihood & Risk	Prevention/Protection Measures and Controls	Residual Scores for Consequence, Likelihood & Risk
Diesel Storage Tank/Mobile Diesel Storage Tank	• Road tanker overfill • Flexible hose failure • Driver drives with uncoupled hose before isolating • Driver fails to disconnect before driving off • Collision or impact with storage tank.	Combustible Liquid and Vapour Release, Pool Fire, Spread of Fire to Other Areas	Unlikely, Severe, Region III	• Training and awareness of staff, management and contractors on site in terms of filling and operation of equipment around the diesel storage tank • Operational procedures • Regular safety audits • Bollards in place to protect storage tank • Signage provided as reminders of procedures to driver and staff on site • Mobile diesel storage tank is self-bunded and vented to atmosphere • Tanker overfill protection (electronic and mechanical) • Procedures in place to control ignition sources • Regular inspection, maintenance and reporting of hoses and its working condition status.	Very Unlikely, Severe, Region III

Table 4-5: Event/Consequence Analysis Table

Functional / Operational Area	Possible Initiating and Chain of Events	Possible Consequence(s)	Preliminary Scores for Consequence, Likelihood & Risk	Prevention/Protection Measures and Controls	Residual Scores for Consequence, Likelihood & Risk
ELV Facility	• Flexible hose failure • Driver drives with uncoupled hose before isolating • Spillage • Ignition after spillage	Combustible Liquid and Vapour Release, Pool Fire, Spread of Fire to Other Areas, Discharge of Hazardous Liquids to Environment	Unlikely, Severe, Region III	• Training and awareness of staff, management and contractors on site in terms of filling and operation of equipment associated with the ELV storage tanks • Operational procedures • Regular safety audits • Bollards in place to protect storage tank • Spill containment • Tank overfill protection (electronic and mechanical) • Procedures in place to control ignition sources • Regular inspection, maintenance and reporting of hoses and its working condition status.	Very Unlikely, Severe, Region III

Table 4-5: Event/Consequence Analysis Table

Functional / Operational Area	Possible Initiating and Chain of Events	Possible Consequence(s)	Preliminary Scores for Consequence, Likelihood & Risk	Prevention/Protection Measures and Controls	Residual Scores for Consequence, Likelihood & Risk
Tyre Storage	• Ignition due to incorrect storage, cause heat build-up; • Ignition due to external source, arson; • Tyre fire.	Combustible and Vapour Release, Pool Fire, Spread of Fire to Other Areas, Discharge of Hazardous Liquids to Environment	Unlikely, Severe, Region III	• The storage of tyres needs to be in accordance with the *Fire and Rescue NSW, Fire Safety Guideline: Guideline for Bulk Storage of Rubber Tyres* • Training and awareness of staff • Operational procedures • Regular safety audits • Procedures in place to control ignition sources	Very Unlikely, Severe, Region III

Table 4-5: Event/Consequence Analysis Table

Functional / Operational Area	Possible Initiating and Chain of Events	Possible Consequence(s)	Preliminary Scores for Consequence, Likelihood & Risk	Prevention/Protection Measures and Controls	Residual Scores for Consequence, Likelihood & Risk
Stormwater Drainage Areas	• Spill of chemicals onto stormwater drainage	Discharge of Hazardous Liquids to Environment	Unlikely, Significant, Region III	• Stormwater isolation • Safe procedures for transfer of materials to minimise spills • Stormwater drains have been appropriately designed – all waterproofed and location selection appropriate • Occasional routine checks and audits by site management to identify and rectify issues • Safety procedures and management system in place to minimise incidents • Procedures to stop operations if critical equipment are compromised, damaged or inoperable • Training, awareness and education of employees, visitors and contractors.	Extremely Unlikely, Minor, Region III

Table 4-5: Event/Consequence Analysis Table

Functional / Operational Area	Possible Initiating and Chain of Events	Possible Consequence(s)	Preliminary Scores for Consequence, Likelihood & Risk	Prevention/Protection Measures and Controls	Residual Scores for Consequence, Likelihood & Risk
High and Low Voltage Electrical Systems, Plant Control Systems	• Electrical faults • Damage due to human error • Arson damage • Initiate fire on transformer	Building Fire, Spread of Fire to Other Fire-Prone Areas	Very Unlikely, Severe, Region III	• Routine maintenance checks of the high voltage electrical systems on site • Electrical cabinets in control rooms and plant equipment are installed, operated and maintained in accordance with the relevant Australian Standards • Fire services available to control fire from these systems • Safety procedures in place to minimise incidents on site • Procedures to stop operations if critical equipment are compromised, damaged or inoperable • Training, awareness and education of employees, visitors and contractors.	Extremely Unlikely, Minor, Region III

Table 4-5: Event/Consequence Analysis Table

Functional / Operational Area	Possible Initiating and Chain of Events	Possible Consequence(s)	Preliminary Scores for Consequence, Likelihood & Risk	Prevention/Protection Measures and Controls	Residual Scores for Consequence, Likelihood & Risk
Natural Hazard Effects on Entire Site	• Destruction of Buildings • Destruction of Diesel Storage Tank • Flood	Discharge of Hazardous Liquids to Environment	Very Unlikely, Serious, Region III	• Stormwater design accounts for possible floods in the area, captures and retains flood water on site and preventing discharge to environment • Equipment, machinery and building structures are built in accordance with Australian Standards to be as structurally strong and solid as much as economically possible and practicable • Weather warnings accounted by site management to prevent operation during significantly disastrous climate conditions • Emergency procedures implemented for safe evacuation and termination of operations • Training, awareness and education of employees, visitors and contractors.	Very Unlikely, Serious, Region III

Table 4-5: Event/Consequence Analysis Table

Functional / Operational Area	Possible Initiating and Chain of Events	Possible Consequence(s)	Preliminary Scores for Consequence, Likelihood & Risk	Prevention/Protection Measures and Controls	Residual Scores for Consequence, Likelihood & Risk
Extraneous Uncontrolled Off-Site Events Affecting Entire Site	• Aircraft crash	Fire, Release of Flammable and Toxic Gases, and Explosion	Extremely Unlikely, Extremely Serious, Region III	• No on-site prevention/ protection measures aside from warning and observation by staff/management on site. Prevention measures are expected to be in place by management of aircraft operators.	Extremely Unlikely, Extremely Serious, Region III

Further details of the prevention and protection measures have been provided in Section 5.

4.5.3 Hazards Identified for Further Analysis

It has been identified that hazardous events expected to occur on site have minimal risk, given that none of the scenarios identified in Table 4-5 do not indicate a high residual risk being present.

However, the following hazardous scenarios (which were obtained from the event / consequence tables) have been examined further:

- LPG fuel tank explosion in pre-shredder/shredder/hammer mill;
- Petrol fuel tank explosion in pre-shredder/shredder/hammer mill;
- Fire in metal stockpiles;
- Fire in flock stockpile; and
- Pool fire from diesel storage tank.

Explosion overpressures from LPG and petrol fuel tank explosions in the hammermill/shredder or preshredder were included in this assessment, to demonstrate the area of effect from this particular incident.

Fire in the metal stockpiles and flock stockpiles were included in this assessment, to demonstrate the area of effect from this particular incident.

The pool fire from the diesel storage tank was also considered. The storage quantities of the mobile diesel tank and the ELV facility are minor and therefore do not warrant further assessment. Risk of a fire from the tyre storage is considered low and does not warrant further assessment.

Details of each assessed scenario have been provided as follows.

4.6 QUANTITATIVE HAZARD ANALYSIS

The following sections provide details of the limited quantitative analyses conducted for each identified scenario considered to have a potential off-site impact. Each of these sections will assess the likelihood and consequence of each event by estimating the relevant figures that can be compared against the relevant HIPAP criteria.

In all of the scenarios considered, the modelling program TNO Effects (version 7.6.0) was utilised to determine overpressures and heat radiation contour(s) where applicable. Results are presented in Attachment 2.

The applicable criteria in assessing the acceptability of the risks associated with each scenario have been outlined in Section 4.3.

4.6.1 LPG Fuel Tank Explosion in Hammermill

The following assumptions were deemed credible and utilised for estimating the consequence resulting from an explosion that could occur on site:

- Assuming a 10% increase in pressure inside the hammermill enclosure during its operation. This increases the potential overpressure resulting from an explosion of flammable gas;
- All of the flammable gas is confined within the hammermill enclosure;
- All flammable gas released was assumed to have contributed to the procurement of the explosion, meaning 100% of the gas volume was detonated;
- Assuming 10.9% (upper explosive limit value) of the fuel tank volume is LPG with the fuel tank capacity being 68 L (the largest obtainable for an LPG fuel tank commercially available). This provides a total amount of approximately 7.412 L. An input of 7.4 kg of LPG was then conservatively used in TNO Effects; and
- It was assumed that the explosion was not attenuated by any structures including the hammermill enclosure.

