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Fire Safety Report

SSD 10447 – REMONDIS Tomago Resource Recovery Facility and Truck Depot

Prepared for: REMONDIS Australia Pty Ltd

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Abbreviations

Abbreviation	Definition
C&I	Commercial and industrial
CBF	Cardboard baling facility
CLS	Cardboard loose storage
CPA	Copper processing area
EIS	Environment Impact Statement
FH	Fire hydrant
FR	Fire hose reel
FRNSW	Fire and Rescue, NSW
GJ	Giga (10^9) Joules
GOPPA	Garden organics primary processing area
HIPAP	Hazardous Industry Planning Advisory Paper
HRR	Heat release rate
HWMRA	Hazardous waste materials recycling area
kL	10^3 litres
kW/m^2	kilojoules of energy released per second per square metre of flame area
LDPE	Low density polyethylene
LD_{50}	Lethal dose for 50% of population
MJ	Mega (10^6) Joules
MRF	Materials recovery facility
NBR	Natural butyl rubber blend
OCC	Old corrugated (cardboard) container
OSD	On-site detention
PFRF	Packaged food recycling facility
PVC	Polyvinyl chloride
RDF	Refuse derived fuel
RTRRF	REMONDIS Tomago Resource Recovery Facility
RU2	Rural landscapes – sustainable primary industry
SP1	Special activities – to ensure protection of water catchments
TDU	Thermal dose unit = Thermal flux^(4/3) x time $(kW/m^2)^{4/3}$ x sec
tpa	Tonnes per annum

Criteria

- Legislation
  - National Construction Code 2019
  - Environmental Planning and Assessment Act 1979 and Regulations 2000 (the Regulations):
    - State Environmental Planning Policy (State and Regional Development) 2011
      - SEPP 33 – Hazardous and Offensive Development
  - Fire and Rescue NSW (2020) Fire Safety Guideline – Fire safety in waste facilities
  - Fire and rescue NSW (2019) Fire Safety Guideline – Access for fire brigade vehicles and firefighters
- Australian standards
  - AS 2419.1:2005 – Fire hydrant installations – System design, installation and commissioning

Probit Injury Criteria

TDU	Injury Sustained (victim clothed)
105	First degree burns
290	Second degree burns
1000	Third degree burns
1800	LD_{50}

Limitations

ACOR Consultants (WA) Pty Ltd has prepared this fire safety study based on the information provided by REMONDIS Australia Pty Ltd in relation to the storage quantities, locations, design layout, and emergency response plans. It remains the responsibility of REMONDIS Australia Pty Ltd to ensure that the installation meets the requirements and initiates the controls, as required by the relevant legislation.

Note: This report and findings are not a substitute for full compliance with Australian standards and Codes of Practice. REMONDIS Australia Pty Ltd shall ensure that they maintain their duty of care and consult the relevant legislation and guidelines.

Should the storage conditions or waste volumes change, the contents and findings in this report shall be reviewed, and the risks associated with any change assessed and controlled.

The Study

The scope of this study is to include:

- Identification of fire hazards and the consequences of possible fire incidents;
- Fire prevention strategies and measures;
- Analysis of the requirements for fire detection and protection;
- Identification of the specific measures to be implemented;
- Calculation of firefighting water supply and demand;
- Containment of contaminated firefighting water; and
- First aid fire protection requirements

The Report

Format of Report includes:

- Clear summary of findings and recommendations;
- Description of facility, including processes, layout and location drawings;
- Identification of flammable materials, fire scenarios that can arise and their consequences;
- Description of fire prevention and mitigation strategies;
- Description of fire system and adequacy to cope with identified fire scenarios; and
- Arrangements for containing contaminated firefighting water.

Summary of Findings

The proposed REMONDIS development at School Drive, Tomago will store significant fire loads within both Building 1 (15,300GJ) and Building 2 (15,000GJ). A smaller fire load is contained in two storage tanks outside Building 3 (2,900GJ).

The three buildings have large buffers to the east (50m to 150m), south (40m to 200m) and north (25m to 150m) of the premises. The west boundary is close to both Building 1 (11m) and Building 2 (7m). Building 3 is effectively buffered by the presence of the other two buildings along the west boundary.

Both Building 1 and Building 2 are classified as Incidental High Hazard storage with fire protection based on Ordinary Hazard 3 occupancies (OH3-bbb) under AS 2118.1:2017. Building 1 has an automatic sprinkler system installed, that will be up-graded to high hazard spacing and spray type. Building 2 will have an automatic sprinkler system installed to the same standard as Building 1. Both buildings will require their fire detection, alarm and notification equipment to be upgraded to current AS 4428, including direct notification to the Tarro fire station, approximately eight (8) minutes response time.

It is anticipated that a fire event will be detected and quickly brought under control by activation of the automatic sprinkler system. In the unlikely event that the sprinkler system fails to activate, ACOR has modelled thermal radiation contours resulting from fire events within any of the proposed fire load compartments. Fire water will be collected within concrete bunded compound to be installed around the internal perimeter of each building.

Although the likelihood of a fire in a warehouse is estimated as 6.7×10^{-5} per year, the likelihood of a fire in a warehouse where an automatic sprinkler system fails to activate is estimated as 5.2×10^{-6} per year. ACOR has used the more conservative likelihood number for calculation of risk.

The Health and Safety Executive (HSE, United Kingdom) and the Netherlands Organisation for Applied Scientific Research (TNO) have identified that a thermal exposure of 3600 TDU is unlikely to cause clothing to self-combust and would therefore result in thermal radiation damage to only 20 per cent of a human body. Assuming third degree burns to 20 per cent of the body is regarded as generating an individual fatality risk of 1.4×10^{-1}. As a consequence, the individual fatality risk has been estimated as 9.4×10^{-6} per year. This risk is less than the acceptable individual fatality risk for an industrial site proposed by HIPAP 4 criteria (5.0×10^{-5} per year). Similarly, as the exposed burn area is 20 per cent, the individual risk of injury has been estimated as 1.4×10^{-5}. This risk is less than the acceptable individual injury risk proposed by HIPAP 4 criteria (5.0×10^{-5} per year).

The risk of structural damage, resulting from thermal radiation exposure of $23 kW/m^2$, does not extend beyond the premises boundary.

This fire safety study and risk assessment has identified that the proposed facility can operate with acceptable risk to persons and property, based on HIPAP 4 criteria.

Secretary's Environmental Assessment Requirements – Fire and Incident Management (excluding bushfire assessment requirements

Agency	Requirement / comment	Response
SEARs – General requirements	Identification of the aggregate quantities of combustible waste products to be stockpiles at any one time	Building 1 – 1628 tonnes Building 2 – 445 tonnes Yard – 106 tonnes
	Technical information on the environmental protection equipment to be installed on the premises such as air, water and noise controls, spill clean-up equipment and fire (including management of fire water, location of fire hydrants and water flow rates at the hydrant) management and containment measures.	Fire water will be contained within each building using concrete bunds: Building 1 – 51m^3 containment, minimum 10mm high concrete bund wall and roll-over access Building 2 – 51m^3 containment, minimum 16mm high concrete bund wall and roll-over access Yard – 135m^3 containment, bund walls minimum of 4.15m high or alternatively, double wall tanks will be used Smoke extraction fans with minimum flow to control internal smoke layer: Building 1 – 18m^3/s Building 2 – 17m^3/s Building 3 – 26m^3/s Typical spill kits will include absorbents and cloths Fire hydrant and fire hose reel locations are available in Appendix I. Site is serviced with a DN150 Hunter Water Corporation mains water supply, branching off a DN500 main that runs along Tomago Road
	Details of how the development would comply with Volume 1 of the National Construction Code, including clauses E1.10 and E2.3	E2.3 - smoke will be controlled by installation of exhaust fans in each building providing a minimum discharge rate as stated above
	Details of how the development would be designed in accordance with applicable FRNSW Guidelines.	FRNSW Guideline *Fire safety in waste facilities* and *Access for fire brigade vehicles and firefighters* have been considered in the facility layout. Internal stockpiles will be a maximum of 1000m^3 each, will be separated by masonry walls with stockpiles finishing 1m below wall height and 2m inside wall perimeter.

Agency	Requirement / comment	Response
		Stockpiles will have a minimum of 6m unobstructed access on each accessible side. Building containing stockpiles will be fitted with an automatic sprinkler system. Access for Building 2 will be addressed through a fire engineered strategy
SEARs - EPA	Provide the maximum annual throughput of waste and the maximum amount of waste anticipated to be stored at the premises at any one time. Consider Fire + Rescue NSW's *Fire Safety in Waste Facilities* guideline 2019.	Annual throughput – 98,200 tonnes At one time – 5,000 tonnes
SEARs - FRNSW	It is understood that the Applicant is seeking to construct and operate the following; Cardboard Baling, Mud Recycling, Packaged Food Recycling Plant, Garden Organics Primary Processing plant, Hazardous Waste Recycling Facility, Copper Processing area, and a Metals Recycling Facility. FRNSW would consider a significant portion of such waste streams to be combustible in nature and would require the provision of fire safety systems and measures commensurate with a worst credible fire scenario.	Automatic sprinkler systems to be installed in both buildings containing wastes. Hydrant system and fire hose reels already installed. Fire extinguishers to be installed at each PA egress
	It is recommended that advice and considerations contained within FRNSW's *Fire Safety Guideline – Emergency Vehicle Access* be addressed. This is required such that FRNSW are able to safely access all parts of the site where an incident may occur.	A BCA audit has identified access issues that will be addressed through a fire engineered strategy
	It is recommended that advice and considerations contained within FRNSW's *Fire Safety Guideline – Fire safety in waste facilities* be addressed. Advice and recommendations contained within the guideline have been developed to enable FRNSW to adequately manage an incident at such facilities.	FRNSW Guideline *Fire safety in waste facilities* and *Access for fire brigade vehicles and firefighters* have been considered in the facility layout. Internal stockpiles will be a maximum of 1000m^3 each, will be separated by masonry walls with stockpiles finishing 1m below wall height and 2m inside wall perimeter. Stockpiles will have a minimum of 6m unobstructed access on each accessible side. Building containing stockpiles will be fitted with an automatic sprinkler system.
	It is recommended that provisions be made for the containment of contaminated fire water run-off based on the worst credible fire scenario for the site. Any system(s) provided is to be automatic in nature and should not rely upon on-site staff or	Fire water will be contained within each building using concrete bunds:

Agency	Requirement / comment	Response
	emergency services personnel to access or activate provided systems or valves in the event of fire.	Building 1 – 51m^3 containment, minimum 10mm high concrete bund wall and roll-over access Building 2 – 51m^3 containment, minimum 16mm high concrete bund wall and roll-over access Yard – 135m^3 containment, bund walls minimum of 4.15m high or alternatively, double wall tanks will be used Automatic sprinkler system is installed in Building 1 and will be installed in Building 2. A fire response alarm will be connected to the Taro fire station Fire hydrant and fire hose reel locations are available in Appendix I.
	It is recommended that if the development proposes to incorporate a fire engineered solution (FES), whether a building design having a performance solution in accordance with the National Construction Code (NCC) or other infrastructure where building codes are not applicable, FRNSW should be engaged in the fire engineering brief (FEB) consultation process at the preliminary design phase, post approval of the development application. FRNSW also recommend that clauses E1.10 and E2.3 be addressed where a FES is required.	FRNSW will be engaged at start of FES process

1 Report Assumptions

In preparing this Fire Safety Report, ACOR Consultants (WA) Pty Ltd (ACOR) has made the following assumptions:

- Building 1 is a large isolated building (Class 5 and Class 8) fitted with automatic sprinkler system. Tilt-up concrete panels to the main entry, remainder of building with lightweight steel construction;
- Building 2 is a large, isolated building (Class 5 and Class 8) recommended/required[1] to be fitted with automatic sprinkler system. Lightweight steel construction;
- Compliance with AS 2118.1-2017 having regards to the existing system including system performance and system coverage throughout and any proposed deviations with respect of the sprinkler system will need to be confirmed;
- Individual bays in Building 1 will be separated by masonry block walls extending one (1) metre vertically and two (2) metres laterally beyond each bay. Each bay will be separated from non-fire rated walls by a minimum of six (6) metres;
- Individual areas in Building 2 will not be physically separated and may allow escalation between work areas;
- Both Building 1 and Building 2 are classified as Incidental High Hazard Storage with sprinkler design for Ordinary Hazard 3 occupancies (OH3-bbb) under AS 2118.1:2017. Sprinkler volumes for wastewater control will be assessed based on this classification;
- Hydraulic power packs are 500 litre capacity. Power packs may contribute to fire but are an unlikely source of a fire;
- A hydrant booster is located off School Drive at the front of Lot 11;
- On-site hydrants are DN65 dual head;
- Thermal radiation contours have been modelled assuming that the automatic sprinkler system fails to activate;
- The drill muds will be water based and non-combustible;
- Wood and timber waste is combustible;
- The oily water is non-combustible;
- The liquid food waste is non-combustible;
- The liquid food waste plastic and paper / cardboard packaging is combustible;
- The polymer insulation on recycled copper wire represents 46 per cent of mass and is combustible;
- Batteries represent 21 per cent of mine workshop waste, of which, lithium batteries make up 29 per cent of the batteries and the lithium content of the batteries is 7 per cent;
- 15 per cent of lithium content is converted to hydrogen gas during oxidation;
- The overnight truck parking area (Lot 21F) does not present a fire load under normal operating conditions;
- Conveyor belt is Class ST1250, with cord diameter DN4.1 and NBR rubber cover of 5mm top and bottom;
- 60kL of diesel fuel will be stored in tank(s) external and separated from Building 1;
- Emergency services from Tarro (8.3km), Mayfield West (15.2km) and Raymond Terrace (15.6km) are available to respond to a fire event within approximately 16 minutes;

[1] Affinity Fire Engineering (February, 2020) Consultancy Advice Note p4. BMG (March, 2020) BCA Audit Report (finding 27) p.24

- All fires will be extinguished within 4 hours from emergency services attendance on site;
- Fire hydrant flow of 10 litres per second; and
- 50% of applied firefighting water will evaporate.