The following distances were obtained for the model:

- For the 7 kPa overpressure: 62.9 metres.
- For the 14 kPa overpressure: 36.0 metres.

No residential receptors were considered to be within proximity to the distances outlined above.

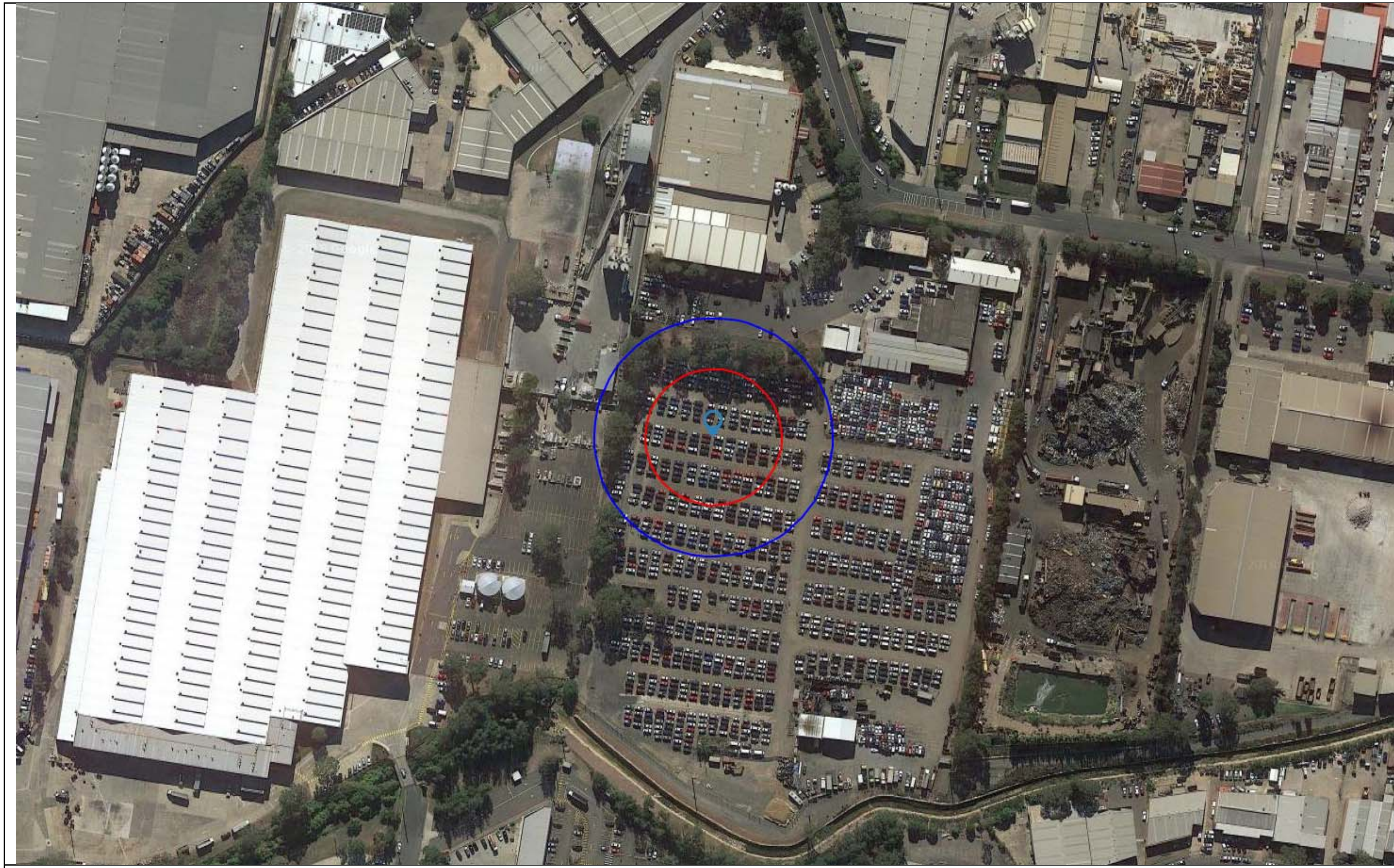
The industrial properties on the western side of the site fall just within the 7 kPa contour.

In addition to the above scenario, control measures would be available to minimise the overpressure effects from the explosion. As outlined in the assumptions, explosion attenuation has not been included and therefore overpressure distances as expected of what would happen in reality would be smaller than what has been reported above and 7kPa contour is unlikely to extend beyond the property boundary.

Therefore, the assessment of this scenario concludes that the risk of explosion of LPG fuel tank inside the hammermill is considered to be acceptable in accordance with the DoPI HIPAP guidelines. This further validates the results predicted by the IAEA method, outlining that this scenario presents a low risk.

Figure 4-1 below provides an illustration of the extent of the outlined explosion overpressures on an aerial map.

Figure 4-1: Explosion Overpressure Contours for the LPG Fuel Tank Explosion Scenario



Notes: Blue contour represents the 7 kPa overpressure distance; Red contour represents the 14 kPa overpressure distance

4.6.2 Petrol Fuel Tank Explosion in Hammermill

The following assumptions were deemed credible and utilised for estimating the consequence resulting from an explosion that could occur on site:

- Assuming a 10% increase in pressure inside the hammermill enclosure during its operation. This increases the potential overpressure resulting from an explosion of flammable gas;
- All of the flammable gas is confined within the hammermill enclosure;
- All flammable gas released was assumed to have contributed to the procurement of the explosion, meaning 100% of the gas volume was detonated;
- Assuming 8% (upper explosive limit value) of the fuel tank volume is petrol with the fuel tank capacity being 85 L (the largest obtainable for a fuel tank commercially available). This provides a total amount of approximately 6.8 L. An input of 6.8 kg of gasoline was then conservatively used in TNO Effects; and
- It was assumed that the explosion was not attenuated by any structures including the hammermill enclosure.

The following distances were obtained for the model:

- For the 7 kPa overpressure: 60.7 metres.
- For the 14 kPa overpressure: 34.7 metres.

No residential receptors were considered to be within proximity to the distances outlined above.

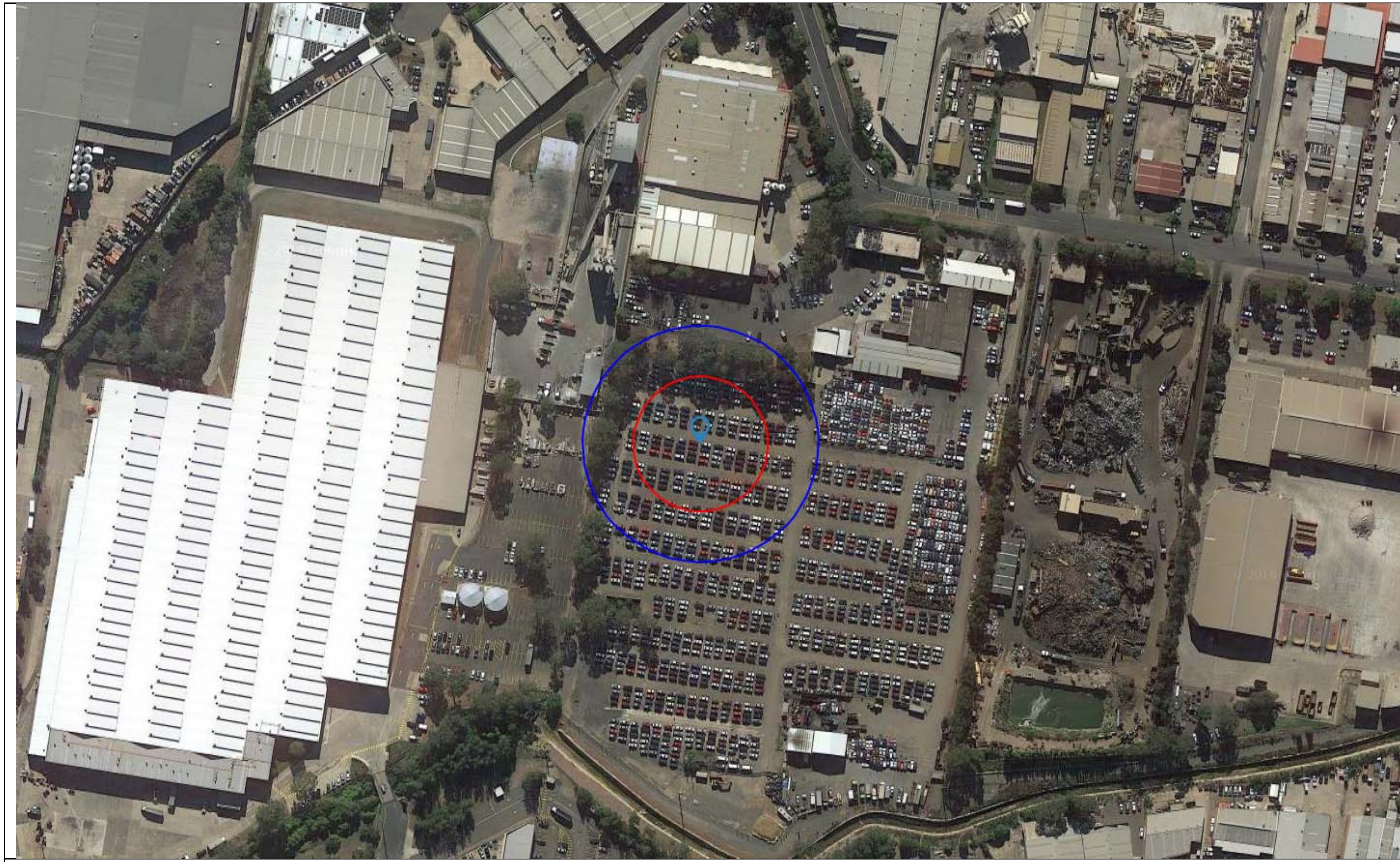
The industrial properties on the western side of the site fall just within the 7 kPa contour.