2 Scope of Report

This Fire Safety Report has been prepared for the proposed development of a resource recovery facility at the former Tomago Aluminium Rod and Conductor Manufacturing Facility, Major Project Development Approval MP 10_0039 (2012) on Lots 11 and 8 on DP270328 (respectively, 21D and 21F), and Lot 301 on DP634536 School Drive, Tomago. The approximately 4.08 hectare sites are located within land zoned as 1N1 General Industrial under the Port Stephens Local Environmental Plan 2013 (refer to Figure 1).

Figure 1 Aerial view of the subject sites at 21D, 21F and Lot 301 School Drive, Tomago.
[Source: Jackson Environment and Planning Pty Ltd]

The proposed project is a State Significant Development under Schedule 1, clause 23(6)(b) of the State Environmental Panning Policy (State and Regional Development) 2011 – Waste and resource management facilities that treats, stores or disposes of industrial liquid waste and handles more than 1,000 tonnes per year of other aqueous or non-aqueous liquid industrial waste.

In response to advice received from the NSW Fire and Rescue on 7 April 2020 and with consideration of the Fire Safety guidelines, this report addresses:

- Availability of safe, efficient and effective access for emergency vehicles.
- Location of fire hydrant system (for building floor areas > 500m^2), installed appropriate to the identified hazards and risks.
- Stockpile management to reduce escalation of fire events.

- Smoke hazard management to retain potentially toxic combustion gases while allowing a minimum four (4) metres of visibility above floor level.
- Primary firewater run-off containment having a net capacity not less than the total (4 hour) hydraulic discharge of the worst-case fire scenario.
- Facility to install a fire detection and alarm system appropriate to the risks and hazards identified for each fire compartment.

This Fire Safety report has considered appropriate, additional infrastructure required to achieve an acceptable level of risk based on the requirements of the Hazardous Industry Planning Advisory Paper (HIPAP) 2 – Fire Safety Study Guidelines.

This report summarises the findings and recommendations resulting from the hazard identification conducted according to HIPAP No. 2, details of the proposed fire safety system showing adequacy to cope with the hazards identified, and arrangements for containing contaminated firefighting water.

3 Description of the Facility

The Tomago Resource Recovery Facility (TRRF) proposed by REMONDIS Australia Pty Ltd (REMONDIS) is located at 21D and 21F School Drive, Tomago. The site has two large secondary sorting warehouses and a workshop pre-existing on the site (refer to Figure 2).

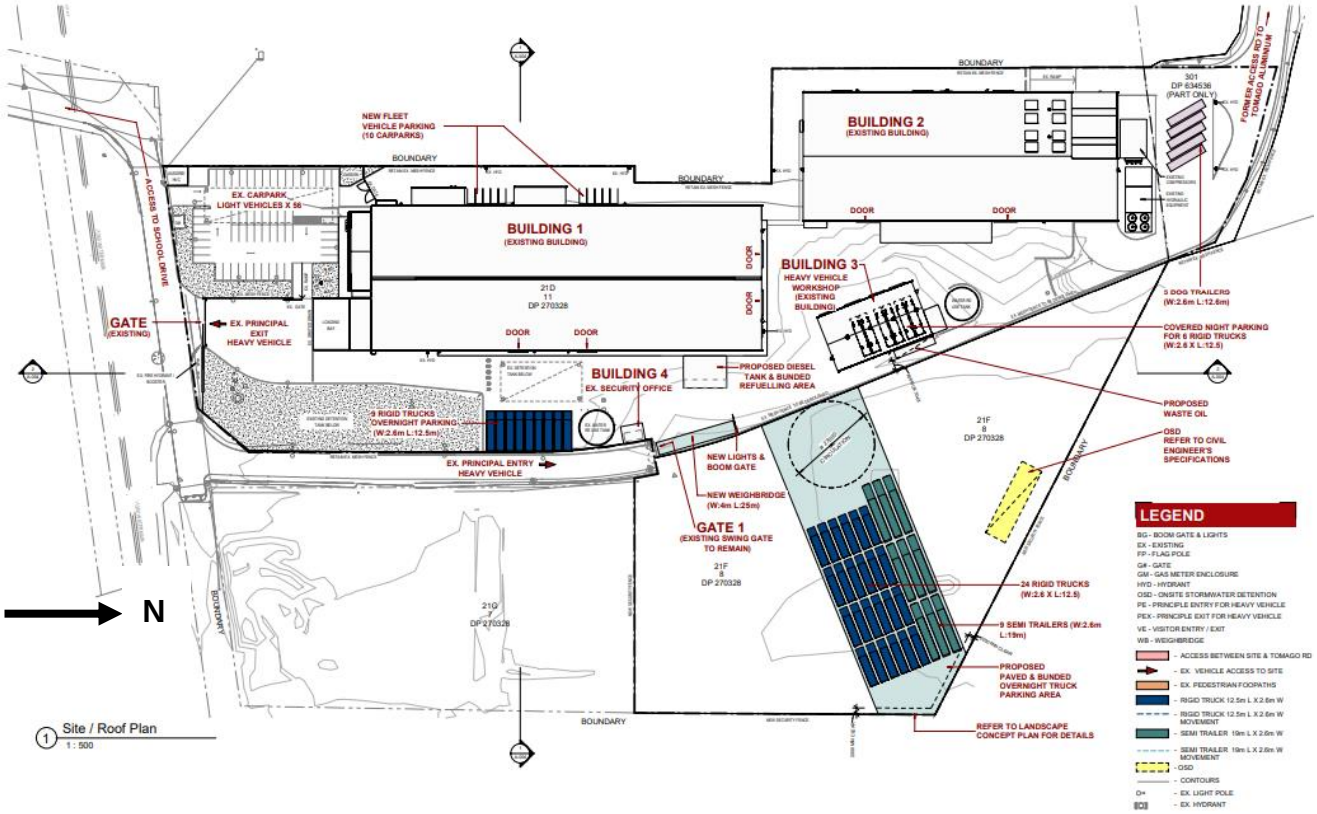

Figure 2 Site Plan - General Arrangement and Traffic Flow

[Source: REMONDIS Australia Pty Ltd]

The site is unsewered and an Envirocycle wastewater treatment system is used to pre-treat contaminated liquids prior to off-site disposal. The site is connected to a DN150 Hunter Water Corporation potable water supply pipeline, fed from a DN500 water main that runs along Tomago Road, to the south of the site.

3.1 Buildings description

3.1.1 Building 1 (21D)

The existing Building 1 has an operational floor area of approximately 5,325m^2 and a gross internal volume of approximately 52,700m^3, of which the rafter volume contributes 33,280m^3. The building is not fitted with smoke hazard management infrastructure. The building is fitted with an automatic fire sprinkler system and six (6) dual fire hydrants [FH1 to FH6]. The building is also fitted with six (6) fire hose reels [FHR1 to FHR6]. The building is constructed from steel frame and zincalume cladding and the walls are non-fire rated.

All waste stockpiles, delineated by masonry block walls, will have a maximum height of three (3) metres (one (1) metre below top of four (4) metre high revetment wall) and terminate two (2) metres short of the revetment walls (as per cl. 8.2 of fire safety guidelines). All baled stockpiles will have a maximum height of four (4) metres.

The building is fitted with five (5) roller doors (2 @ 8m x 4.7m, 2 @ 6m x 4.5m, 1 @ 8m x 4.6m) for access and ventilation.

3.1.2 Building 2 (21D)

The existing Building 2 has an operational floor area of approximately 3,239m^2 and a gross internal volume of approximately 35,653m^3, of which the rafter volume contributes approximately 18,910m^3. The building is not fitted with smoke hazard management infrastructure. The building will be fitted with an automatic fire sprinkler system and is fitted with three (3) dual fire hydrants [FH4, FH7 and FH10, although FH10 is located under an awning and is non-compliant].

Fire hydrants FH8 and FH9 are located approximately 30 metres north of Building 2 adjacent the dog trailer parking area. The building is constructed from steel frame and zincalume cladding and the walls are non-fire rated.

All waste stockpiles will have a maximum height of four (4) metres.

The building is fitted with five (5) roller doors (5 @ 5.5m x 4.4m) for access and ventilation.

3.1.3 Building 3 (21D)

The existing Building 3 has an operational floor area of approximately 568m^2 and a gross internal volume of approximately 4,031m^3, of which the rafter volume contributes 1,842m^3. Building 3 will be used as a heavy vehicle workshop. The building is fitted with one (1) fire hose reel [FHR7] and can access fire hydrant FH5. A waste oil tank is located external, at the northeast corner of Building 3. The building is constructed from steel frame and zincalume cladding and the walls are non-fire rated.

The building is fitted with four (4) roller doors (4 @ 5m x 4m) for access and ventilation.

3.1.4 Waste Oil / Coolant

The recovered waste oil and coolant, from the hazardous waste facility, will be stored in tanks inside a formed concrete bunded compound designed to AS 1940:2017. The bunded compound will have sufficient ullage for the volume of one tank plus 20 minutes of firefighting water. Contaminated fire water is not anticipated to breach the bunded compound.

3.1.5 Overnight Truck parking Area (21F)

The overnight truck parking area is proposed to accommodate 24 x rigid trucks and 9 x semi-trailers.

The location is not anticipated to be a fire load under all normal operating scenarios. The site can be service by fire hydrant FH5. All vehicles are fitted with 4.5kg DCP fire extinguishers.

The TRRF will undertake the activities described in Table 1. eight steel cladding and are not fire rated. Consequently, fire loads and thermal flux are considered to be undiminished by the buildings. The fire load density for each building is described in Tables 2 to 6, below.

Table 1 Combustible and Non-combustible Processes

Combustible	Building	Non-combustible	Building
Cardboard baled storage (CBS)	1	Hazardous waste materials recycling (HWMR)	2
MRF tipping floor	1	Copper processing area (CPA)	2
RDF production area	1	Drill mud recycling facility (DMRF)	2
Old corrugated container (OCC) tipping floor	1	Metal recycling	2
Packaged food recycling plant (PFRP)	2	Heavy vehicle workshop (HVW)	3
Garden organics primary processing (GOPP)	2	Truck parking area	Lot 21F

Table 2 Building 1, Waste Fire Load Density and Storage

System	Floor Area (m^2)	Fire Load Density (GJ/m^2)	Burn Time (min)	Waste (m^3)	Waste (tonnes)
Waste input	1,264	7.454	390	420	125
Shredded wood	1,626	13.038	750	34	8
Heavy	18	7.454	160	55	16
Fines	16	7.454	160	48	7
RDF loose	1,561	13.083	860	100	29
Plastics	437	1.5	1,185	20	2
PVC mixed	6	13.415	90	10	2
Cardboard loose	881	3.839	110	640	50
OCC tipping	174	8.262	320	525	41
Wood pallet input	177	5.945	430	530	83

Table 3 Building 1, Product Fire Load Density and Storage

System	Floor Area (m^2)	Fire Load Density (GJ/m^2)	Burn Time (min)	Product (m^3)	Product (tonnes)
Cardboard baled storage	264	8.262	640	790	396
Old corrugated container baled storage	434	8.262	320	1,300*	651
RDF loose	326	3.954	2,635	980	291
Bale wrapper	87	5.423	210	260	130

Table 4 Building 1, Consumables Fire Load Density and Storage

System	Floor Area (m^2)	Fire Load Density (GJ/m^2)	Burn Time (min)	Volume (m^3)	Mass (tonnes)
Power pack	16	16.540	300	0.5	0.4
Power pack	16	16.540	300	0.5	0.4
Mobile equipment	214	0.392	5	24	1.7
Conveyors	639	0.137	4	4.7	2.6
50kL diesel tank	34	63.920	2,920	50	42

Table 5 Building 2, Waste Fire Load Density and Storage

System	Floor Area (actual) (m^2)	Fire Load Density (GJ/m^2)	Burn Time (min)	Waste (m^3)	Waste (tonnes)
PFRP	881	0.575	990	1,760*	25
GOPPA	367	4.822	730	735	102
CPA	252 (4.3)	3.38	90	3	0.63
HWMR	378 (143.6)	4.19	300	144	1.2

Table 6 Building 3, Fire Load Density and Storage

System	Floor Area (m^2)	Fire Load Density (GJ/m^2)	Burn Time (min)	Volume (m^3)	Mass (tonnes)
Vehicles	525	0.828	690	24	1.7
Tank 1 (waste oil)	32	60.835	3,290	54	47
Tank 2 (coolant)		26.493	25	67	59

*Aggregate volume of two <1000 m^3 stockpiles separated by 6 metres, but assumed to both burn due to knock-on effects

The TRRF project will involve the construction and operation of a best practice resource recovery (recycling) facility that will enable the receipt of up to 98,200 tonnes per year of materials from households, business and industries across the Hunter region. The facility will also include storage for liquid wastes and fuels / oils for the collection fleet.

REMONDIS propose that up to 5,000 tonnes of solids and liquids (combustible and non-combustible) will be on site at any one time. The modelled breakdown of waste composition is shown in Appendix A.

The project will involve the re-development of a largely developed industrial site (refer Figure 1 and Figure 2), to enable the facility to be used to receive, process and recycle dry, non-putrescible waste materials from commercial and industrial sources, and dry, mixed building waste (construction waste only) from residential and commercial construction, including office fit-outs. No demolition waste will be accepted. All waste materials will be received and processed indoors, to minimise impacts on the environment and neighbours.

Identified waste materials have been assessed for fire load based on the fire characteristics shown in Appendix B.

The off-set distances to site boundaries for all buildings containing fire loads are shown in Appendix C.

3.2 Site layout diagrams

Figure 3 illustrates the proposed design layout of the recycling infrastructure in Building 1. The delivery truck on-site movements are indicated by the arrows.

Figure 4 illustrates the proposed design layout of the recycling infrastructure in Building 2. The delivery truck on-site movements are indicated by the arrows.