In addition to the above scenario, control measures would be available to minimise the overpressure effects from the explosion. As outlined in the assumptions, explosion attenuation has not been included and therefore overpressure distances as expected of what would happen in reality would be smaller than what has been reported above and 7kPa contour is unlikely to extend beyond the property boundary.

Therefore, the assessment of this scenario concludes that the risk of explosion of petrol fuel tank inside the hammermill is considered to be acceptable in accordance with the DoPI HIPAP guidelines. This further validates the results predicted by the IAEA method, outlining that this scenario presents a low risk.

Figure 4-2 below provides an illustration of the extent of the outlined explosion overpressures on an aerial map.

Figure 4-2: Explosion Overpressure Contours for the Petrol Fuel Tank Explosion Scenario



Notes: Blue contour represents the 7 kPa overpressure distance; Red contour represents the 14 kPa overpressure distance

4.6.3 Pool Fire at 15,000 L Diesel Storage Tank Location

The following assumptions were deemed credible and utilised for estimating the consequence resulting from a fire within the 15,000 L diesel fuel tank bund that could occur on site:

- Assuming 15 kL (12,800 kg) of diesel has been spilled, which is the total volume of the containment;
- Diesel liquid has allowed its top layer of liquid to reach flash point, allowing it to be prone to ignition;
- A surface area of 28 m^2 was assumed as the surface area (based on the approximate bunded area); and
- A substitute chemical, gasoline, was used as input for the pool fire given that their similarities in heat of combustion properties.

The following distances were obtained for the model:

- For the 4.7 kW/m^2 heat contour: 16.7 metres.
- For the 12.6 kW/m^2 heat contour: 12.5 metres.
- For the 23 kW/m^2 heat contour: 7.96 metres.

No residential receptors were considered to be within proximity to the distances outlined above.

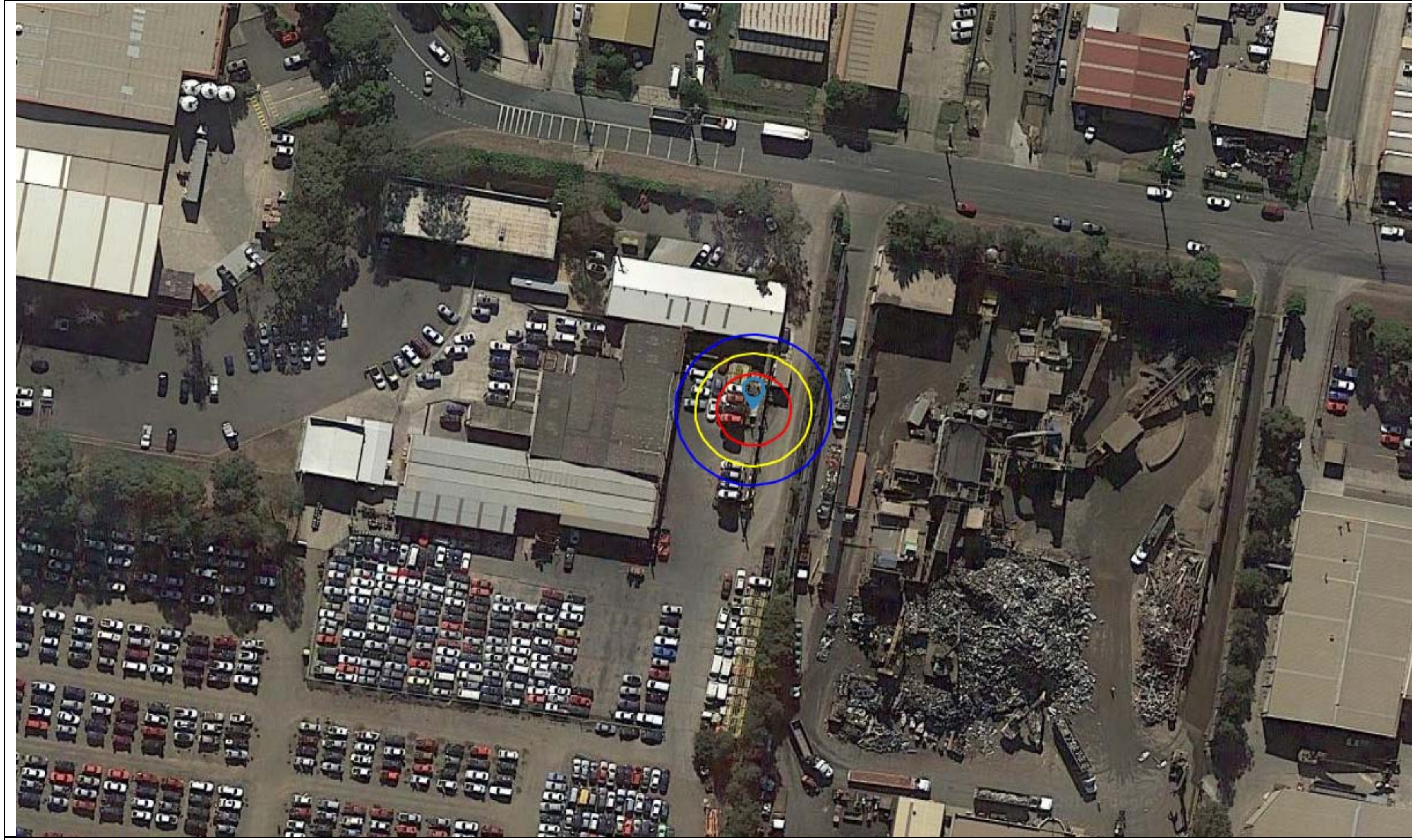
The industrial properties on the eastern side of the site fall just within the 12.6 kW/m^2 heat contour and 4.7 kW/m^2 heat contour.

In addition to the above scenario, control measures would be available to minimise the heat of radiation such as walls and concrete bunding have not been included in the model therefore heat of radiation distances as expected of what would happen in reality would be smaller than what has been reported above the 4.7 kW/m^2 heat contour is unlikely to extend beyond the property boundary.

Therefore, the assessment of this scenario concludes that the risk associated with the 15,000 L diesel fuel tank on site is considered to be acceptable in accordance with the DoPI HIPAP guidelines.

Figure 4-2 below provides an illustration of the extent of the outlined heat of radiation contour on an aerial map.

Figure 4-3: Heat Radiation Contours for the 15,000 L Diesel Tank Pool Fire Scenario



Notes: Blue contour represents the 4.7 kW/m^2 distance; Yellow contour represents the 12.6 kW/m^2 distance; Red contour represents the 23 kW/m^2 distance

4.6.4 Shredder Stockpile Fire

The following assumptions were deemed credible and utilised for estimating the consequence resulting from a fire with the metal shredder stockpile that could occur on site:

- Assuming 1,200 tonnes of metal the total mass of metal is on fire;
- A surface area of 300 m^2 was assumed as the surface area (based on the stockpile area); and
- A substitute chemical, Ethylene dichoride, was used as input for the pool fire given that their similarities in heat of combustion properties (Note: Heat of Combustion for Metal is 7,500 J/g (Cryogenics Division Institute for Basic Standards National Bureau of Standards Boulder, Colorado 80302, 1973) and Ethylene dichloride 8,000 J/g (TNO Effects)).

The following distances were obtained for the model:

- For the 4.7 kW/m^2 heat contour: 21.98 metres.
- For the 12.6 kW/m^2 heat contour: 14.68 metres.
- For the 23 kW/m^2 heat contour: 14.68 metres.

No residential, commercial and industrial receptors were within the distances outlined above.

In addition to the above, control measures would be available to minimise the risk of fire.

Therefore, the assessment of this scenario concludes that the risk associated with stockpiling of shredded metal on site is considered to be acceptable in accordance with the DoPI HIPAP guidelines.

Figure 4-2 below provides an illustration of the extent of the outlined heat of radiation contour on an aerial map.

Figure 4-4: Heat Radiation Contours for the Shredder Stockpile Fire Scenario

Notes: Blue contour represents the 4.7 kW/m^2 distance; Yellow contour represents the 12.6 kW/m^2 distance; Red contour represents the 23 kW/m^2 distance

4.6.5 Shear Stockpile Fire

The following assumptions were deemed credible and utilised for estimating the consequence resulting from a fire with the sheared metal stockpile that could occur on site:

- Assuming 100 tonnes of metal the total mass of metal is on fire;
- A surface area of 120 m^2 was assumed as the surface area (based on the stockpile area); and
- A substitute chemical, Ethylene dichoride, was used as input for the pool fire given that their similarities in heat of combustion properties (Note: Heat of Combustion for Metal is 7,500 J/g (Cryogenics Division Institute for Basic Standards National Bureau of Standards Boulder, Colorado 80302, 1973) and Ethylene dichloride 8,000 J/g (TNO Effects)).

The following distances were obtained for the model:

- For the 4.7 kW/m^2 heat contour: 13.90 metres.
- For the 12.6 kW/m^2 heat contour: 8.65 metres.
- For the 23 kW/m^2 heat contour: 8.65 metres

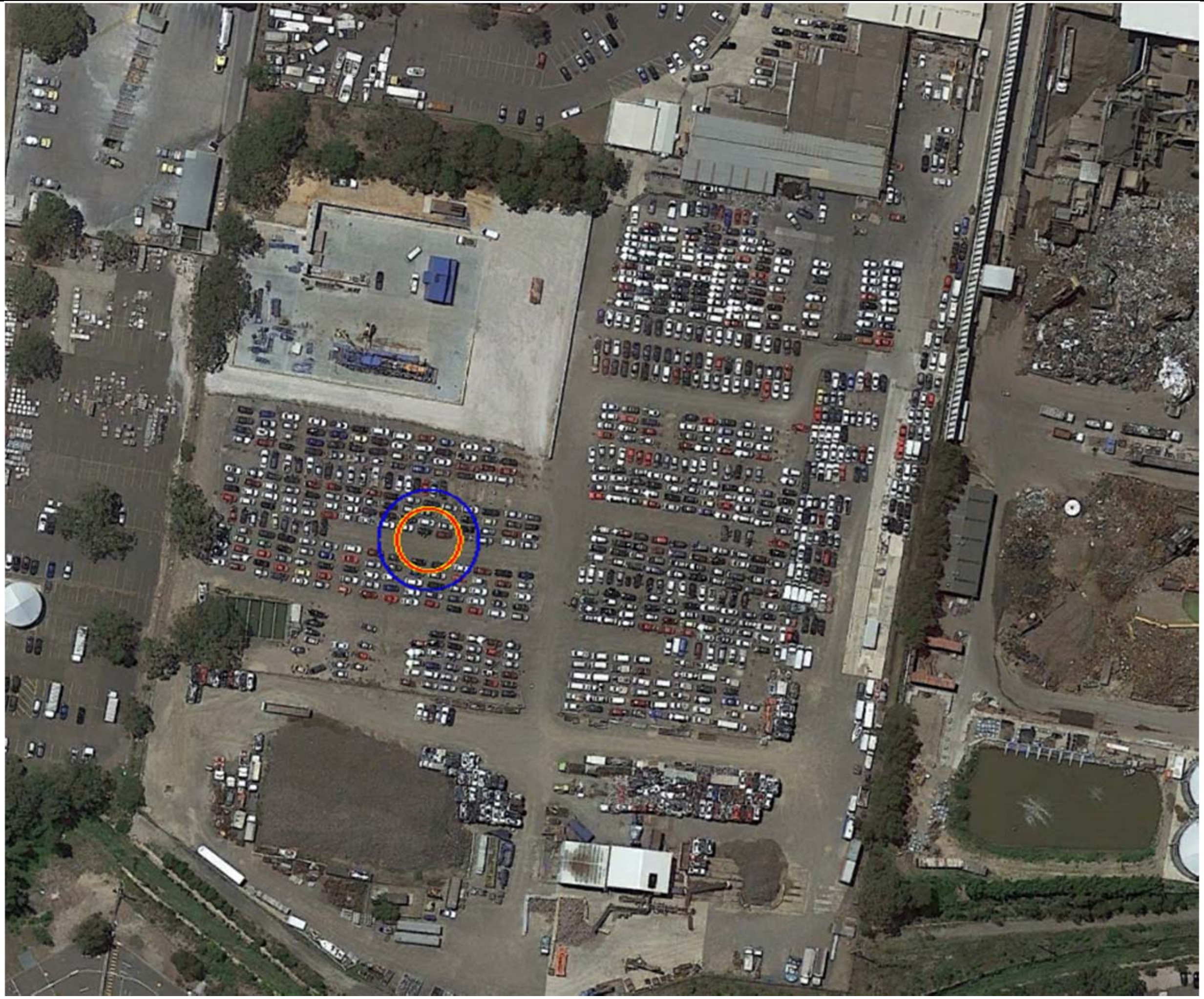
No residential, commercial and industrial receptors were within the distances outlined above.

In addition to the above, control measures would be available to minimise the risk of fire.

Therefore, the assessment of this scenario concludes that the risk associated with stockpiling of sheared metal on site is considered to be acceptable in accordance with the DoPI HIPAP guidelines.

Figure 4-2 below provides an illustration of the extent of the outlined heat of radiation contour on an aerial map.

Figure 4-5: Heat Radiation Contours for the Shear Stockpile Fire Scenario



Notes: Blue contour represents the 4.7 kW/m^2 distance; Yellow contour represents the 12.6 kW/m^2 distance; Red contour represents the 23 kW/m^2 distance

4.6.6 Flock Stockpile Fire

The following assumptions were deemed credible and utilised for estimating the consequence resulting from an explosion that could occur on site:

- Assuming 30 tonnes of material the total mass of material is on fire;
- A surface area of 65 m^2 was assumed as the surface area (based on the stockpile area); and
- A substitute chemical, Gasoline, was used as input for the pool fire given that their similarities in heat of combustion properties (Note: Heat of Combustion for Plastic (PE) is 47,740 J/g (Costiuc, et al., 2015)).

The following distances were obtained for the model:

- For the 4.7 kW/m^2 heat contour: 27.5 metres.
- For the 12.6 kW/m^2 heat contour: 19.3 metres.
- For the 23 kW/m^2 heat contour: 14.9 metres.

No residential, commercial and industrial receptors were within the distances outlined above.

In addition to the above, control measures would be available to minimise the risk of fire.

Therefore, the assessment of this scenario concludes that the risk associated with stockpiling of floc on site is considered to be acceptable in accordance with the DoPI HIPAP guidelines.

Figure 4-2 below provides an illustration of the extent of the outlined heat of radiation contour on an aerial map.

Figure 4-6: Heat Radiation Contours for the Flock Stockpile Fire Scenario

Notes: Blue contour represents the 4.7 kW/m^2 distance; Yellow contour represents the 12.6 kW/m^2 distance; Red contour represents the 23 kW/m^2 distance

4.7 DISCUSSION

Results from the detailed quantitative analysis provided in Section 4.6 shows that the criteria stipulated within the HIPAP guidelines for the following scenarios have been met for all significant sources of hazard risks on site:

- Explosion overpressure for the adjacent commercial/industrial buildings and the nearest sensitive land uses; and
- Heat radiation flux levels for the adjacent commercial/industrial buildings and the nearest sensitive land uses.