Figure 5 illustrates the proposed design layout of the collection vehicle workshop in Building 3.

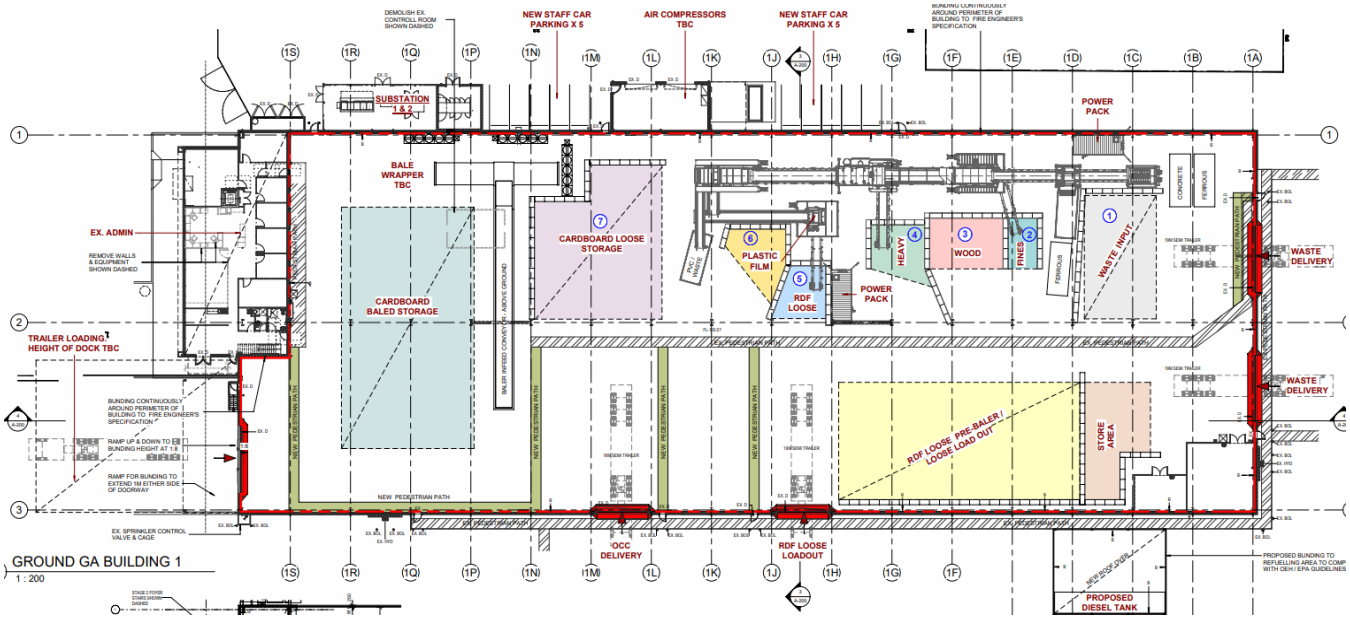

Figure 3 General Layout of Building 1 [Source: REMONDIS Australia Pty Ltd]

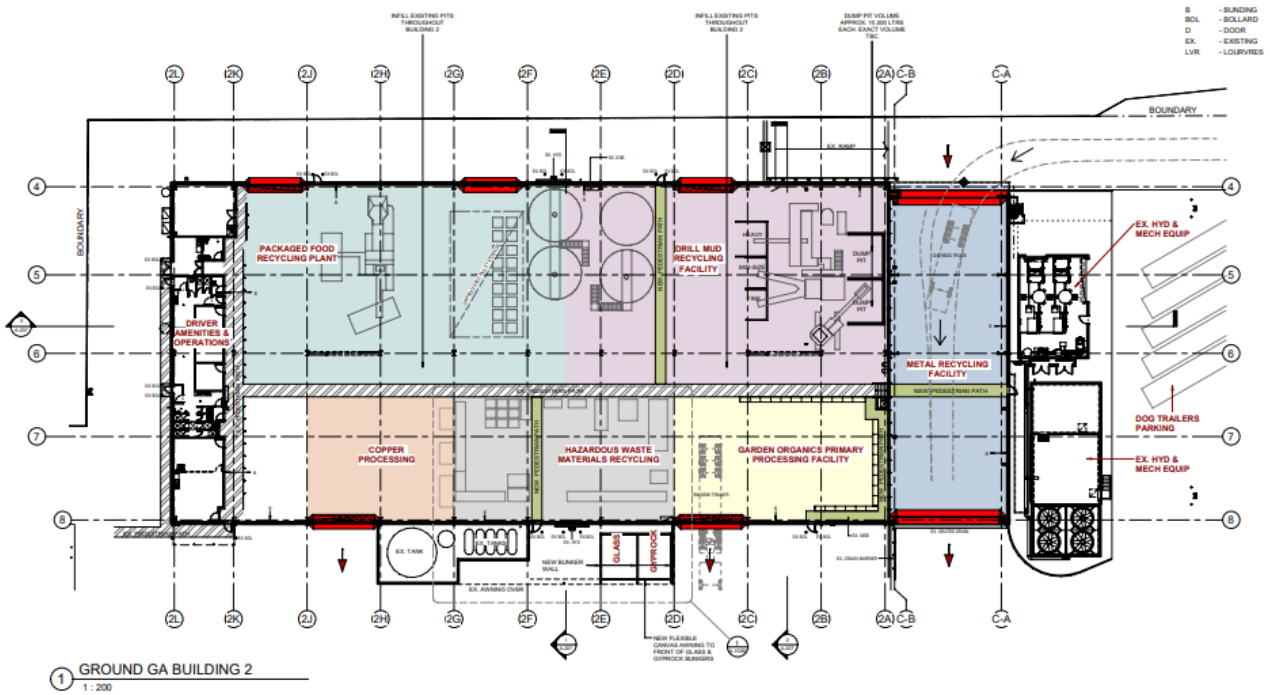

Figure 4 General Layout of Building 2 [Source: REMONDIS Australia Pty Ltd]