Section 5 provides recommendations prevention/protection measures and controls to further minimise likelihood and severity of the potential hazardous scenarios examined in Section 4.6.

5. CONTROL MEASURES

The proposed design and operation of the facility would typically include safeguards to provide sufficient protection to the site to minimise the likelihood and severity of a pollution incident or an emergency event occurring on site. With the control measures implemented there would be minimal impact to the natural environment or nuisance caused to the amenity of adjacent occupiers of neighbouring premises.

5.1 PLANS/PROCEDURES

It is recommended the following plans and procedures be prepared for the site:

- Environmental Management Plan, including:
  - Spill procedure;
  - Storage and handling of dangerous goods procedure;
  - Environmental housekeeping procedure;
- Screening procedure – minimise the hazardous material entering the hammermill;
- Fire Safety Study;
- Emergency plan;
- Safe forklift operating procedure;
- Maintenance schedule; and
- Ignition control procedures.

5.2 FIRE SAFETY EQUIPMENT

The following fire safety equipment is recommended to minimise the likelihood and severity of a fire from the hazardous events considered.

- Stockpile temperature monitor (infrared camera/sensor cables);
- Hydrant coverage of main stockpile from two directions (preferably monitor hydrants);
- Use of static earth straps wherever applicable;
- Fire extinguishers (located as per AS 2419);
- Declaration of smoking policy and clearly signposted;
- Bunding and signage of dangerous goods; and
- Use of dust suppressant (Synthecol XL Foamer) sprayed over shredding area.

5.3 ENVIRONMENTAL PROTECTION EQUIPMENT

The following environment protection equipment is recommended:

- Stormwater Isolation system;
- Spill kits; and
- Use of dust suppressant (Synthecol XL Foamer) sprayed over shredding area.

5.4 TRAINING

The following training is recommended:

- Emergency response training;
- Environmental management training (in accordance with the site's environmental management plan);
- Safety awareness training, including contractors and visitors;
- Staff material screening training, to ensure staff minimised the hazardous material entering the hammermill;
- Staff maintenance training to ensure the equipment on site is maintained in accordance with the maintenance schedule; and
- Safe forklift driver training.

- Establish a system wherein a Job Safety Analysis (JSA), Proposed Work Method Statements or other similar systems which achieves (but is not limited to) the following objectives:
  - ▸ Changes to the operations of the site – how these changes may affect the risk elements on site.
  - ▸ Works proposed to be conducted by contractors – similarly, how the scope of works of each contractor entering a site would affect the risk on site.
  - ▸ Promote a system that establishes a mindset or an attitude to all employees on site to prioritise safety.

  These would be incorporated into a Site Safety Management System.

- Promote minor safety aspects such as providing dedicated pedestrian pathways, discouraging the use of mobile phones while in forklift traffic areas, providing appropriate signage for critical areas, and enforcing speed limits.

6. CONCLUDING REMARKS

This preliminary hazard analysis addresses the risks of fire or explosion presented by the use of the shredder/hammermill in site operations, the onsite metal stockpiles and the diesel storage in accordance with the Multi-Level Risk Assessment and Hazardous Industry Planning Advisory Paper (HIPAP) guidelines.

Results from the detailed quantitative analysis provided in Section 4.6 shows that the criteria stipulated within the HIPAP guidelines for the following scenarios have been met for all significant sources of hazard risks on site. The assessment has determined that the operation of the proposed development would not cause any risk, significant or minor, to the community, with the recommended safeguards in place.

It is the conclusion of this assessment that the proposed site and its operations would meet all the safety requirements stipulated by the Department of Planning and Infrastructure. Hence, this facility would not be considered an offensive or hazardous development in accordance with the HIPAP guidelines.

This concludes this risk assessment evaluation.

Emma Hansma	R T Benbow
<u>Senior Engineer</u>	<u>Principal Consultant</u>

7. LIMITATIONS

Our services for this project are carried out in accordance with our current professional standards for site assessment investigations. No guarantees are either expressed or implied.

This report has been prepared solely for the use of Auto Recyclers Pty Ltd, as per our agreement for providing environmental services. Only Auto Recyclers Pty Ltd is entitled to rely upon the findings in the report within the scope of work described in this report. Otherwise, no responsibility is accepted for the use of any part of the report by another in any other context or for any other purpose.

Although all due care has been taken in the preparation of this study, no warranty is given, nor liability accepted (except that otherwise required by law) in relation to any of the information contained within this document. We accept no responsibility for the accuracy of any data or information provided to us by Auto Recyclers Pty Ltd for the purposes of preparing this report.

Any opinions and judgements expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal advice.

8. REFERENCES

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ATTACHMENTS

Attachment 1: Synthecol XL Foamer SDS

Material Safety Data Sheet in accordance with NOHSC:2011/HSNOCOP 8-1

1. Identification of the substance/preparation and of the company/undertaking

Trade name: SYNTHECOL XL FOAMER

Identification of the company

Chemcolour Industries Australia Pty Ltd
Monash Business Park
20-22 Gardiner Road
Notting Hill, VIC 3168
Australia
Telephone no. : +61 (3) 9538 0300

Chemcolour Industries (NZ) Ltd
24-26 Poland Road
Wairau Valley
North Shore, 0627
New Zealand
Telephone no. : +64 (9) 444 4650

Information about the substance/preparation
Regulatory Department
Tel: +61 (3) 9538 0300 (Australia); +64 (9) 444 4650 (New Zealand)
e-mail: ProductSafety@chemcolour.com

Emergency telephone numbers :	1800 127 406	(24 h, Australia)
	0800 243 622	(24 h, New Zealand)
	+64 3 353 0199	(24 h, Worldwide)

2. Hazards identification

Hazard Classification
Not classified as hazardous according to the criteria of ASCC.
Classified as hazardous according to the criteria of GHS
Classified as hazardous according to the criteria of HSNO Minimum degrees of hazard regulations.

Not classified as dangerous goods according to the Australian Code for Transport of Dangerous Goods (ADG).
Not classified as dangerous goods according to the Transport of Dangerous Goods on Land (NZS5433).

Risk phrase(s) :
None

Safety phrase(s) :
S24 Avoid contact with skin
S25 Avoid contact with eyes
S61 Avoid release to the environment.

Classification:

GHS Class	HSNO Class	SIGNAL WORD	Hazard Statement
Skin corr/irr't: Cat 2	**6.3A**	**Warning**	**H315 Causes skin irritation**
Eye damage/ irr't: Cat 2A	**6.4A**	**Warning**	**H320 Causes eye irritation**

Aquatic Toxicity (Chronic) Cat 4	**9.1D**	**--**	**H402 Harmful to aquatic life.**

3. Composition/information on ingredients

Hazardous ingredients

Component	CAS #	EINECS #	Proportion
2-Methylpentane-2,4-diol	107-41-5	203-489-0	<10%
Blend of surfactants	--	--	>10-<30%
Non Hazardous components	--	--	Balance

4. First aid measures

If on skin

Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/ attention. Take off contaminated clothing and wash before re-use.

If in eyes

Immediately rinse eyes with running water. Remove contact lenses (if present) and continue flushing. If eye irritation persists, get medical advice/attention.

If inhaled

If breathing is difficult, remove to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.

If swallowed

Call a POISON CENTER or doctor/ physician if you feel unwell.

5. Fire-fighting measures

Suitable extinguishing media

Compatible with all usual extinguishing media

Extinguishing media that must not be used for safety reasons

No restrictions

Special hazards from the substance itself, its combustion products or from its vapours

In the event of fire toxic fumes are emited.

Special protective equipment for firefighting

In case of combustion use a suitable breathing apparatus.

6. Accidental release measures

Methods for cleaning up/taking up

Do not allow the product to enter drains, sewers or waterways. Remove leaking containers to a detached area. Bund spill area and recover – consider recycling. Absorb spilled product with inert material (e.g. sand, earth etc.)

Additional information

Floors will become slippery.
Must not be released into sewers, drains or wells.
Take up as such and consider recycling.

Material Safety Data Sheet in accordance with NOHSC:2011/HSNOCOP 8-1

7. Handling and storage

Advice on safe handling

Ensure adequate ventilation
Read label before use.

Advice on protection against fire and explosion

No special measures necessary

8. Exposure controls / personal protection

National exposure standards

NZ Workplace Exposure Standards

2- Methyl-2,4-pentanediol CAS: 107-41-5 TWA Ceiling 25ppm (121mg/m3)

AU HSIS Exposure Standards

2- Methyl-2,4-pentanediol CAS: 107-41-5 TWA mg/m3 121 Peak limitation

Occupational exposure controls
Hygiene measures

Observe the usual precautions when handling chemicals.

Eye protection:	Safety glasses/ goggles
Hand protection:	PVC gloves
Skin and body protection:	Protective clothing, PVC apron and boots.

9. Physical and chemical properties

Form :	liquid
Colour :	Slight yellow
Odour :	Mild
Boiling point :	~100°C
Flash point (ºC) :	Not applicable expected >93ºC
Solubility in water:	Miscible
Ph :	6-8

10. Stability and reactivity

Stability :	Stable at normal temperatures
Incompatible materials :	Mild steel. Copper. Copper alloys. Strong acids.
Conditions to Avoid :	Temperatures above 40°C

Hazardous reactions

No hazardous reactions when stored and handled according to prescribed instructions.

Hazardous decomposition products

None expected under normal use conditions.

11. Toxicological information

Acute oral toxicity :	LD50 >5000 mg/kg
Irritant effect on eye :	Direct contact may cause severe damage
Irritant effect on skin :	Irritating to skin.

12. Ecological information

Ecotoxicity : Harmful to the environment

13. Disposal considerations

Product
Dispose of in accordance with local authority regulations
Uncleaned packaging
Consider recycling.

14. Transport information

Land : ADG	not restricted
Land : NZS5433	not restricted
Air : IATA	not restricted
Sea : IMDG	not restricted

15. Regulatory information

HSNO Approval Number: HSR002503 - Additives, Intermediates, Process Chemicals and Raw Materials (Subsidiary Hazard) Group Standard 2006
Tracking: Not required
Approved Handler: Not required

Poison Schedule (SUSMP): None allocated

National Chemical Inventories
AICS : All components are listed on the Australian Inventory of Chemical Substances
NZIoC : All hazardous components are listed on the New Zealand Inventory of Chemicals

16. Other information

This MSDS summarises our best knowledge of the health and safety hazard information of the product and how to safely handle and use the product in the workplace. Each user should read this MSDS and consider the information in the context of how the product will be handled and used in the workplace, including in conjunction with other products.
If clarification or further information is needed to ensure that an appropriate risk assessment can be made, the user should contact this company.
Our responsibility for products sold is subject to our standard terms and conditions, a copy of which is sent to our customers and is also available on request.

Material Safety Data Sheet in accordance with NOHSC:2011/HSNOCOP 8-1

Since the actual use of this product is beyond the control of Chemcolour Industries, we make no warranty, expressed or implied, concerning the use of this product. It is the responsibility of users to ascertain that the product is suitable for intended applications.

Attachment 2: TNO Effects Model Results

Results of vapour cloud explosion models

Project : TNO Model

--------------------------- START OF SESSION 1(mYBNewMultiEnergyExplosion)

INPUT

```
Model................................................... : vapour cloud
explosion (multi
                                                            energy) (195)
Version................................................. : 5.03
Reference............................................... : Yellow Book CPR14E
3rd Edition -
                                                            Chapter 5: Vapour
cloud explosions
Case description........................................ : LPG Tank Explosion
Chemical name........................................... : Propane
Ambient pressure........................................ : 1.155 Bar
Total mass in explosive range........................... : 7.412 kg
Fraction of flammable cloud confined.................... : 100 %
Curve number............................................ : 10 (Detonation)
Distance from release (Xd).............................. : 750 m
Offset between release point and cloud centre........... : 46 m
Threshold overpressure.................................. : 140 mBar
X-coordinate of release................................. : 0 m
Y-coordinate of release................................. : 0 m
Predefined wind direction............................... : N
Wind comes from (West = 180 degrees).................... : 90 deg
```

RESULTS

```
Confined mass in explosive range........................ : 7.412 kg
Total combustion energy................................. : 341.05 MJ
Peak overpressure at Xd................................. : 4.6762 mBar
Peak dynamic pressure at Xd............................. : 1.155 mBar
Pressure impulse at Xd.................................. : 5.5046 Pa*s
Positive phase duration at Xd........................... : 23.543 ms
Dist. from center mass of cloud at threshold overpressure... : 35.986 m
```

--------------------------- END OF SESSION 1 --------------------------------

Administrative & version data:

```
Main program (production date) : Effects (25 Jul 2008  00:36:28)
Run mode (complexity level)    : Expert
Model name                     : vapour cloud explosion (multi energy) (195)
Date of this calculation       : 26 Sep 2018  13:55:42
License owner                  : Emma
Calculation performed by       : emma
Software library version       : 7.6.0.1409
Model driver version(s)        : 5.03
Model driver last modification : 26 Feb 2008
Model executable version(s)    : N/A
Session nr.                    : 1
References                     : Yellow Book CPR14E 3rd Edition - Chapter 5: Vapour
cloud explosions
Project file name              : "TNO Model.alf
Chemical database used         : "Purple Book (1999).rdb" (24 Jul 2017  12:30:57)
Environment database used      : "Purple Book (1999).Env" (20 May 2008  17:53:47)
System database used           : "Purple Book (1999).SPF" (20 May 2008  17:53:47)
Dispersion database used       : "Purple Book (1999).dpf" (20 May 2008  17:53:47)
```

Results of vapour cloud explosion models

```
Map background file used       : "" (01 Jan    0  00:00:00)
Project file directory         : "J:\JOBS - ACTIVE\181112 - Pick and Pay Less Car
Yard\Job\Reports"
Chemical database directory    : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
Environment database directory : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
System database directory      : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
Dispersion database directory  : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
Map background directory       : ""
-------------------------------------
End of administrative & version data:


---------------------------- START OF SESSION 2(mYBNewMultiEnergyExplosion)
-------------------------------
INPUT

Model.................................................... : vapour cloud
explosion (multi
                                                            energy) (195)
Version.................................................. : 5.03
Reference................................................ : Yellow Book CPR14E
3rd Edition -
                                                            Chapter 5: Vapour
cloud explosions
Case description......................................... : Gasoline Tank
Explosion
Chemical name............................................ : Gasoline
Ambient pressure......................................... : 1.155 Bar
Total mass in explosive range............................ : 6.8 kg
Fraction of flammable cloud confined..................... : 100 %
Curve number............................................. : 10 (Detonation)
Distance from release (Xd)............................... : 750 m
Offset between release point and cloud centre............ : 46 m
Threshold overpressure................................... : 140 mBar
X-coordinate of release.................................. : 0 m
Y-coordinate of release.................................. : 0 m
Predefined wind direction................................ : N
Wind comes from (West = 180 degrees)..................... : 90 deg



RESULTS

Confined mass in explosive range......................... : 6.8 kg
Total combustion energy.................................. : 306 MJ
Peak overpressure at Xd.................................. : 4.4902 mBar
Peak dynamic pressure at Xd.............................. : 1.155 mBar
Pressure impulse at Xd................................... : 5.1106 Pa*s
Positive phase duration at Xd............................ : 22.764 ms
Dist. from center mass of cloud at threshold overpressure... : 34.708 m


---------------------------- END OF SESSION 2 ---------------------------------

Administrative & version data:
-------------------------------
Main program (production date) : Effects (25 Jul 2008  00:36:28)
Run mode (complexity level)    : Expert
```

Results of vapour cloud explosion models

```
Model name                      : vapour cloud explosion (multi energy) (195)
Date of this calculation        : 26 Sep 2018  13:55:42
License owner                   : Emma
Calculation performed by        : emma
Software library version        : 7.6.0.1409
Model driver version(s)         : 5.03
Model driver last modification : 26 Feb 2008
Model executable version(s)     : N/A
Session nr.                     : 1
References                      : Yellow Book CPR14E 3rd Edition - Chapter 5: Vapour
cloud explosions
Project file name               : "TNO Model.alf
Chemical database used          : "Purple Book (1999).rdb" (24 Jul 2017  12:30:57)
Environment database used       : "Purple Book (1999).Env" (20 May 2008  17:53:47)
System database used            : "Purple Book (1999).SPF" (20 May 2008  17:53:47)
Dispersion database used        : "Purple Book (1999).dpf" (20 May 2008  17:53:47)
Map background file used        : "" (01 Jan    0  00:00:00)
Project file directory          : "J:\JOBS - ACTIVE\181112 - Pick and Pay Less Car
Yard\Job\Reports"
Chemical database directory     : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
Environment database directory : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
System database directory       : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
Dispersion database directory  : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
Map background directory        : ""
-------------------------------------
End of administrative & version data:
```