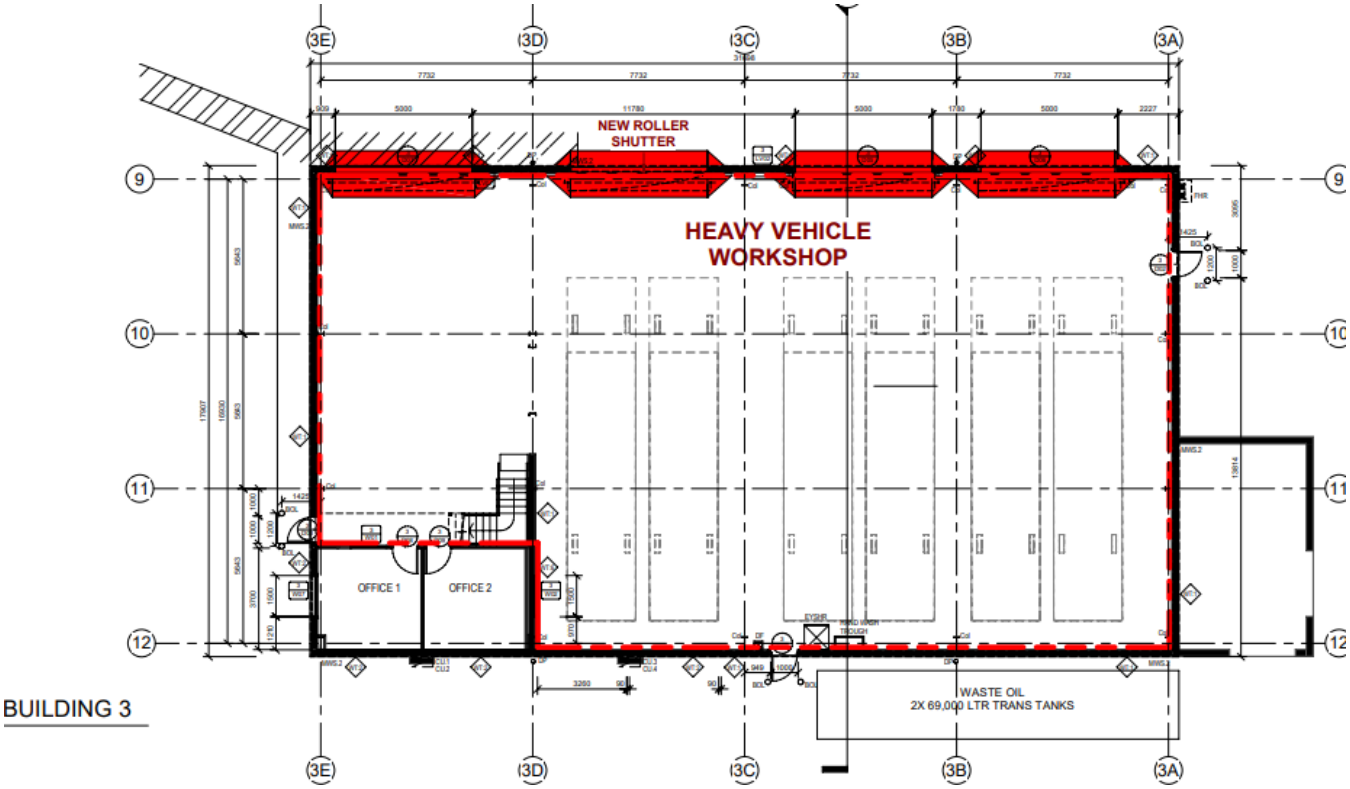

Figure 5 General Layout of Building 3 [Source: REMONDIS Australia Pty Ltd]

3.3 Firewater Containment

Under the NCC, a fire in the warehouses will require that water is applied from two (2) hydrants [2 x 600L/min] for a minimum of 20 minutes and that a minimum 1080L/min is applied to an area of 216m^2 (18 sprinklers) for a minimum of 72 minutes. This is estimated to require storage for 51kL (50% evaporation rate applied to 102kL) of contaminated firefighting water in either building:

- Building 1 – floor area of 5325m^2, depth of 51m^3 equal to 10mm bund wall around the inside perimeter of the building and at each building exit
- Building 2 – floor area of 3239m^2, depth of 51m^3 equal to 16mm bund wall around the inside perimeter of the building and at each building exit

Building 3 has no specific firefighting requirements. However, it is assumed that 1 x fire hose reel will operate for 20 minutes, generating 270 litres (50% evaporation rate applied to 540 litres) of firewater. This will require a 5 mm bund wall around the inside perimeter of the building and at each building exit.

Firewater and contaminated wash water will be contained within the bunded areas of the buildings. After completion of testing by a NATA certified laboratory, contaminated firefighting water will be removed for off-site treatment and disposal.

3.3.1 Emergency Vehicle Access

Figure 2 shows the swept path analysis for 19 metre semi-trailer or quad-dog trailer. The access will provide effective access for a typical fire appliance (15 metre) vehicle. Access paths will be a minimum of 4.5 metres wide with the following minimum turning circle radius:

- 7.5 metre (inner); and
- 14.6 metre (outer).

The distance between inner and outer turning circle radius will be not less than 7.5 metres. Access road will be compacted to allow for the movement of ten tonne axle loads.

As noted by Affinity Fire Engineering (2020), access to Building 2 is not within 18 metres of the structure (BCA cl.C2.4) on the northern side of the building where it passes the dog-trailer parking area. Other than this non-conformance, the site is largely compliant with the requirements of the NSW FR Fire Safety Guideline – *Access for fire brigade vehicles and firefighters*.

A fire hydrant booster is located in the south east corner of the site, adjacent the heavy vehicle exit gate, off School Drive at the front of the site.

3.4 Separation Distances

The processing areas are separated from off-site receptors by the distances shown in Appendix C. All on-site receptors will be protected by fire alarms/automatic sprinkler systems, evacuation procedures and 24 hour occupancy.

3.5 Consumables

In addition to secondary resources brought to site, the site will store fuel for mobile equipment. It is anticipated that 50kL of diesel will be stored on site.

3.6 Operating Hours

The TRRF is proposed to operate 24 hours per day, 7 days per week, although peak activity will be between the hours of 06:00 and 22:00.

3.7 Staff Numbers

REMONDIS propose to employ the following staff:

- 16 office, sales and administration staff during weekday business hours; and
- 60 truck drivers, operators, mechanics and recycling hands, three crews on two twelve hour shifts

3.8 Surrounding Land Use

The proposed development site is surrounded by mainly 1N1 General Industry and several other zoning types, as shown in Table 7.

Table 7 Location of Surrounding Land Use

	Property Address	Zoning	Distance (m)
1	23A School Drive, Tomago	SP1	30m S
2	9A McIntyre Road, Tomago	SP1	160m SW
3	421 Tomago Road, Tomago	RU2	330m SE
4	164 Tomago Road, Tomago	SP1	800m NE
5	7A Graham Drive, Tomago	RU2	1200m E

4 Hazards identified

The secondary resources (refer to Tables 2, 3 and 4) and diesel fuel stored at the facility are classified as combustible materials according to NSW Planning – Storage and Handling of Dangerous Goods – Code of Practice 2005. 'Combustible material' is defined as 'any type of combustible material and includes without

limitation C2 combustible liquids and empty combustible containers, such as paper bags, fibre board drums and boxes, plastic containers and liners for containers, and wooden boxes and barrels'.

Any material at the site that contains wood, paper, fibre, cardboard, plastic or organic material has been classified as 'Combustible material'. Combustible materials have the potential to ignite, burn, support combustion, or release flammable vapours.

A hazard analysis was prepared and is provided in Table 8. The table includes all identified occupational health and safety hazards that may present a risk to the public, employees and contractors working on the proposed development.

Table 8 Hazard Analysis

Item	Building	Hazard	Causes	Consequences
1	1 (external)	Diesel storage, external	50,000L tank damaged by mobile equipment	Fire – thermal radiation Toxic fumes Contaminated firewater
2	1	Hydraulic oil, external	Knock-on from encroaching fire	Fire – thermal radiation Toxic fumes Contaminated firewater
3	1	Conveyor rubber, internal	Ignition of combustible materials during crushing Bearing seizure (friction) Belt misalignment (friction) Fire transfer between belts Belt failure due to fire Inadequate maintenance	Fire – thermal radiation, conduction, convection Toxic fumes Contaminated firewater
4	1	Plastics (PVC and LDPE) storage, internal	Knock-on from encroaching fire Ignition during shredding	Fire – thermal radiation, conduction Toxic fumes Contaminated firewater
5	1	Paper storage, internal	Knock-on from encroaching fire Inappropriate management of naked flames	Fire – thermal radiation Contaminated firewater
6	1	Cardboard storage, internal	Knock-on from encroaching fire Inappropriate management of naked flames	Fire – thermal radiation Contaminated firewater
7	1	Textiles storage, internal	Knock-on from encroaching fire Inappropriate management of naked flames	Fire – thermal radiation Contaminated firewater
8	1	Solid wood storage, internal	Knock-on from encroaching fire Inappropriate management of naked flames	Fire – thermal radiation Contaminated firewater
9	1	Shredded wood storage, internal		Fire – thermal radiation Contaminated firewater
10	3 (external)	Waste oil storage, external	54kL / 67kL tanks damaged by mobile equipment	Fire – thermal radiation Toxic fumes

Item	Building	Hazard	Causes	Consequences
11	3 (external)	Waste coolant storage, external	20kL tanks damaged by mobile equipment	Contaminated firewater
12	2	Aerosol storage, internal	Damage from handling	Fire – thermal radiation Vapour cloud explosion
13	2	Li Battery storage, internal	Ineffective cell discharge and exposure to atmosphere	

5 Consequences of Incidents

ACOR has undertaken modelling of each of the identified combustible materials under plausible event scenarios using the data in Appendix B and Appendix H. Model outputs are shown in Appendix D.

5.1 Fire Services Response Time

Three fire brigades are located within a 16 minute response time to the proposed REMONDIS development:

- Tarro, 8 Eastern Avenue, Taro – 8.3km (estimated 8 minutes response time)
- Raymond Terrace, 3 Leisure Way, Raymond Terrace – 15.6km (estimated 14 minutes response time)
- Mayfield West, Industrial Drive, Mayfield West – 15.2km (estimated 16 minutes response time)

Given the response time for attendance and set-up, the installed sprinkler systems will be the primary fire protection system for the site.

5.2 Thermal Radiation

The modelled thermal radiation contours (refer to Appendix F) have been prepared. The contours indicate that injurious thermal radiation (first degree burns @ 105 TDU) originating in each of the building will generate injurious thermal radiation to the distance and after the exposures shown in Table 9.

Table 9 Injurious Thermal Radiation

Location	Distance (m) past REMONDIS premises (105 TDU exposure (clothed) after seconds)			
	West	East	North	South
Building 1				
Waste input	12 (2)	-	9 (50)	-
Shredded wood	3 (30)	-	-	-
Plastic film	17 (50)	-	-	-
Cardboard (loose)	45 (2 to 50)	-	-	-
Cardboard (baled)	50 (10 to 50)	-	-	4 (50)
Cardboard (baled)	46 (10 to 50)	-	-	4 (50)

Location	Distance (m) past REMONDIS premises (105 TDU exposure (clothed) after seconds)			
	West	East	North	South
Cardboard (baled)	70 (5 to 50)	-	-	58 (10 to 50)
Cardboard (loose)	53 (10 to 50)	-	-	-
Mobile equipment	40 (10 to 50)	-	-	-
Wood pallets	25 (10 to 50)	-	-	-
Cardboard (baled)	43 (2 to 50)	-	-	-
Conveyor belts	60 (2 to 50)	-	-	-
Building 2				
Packaged food	13 (10 to 50)	-	-	-
Garden organics	33 (10 to 50)	-	45 (10 to 50)	-
Building 3				
Oil tank	86 (10 to 50)	98 (10 to 50)	95 (10 to 50)	-
Coolant tank	86 (10 to 50)	98 (10 to 50)	95 (10 to 50)	-

All other fire load sources do not result in injurious thermal radiation extending beyond the boundary of the REMONDIS premises.

The thermal radiation, capable of causing structural damage (23kW/m^2 after 30 minutes exposure) may cause damage to the cladding on the building on the property immediately west of Building 1 but is unlikely to cause structural damage.

5.3 Smoke Management

Assuming an unsteady fire and fill rate, to achieve an outcome where at least 90 per cent of the compartment does not have smoke a smoke layer descend below four (4) metres above floor level, the following exhaust rates are required for each building:

- Building 1 – 18 m^3/s (the maximum extraction rate for a single fan is 537m^3/s at smoke layer temperature)
- Building 2 – 17 m^3/s (the maximum extraction rate for a single fan is 768m^3/s at smoke layer temperature)
- Building 3 – 26 m^3/s (the maximum extraction rate for a single fan is 75m^3/s at smoke layer temperature)

The exhaust fans should be installed along the building ridgeline to maximise the ceiling void volume and reduce the discharge of potentially toxic smoke into the surrounding environment.

6 Risk Assessment

Due to the significant distances that thermal radiation may extend over the western boundary during a fire event in either Building 1 or Building 2, a risk assessment has been completed against the criteria in HIPAP 4. The following risk criteria has been used for this risk assessment:

- Individual fatality risk at an industrial site @ 5 x 10^{-5} per year
- Thermal radiation injury risk (4.7kW/m^2) @ 5 x 10^{-5} per year
- Property (steel) damage (23kW/m^2) @ 5 x 10^{-5} per year – Nil probability

6.1 Likelihood

Businesses in Australia classified as warehousing are reported by the ABS (2019) as representing some 190,000 businesses, including those used for sorting of secondary resources,

During 2013/14, there were approximately 19,520 building fires in Australia. Warehouse fires in Australia accounted for approximately six (6) per cent of all building fires (equivalent to 1,170 based on 2013/14 data). Of this six per cent, approximately 18 per cent (1.1%) were caused by intentional actions and another 18 per cent (1.1%) resulted from electrical faults.

Statistically, the chances of a fire in a warehouse is equivalent to 6.15 x 10^{-3} per year (1170/190,000) for an individual business.

If it is assumed that the REMONDIS facility will have an operational life of 50 years, then it could be anticipated that a fire that impacts on an area of greater than or equal to 100m^2 might occur once during that operational life.

Warehouse fires result in fire damage that is confined to the fire origin in 37 per cent of incidents and are confined to the fire load area in another 25 per cent of incidents.

The typical cause of warehouse fires consuming a significant proportion of the building include:

- The dimensions, installation, servicing/maintenance are inadequate for the fire load at the site
- The flow and line pressure of the available water supply is inadequate for the sprinkler system or responding fire brigades to successfully fight the fire
- Inadequate fire detection systems allowing fires to fully develop
- Failure of employees to attempt to tackle the initial fire outbreak
- Human error and gross negligence, including arson, hot works, faulty electrical installation, careless handling of flammable liquids, and incorrect storage

The REMONDIS facility will have installed a fully automatic sprinkler system complying with AS 2118.1 and AS 4118 series.

Even a system installed to Australian standard criteria can be subject to failures, although regular maintenance reduces the likelihood of this source of failure. Typical failure rates for sprinkler system design are shown in Table 10.

Table 10 Failure likelihood

System Component	Failure rate (per demand)

Alarm	2×10^{-3}
Pump	8.4×10^{-2}
Storage tank	4.6×10^{-3}
Water pipeline	1.3×10^{-5}
Direct fire brigade alarm	5.3×10^{-3}
Sprinkler head	7.8×10^{-2}
Isolation valve (fails open)	1.9×10^{-3}
Seized roller bearing	3.4×10^{0}

Luke[2] found that it is difficult to ignite fuels with a moisture content above 35%. Consequently, all vegetation for sorting as RDF will be maintained at 35% moisture.

Typically, the likelihood of ignition occurring during exposure of combustible materials to a naked flame is 10 per cent. Consequently, enforcement of the REMONDIS policy to not carry sources of naked flames on site should reduce this likelihood to zero.

REMONDIS have prepare and enforce a strict hot work permit system with spotters available and equipped, who have been trained in the use of fire extinguishers. Spotters remain for a period of 20 minutes after the completion of hot works, or hose the works down with water, if appropriate to do so.

Electrical faults, including seized bearings in electrical equipment and conveyor rollers, remain the most significant source for ignition. However, statistically, the likelihood of an electrical fault resulting in a fire event ≥100m^2 is estimated at 6.7×10^{-5} per year [$6.15 \times 10^{-3} \times 1.1\%$].

Conveyors operating 24 hours per day have a reliability factor of 0.75 (failure of 0.25). The peak time to failure is 666 hours[3]. Consequently, one roller bearing could be anticipated to fail every 21 days of continuous operation. Friction generated fires represent 40 percent of conveyor fires. With two bearings per roller it is estimated that the probability of a conveyor fire is 3.4 per year.

REMONDIS will use thermal imaging technology to check for roller bearing hot spots on a weekly basis. Rollers will be replaced if a temperature greater than 60^{o}C is indicated during weekly checks.

6.1.1 Likelihood Calculation

The likelihood that a fire will occur at the REMONDIS facility is:

- Fire at warehouse – 6.7×10^{-5}
- Water pipeline failure – 1.3×10^{-5}
- Sprinkler head failure (individual) – 7.8×10^{-2}. Unlikely that 18 sprinkler heads will simultaneously fail.

[2] Luke, R.H.; Mcarthur, A.G. Bush fires in Australia. Eur. J. Surg. Oncol. 1978, 22, 354–358.
[3] Li, M et al 2019

6.2 Consequence

Thermal radiation resulting from a fire event in Building 1 may cause minor damage to cladding and cable insulation in the building on the western property immediately adjacent Building 1, however, it is unlikely to cause structural damage.

The data shown in Appendix H indicates that the consequence of the thermal radiation contours shown in Appendix F would have limited impacts upon persons working to the south and west of the proposed REMODIS development.

Healthline[4] report that the typical lowest velocity for a walking human between the ages of 20 and 69 is 1.34 metres per second (4.8km/hr).

Although thermal contours at 23kW/m^2 extend into the property to the west by an estimated 12 metres from Building 1, a 1 per cent probability of fatality would only occur after 34 seconds of continuous exposure. ACOR estimate that a person would move the maximum 12 metres away from a fire incident in either Building 1 much sooner than 34 seconds (1.27km/hr). Walking at 1.34m/s, a person working on the property boundary to the west of the proposed REMONDIS development would be exposed to a total of 2933 TDU:

- 8.9 seconds at an average 38.6W/m^2 = 1161 TDU
- 26.1 seconds at an average 17.8kW/m^2 = 1213 TDU
- 26.1 seconds at an average 8.7kW/m^2 = 467 TDU
- 14.9 seconds at an average 3.9kW/m^2 = 92 TDU

This dose would be less than the TNO estimated exposure (3600 TDU) to cause clothing to ignite, and consequently, the probability of fatality is estimated as 1.4 x 10^{-1}.

The probability of injury for thermal radiation greater than 4.7kW/m^2 is 2.0 x 10^{-1}.

6.3 Risk Assessment

The individual fatality risk to a person working on the western property boundary, who does not move away for the approximately 12 minutes required for a fire to fully develop is:

- 6.7 x 10^{-5} x 1.4 x 10^{-1} = 9.4 x 10^{-6} which is less than the HIPAP criteria for an industrial site.

The individual injury risk to a person working on the western property boundary, who does not move away for the approximately 12 minutes required for a fire to fully develop is:

- 6.7 x 10^{-5} x 2 x 10^{-1} (third degree burns to less than 20% of body) = 1.4 x 10^{-5} which is less than the HIPAP criteria for individual injury risk.

Consequently, the development is an acceptable risk under HIPAP 4 development criteria

7 Fire Prevention Strategies/Measures

7.1 Prevention and Detection

The first element of fire safety is prevention. Suitable design and layout of the facility and operating procedures and arrangement are important aspects of fire prevention. REMONDIS plans to prevent fire at the proposed facility by:

- Eliminating ignition sources near dusts and combustible material;

[4] https://www.healthline.com/health/exercise-fitness/average-walking-speed

- Prohibit smoking and naked flame to designated smoking areas (no smoking policy for employees and signage for visitors);
- Employee induction and education on fire prevention;
- Regular inspection of stockpiles;
- Sprinkler systems will be installed, in permanent locations, to control dust to the point where potential for fire is minimised;
- Site security (fencing, locked gates when facility is closed, gate houses for visitors);
- Plant maintenance;
- Keeping maintenance and activities that can produce sparks, such as welding, away from combustible material piles;
- Avoiding conditions that can lead to spontaneous combustion (e.g., moisture between 25 – 45 percent and temperatures above about 93ºC in stockpiles);
- Keeping shredded wood stockpiles low and turning them when the temperature exceeds 60ºC;
- Management of vegetation and debris; and
- Designing the facility for access by firefighting equipment, including clear aisles among stockpiles and access to an adequate water supply.

7.2 Mitigation Measures

REMONDIS will implement management procedures for staff induction, safety inspections and emergency drills in preparation for fire events. Housekeeping will be maintained at a high level to remove combustible materials from the outside of building to reduce the risk of off-site fires escalating into waste storage areas.

The site will have strict no smoking enforcement, other than in designated areas. The site will operate a work permit system preventing hot works in areas containing combustible materials and will require roll out of fire hose reels during maintenance and construction and the use of “fire spotters”.

REMONDIS operate all sites under the corporate emergency plan, modified for specific site requirements.

A Fire Safety Statement will be prepared and submitted annually to the Port Stephens council and the FRNSW reporting maintenance of the fire safety system.

7.3 Fire Suppression and Control

Fire suppression and control is an essential element of preventing escalation of the risks of combustible material. All fire protection and detection equipment should conform to appropriate Australian Standards.

Equipment, such as couplings, firefighting media, hose reels, hydrants and monitors should be selected and installed in consultation with the Emergency Services to ensure compatibility. Firefighting equipment at the premises should be capable of being used with the equipment used by the local fire brigade, without adaptation or