Results of pool fire models -no mobile diesel tank

Project : TNO Model

---------------------------- START OF SESSION 1(mYBPoolFire) -------------------------------

INPUT

```
Model.............................................................. : Pool fire (137)
Version............................................................ : 5.11
Reference.......................................................... : Yellow Book
(CPR-14E), 3rd edition
                                                                      1997, Paragraph
6.5.4
Case description................................................... : 15kL Diesel Pool
Fire
Chemical name...................................................... : Gasoline
Type of confinement................................................ : Confined
Total mass released................................................ : 12800 kg
Fixed pool surface................................................. : 28 m2
Height of the observer position above ground level................. : 1.5 m
Height of the confined pool above ground level..................... : 0 m
Temperature of the pool............................................ : 20 °C
Pool burning rate.................................................. : Calculate/Default
Fraction combustion heat radiated.................................. : 100 %
Soot Fraction...................................................... : Calculate/Default
Wind speed at 10 m height.......................................... : 3 m/s
Ambient temperature................................................ : 20 °C
Ambient relative humidity.......................................... : 70 %
Amount of CO2 in atmosphere........................................ : 0.04 %
Distance from the edge of the pool................................. : 500 m
Exposure duration to heat radiation................................ : 30 s
Take protective effects of clothing into account?.................. : No
X-coordinate of release............................................ : 0 m
Y-coordinate of release............................................ : 0 m
Predefined wind direction.......................................... : N
Wind comes from (West = 180 degrees)............................... : 90 deg
Calculate all contours for......................................... : Physical effects
Heat radiation level (lowest) for first contour plot............... : 4.7 kW/m2
Heat radiation level for second contour plot....................... : 12.6 kW/m2
Heat radiation level (highest) for third contour plot.............. : 23 kW/m2
```

RESULTS

```
Heat radiation at X................................................ : 0.00099402 kW/m2
Heat radiation first contour at.................................... : 16.679 m
Heat radiation second contour at................................... : 12.534 m
Heat radiation third contour at.................................... : 7.9566 m
Combustion rate.................................................... : 1.54 kg/s
Duration of the pool fire.......................................... : 8311.7 s
Heat emission from fire surface.................................... : 86.253 kW/m2
Flame tilt......................................................... : 49.957 deg
```

Results of pool fire models -no mobile diesel tank

```
View factor.................................................. : 0.0022045 %
Atmospheric transmissivity................................... : 52.276 %
Flame temperature............................................ : 838.74 °C
Height of the Flame.......................................... : 9.0249 m
Weight ratio of HCL/chemical................................. : 0 %
Weight ratio of NO2/chemical................................. : 0 %
Weight ratio of SO2/chemical................................. : 0 %
Weight ratio of CO2/chemical................................. : 366.58 %
Weight ratio of H2O/chemical................................. : 0 %
```

---------------------------- END OF SESSION 1 ----------------------------------

```
Administrative & version data:
--------------------------------
Main program (production date) : Effects (25 Jul 2008  00:36:28)
Run mode (complexity level)    : Expert
Model name                     : Pool fire (137)
Date of this calculation       : 26 Sep 2018  14:42:20
License owner                  : Emma
Calculation performed by       : emma
Software library version       : 7.6.0.1409
Model driver version(s)        : 5.11
Model driver last modification : 31 Nov 2007
Model executable version(s)    : N/A
Session nr.                    : 1
References                     : Yellow Book (CPR-14E), 3rd edition 1997,
Paragraph 6.5.4
Project file name              : "TNO Model.alf
Chemical database used         : "Purple Book (1999).rdb" (24 Jul 2017
12:30:57)
Environment database used      : "Purple Book (1999).Env" (20 May 2008
17:53:47)
System database used           : "Purple Book (1999).SPF" (20 May 2008
17:53:47)
Dispersion database used       : "Purple Book (1999).dpf" (20 May 2008
17:53:47)
Map background file used       : "TNO Model.gbf" (01 Jan    0  00:00:00)
Project file directory         : "J:\JOBS - ACTIVE\181112 - Pick and Pay Less
Car Yard\Job\Reports"
Chemical database directory    : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
Environment database directory : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
System database directory      : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
Dispersion database directory  : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
Map background directory       : "J:\JOBS - ACTIVE\181112 - Pick and Pay Less
Car Yard\Job\Reports"
-------------------------------------
End of administrative & version data:
```

Results of pool fire models -no mobile diesel tank

---------------------------- START OF SESSION 2(mYBPoolFire) -------------------------------

INPUT

Model... : Pool fire (137)
Version... : 5.11
Reference... : Yellow Book (CPR-14E), 3rd edition
1997, Paragraph 6.5.4
Case description.. : Shredder Stockpile
Chemical name... : Ethylene dichloride
Type of confinement... : Confined
Total mass released... : 1.2E06 kg
Fixed pool surface.. : 1012 m2
Height of the observer position above ground level.......... : 0 m
Height of the confined pool above ground level.............. : 3.5 m
Temperature of the pool..................................... : 20 °C
Pool burning rate... : Calculate/Default
Fraction combustion heat radiated........................... : 100 %
Soot Fraction... : Calculate/Default
Wind speed at 10 m height................................... : 3 m/s
Ambient temperature... : 20 °C
Ambient relative humidity................................... : 70 %
Amount of CO2 in atmosphere................................. : 0.04 %
Distance from the edge of the pool.......................... : 500 m
Exposure duration to heat radiation......................... : 30 s
Take protective effects of clothing into account?........... : No
X-coordinate of release..................................... : 0 m
Y-coordinate of release..................................... : 0 m
Predefined wind direction................................... : N
Wind comes from (West = 180 degrees)........................ : 90 deg
Calculate all contours for.................................. : Physical effects
Heat radiation level (lowest) for first contour plot........ : 4.7 kW/m2
Heat radiation level for second contour plot................ : 12.6 kW/m2
Heat radiation level (highest) for third contour plot....... : 23 kW/m2

RESULTS

Heat radiation at X... : 0.0067109 kW/m2
Heat radiation first contour at............................. : 38.691 m
Heat radiation second contour at............................ : 22.769 m
Heat radiation third contour at............................. : 22.769 m
Combustion rate... : 19.718 kg/s
Duration of the pool fire................................... : 60859 s

Results of pool fire models -no mobile diesel tank

Heat emission from fire surface............................. : 27.361 kW/m2
Flame tilt.. : 42.698 deg
View factor... : 0.056278 %
Atmospheric transmissivity.................................. : 43.581 %
Flame temperature... : 563.47 °C
Height of the Flame... : 15.65 m
Weight ratio of HCL/chemical................................ : 73.445 %
Weight ratio of NO2/chemical................................ : 0 %
Weight ratio of SO2/chemical................................ : 0 %
Weight ratio of CO2/chemical................................ : 89.804 %
Weight ratio of H2O/chemical................................ : 36.768 %

--------------------------- END OF SESSION 2 ---------------------------------

Administrative & version data:

Main program (production date) : Effects (25 Jul 2008 00:36:28)
Run mode (complexity level)   : Expert
Model name   : Pool fire (137)
Date of this calculation   : 26 Sep 2018 14:42:20
License owner   : Emma
Calculation performed by   : emma
Software library version   : 7.6.0.1409
Model driver version(s)   : 5.11
Model driver last modification : 31 Nov 2007
Model executable version(s)   : N/A
Session nr.   : 1
References   : Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4
Project file name   : "TNO Model.alf
Chemical database used   : "Purple Book (1999).rdb" (24 Jul 2017 12:30:57)
Environment database used   : "Purple Book (1999).Env" (20 May 2008 17:53:47)
System database used   : "Purple Book (1999).SPF" (20 May 2008 17:53:47)
Dispersion database used   : "Purple Book (1999).dpf" (20 May 2008 17:53:47)
Map background file used   : "TNO Model.gbf" (01 Jan   0 00:00:00)
Project file directory   : "J:\JOBS - ACTIVE\181112 - Pick and Pay Less Car Yard\Job\Reports"
Chemical database directory   : "C:\Program Files\TNO\Effects 7.6\Shared data\Databases"
Environment database directory : "C:\Program Files\TNO\Effects 7.6\Shared data\Databases"
System database directory   : "C:\Program Files\TNO\Effects 7.6\Shared data\Databases"
Dispersion database directory : "C:\Program Files\TNO\Effects 7.6\Shared data\Databases"
Map background directory   : "J:\JOBS - ACTIVE\181112 - Pick and Pay Less Car Yard\Job\Reports"

```
               Results of pool fire models -no mobile diesel tank
-------------------------------------
End of administrative & version data:


---------------------------- START OF SESSION 3(mYBPoolFire)
-------------------------------
INPUT

Model.................................................... : Pool fire (137)
Version.................................................. : 5.11
Reference................................................ : Yellow Book
(CPR-14E), 3rd edition
                                                            1997, Paragraph
6.5.4
Case description......................................... : Shear Stockpile
Fire
Chemical name............................................ : Ethylene
dichloride
Type of confinement...................................... : Confined
Total mass released...................................... : 1E05 kg
Fixed pool surface....................................... : 100 m2
Height of the observer position above ground level....... : 0 m
Height of the confined pool above ground level........... : 3.5 m
Temperature of the pool.................................. : 20 °C
Pool burning rate........................................ : Calculate/Default
Fraction combustion heat radiated........................ : 100 %
Soot Fraction............................................ : Calculate/Default
Wind speed at 10 m height................................ : 3 m/s
Ambient temperature...................................... : 20 °C
Ambient relative humidity................................ : 70 %
Amount of CO2 in atmosphere.............................. : 0.04 %
Distance from the edge of the pool....................... : 500 m
Exposure duration to heat radiation...................... : 30 s
Take protective effects of clothing into account?........ : No
X-coordinate of release.................................. : 0 m
Y-coordinate of release.................................. : 0 m
Predefined wind direction................................ : N
Wind comes from (West = 180 degrees)..................... : 90 deg
Calculate all contours for............................... : Physical effects
Heat radiation level (lowest) for first contour plot..... : 4.7 kW/m2
Heat radiation level for second contour plot............. : 12.6 kW/m2
Heat radiation level (highest) for third contour plot.... : 23 kW/m2




RESULTS

Heat radiation at X...................................... : 0.00072325 kW/m2
Heat radiation first contour at.......................... : 12.541 m
Heat radiation second contour at......................... : 8.1147 m
Heat radiation third contour at.......................... : 8.1147 m
```

```
                Results of pool fire models -no mobile diesel tank
Combustion rate.............................................. : 1.9484 kg/s
Duration of the pool fire.................................... : 51324 s
Heat emission from fire surface.............................. : 25.251 kW/m2
Flame tilt................................................... : 47.462 deg
View factor.................................................. : 0.0067008 %
Atmospheric transmissivity................................... : 42.745 %
Flame temperature............................................ : 547.11 °C
Height of the Flame.......................................... : 6.6851 m
Weight ratio of HCL/chemical................................. : 73.445 %
Weight ratio of NO2/chemical................................. : 0 %
Weight ratio of SO2/chemical................................. : 0 %
Weight ratio of CO2/chemical................................. : 89.804 %
Weight ratio of H2O/chemical................................. : 36.768 %


---------------------------- END OF SESSION 3 ----------------------------------

Administrative & version data:
--------------------------------
Main program (production date) : Effects (25 Jul 2008  00:36:28)
Run mode (complexity level)    : Expert
Model name                     : Pool fire (137)
Date of this calculation       : 26 Sep 2018  14:42:20
License owner                  : Emma
Calculation performed by       : emma
Software library version       : 7.6.0.1409
Model driver version(s)        : 5.11
Model driver last modification : 31 Nov 2007
Model executable version(s)    : N/A
Session nr.                    : 1
References                     : Yellow Book (CPR-14E), 3rd edition 1997,
Paragraph 6.5.4
Project file name              : "TNO Model.alf
Chemical database used         : "Purple Book (1999).rdb" (24 Jul 2017
12:30:57)
Environment database used      : "Purple Book (1999).Env" (20 May 2008
17:53:47)
System database used           : "Purple Book (1999).SPF" (20 May 2008
17:53:47)
Dispersion database used       : "Purple Book (1999).dpf" (20 May 2008
17:53:47)
Map background file used       : "TNO Model.gbf" (01 Jan    0  00:00:00)
Project file directory         : "J:\JOBS - ACTIVE\181112 - Pick and Pay Less
Car Yard\Job\Reports"
Chemical database directory    : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
Environment database directory : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
System database directory      : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
Dispersion database directory  : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
```

Results of pool fire models -no mobile diesel tank

Map background directory : "J:\JOBS - ACTIVE\181112 - Pick and Pay Less Car Yard\Job\Reports"

End of administrative & version data:

---------------------------- START OF SESSION 4(mYBPoolFire) ------------------------------

INPUT

Model.. : Pool fire (137)
Version.. : 5.11
Reference.. : Yellow Book (CPR-14E), 3rd edition
1997, Paragraph 6.5.4
Case description... : Flock Stockpile Fire
Chemical name.. : Gasoline
Type of confinement...................................... : Confined
Total mass released...................................... : 30000 kg
Fixed pool surface....................................... : 49 m2
Height of the observer position above ground level.......... : 0 m
Height of the confined pool above ground level............. : 0.5 m
Temperature of the pool.................................. : 20 °C
Pool burning rate.. : Calculate/Default
Fraction combustion heat radiated........................ : 100 %
Soot Fraction.. : Calculate/Default
Wind speed at 10 m height................................ : 3 m/s
Ambient temperature...................................... : 20 °C
Ambient relative humidity................................ : 70 %
Amount of CO2 in atmosphere.............................. : 0.04 %
Distance from the edge of the pool....................... : 500 m
Exposure duration to heat radiation...................... : 30 s
Take protective effects of clothing into account?........... : No
X-coordinate of release.................................. : 0 m
Y-coordinate of release.................................. : 0 m
Predefined wind direction................................ : N
Wind comes from (West = 180 degrees)...................... : 90 deg
Calculate all contours for............................... : Physical effects
Heat radiation level (lowest) for first contour plot........ : 4.7 kW/m2
Heat radiation level for second contour plot............... : 12.6 kW/m2
Heat radiation level (highest) for third contour plot....... : 23 kW/m2

RESULTS

Heat radiation at X...................................... : 0.0036299 kW/m2
Heat radiation first contour at.......................... : 24.256 m
Heat radiation second contour at......................... : 17.081 m

Results of pool fire models -no mobile diesel tank

```
Heat radiation third contour at.............................. : 13.081 m
Combustion rate............................................... : 2.695 kg/s
Duration of the pool fire..................................... : 11132 s
Heat emission from fire surface............................... : 90.842 kW/m2
Flame tilt.................................................... : 48.872 deg
View factor................................................... : 0.0075767 %
Atmospheric transmissivity.................................... : 52.738 %
Flame temperature............................................. : 853.18 °C
Height of the Flame........................................... : 11.086 m
Weight ratio of HCL/chemical.................................. : 0 %
Weight ratio of NO2/chemical.................................. : 0 %
Weight ratio of SO2/chemical.................................. : 0 %
Weight ratio of CO2/chemical.................................. : 366.58 %
Weight ratio of H2O/chemical.................................. : 0 %
```

---------------------------- END OF SESSION 4 ----------------------------------

```
Administrative & version data:
--------------------------------
Main program (production date) : Effects (25 Jul 2008  00:36:28)
Run mode (complexity level)    : Expert
Model name                     : Pool fire (137)
Date of this calculation       : 26 Sep 2018  14:42:20
License owner                  : Emma
Calculation performed by       : emma
Software library version       : 7.6.0.1409
Model driver version(s)        : 5.11
Model driver last modification : 31 Nov 2007
Model executable version(s)    : N/A
Session nr.                    : 1
References                     : Yellow Book (CPR-14E), 3rd edition 1997,
Paragraph 6.5.4
Project file name              : "TNO Model.alf
Chemical database used         : "Purple Book (1999).rdb" (24 Jul 2017
12:30:57)
Environment database used      : "Purple Book (1999).Env" (20 May 2008
17:53:47)
System database used           : "Purple Book (1999).SPF" (20 May 2008
17:53:47)
Dispersion database used       : "Purple Book (1999).dpf" (20 May 2008
17:53:47)
Map background file used       : "TNO Model.gbf" (01 Jan    0  00:00:00)
Project file directory         : "J:\JOBS - ACTIVE\181112 - Pick and Pay Less
Car Yard\Job\Reports"
Chemical database directory    : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
Environment database directory : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
System database directory      : "C:\Program Files\TNO\Effects 7.6\Shared
data\Databases"
Dispersion database directory  : "C:\Program Files\TNO\Effects 7.6\Shared
```

data\Databases"
Map background directory   : "J:\JOBS - ACTIVE\181112 - Pick and Pay Less Car Yard\Job\Reports"

End of administrative & version data: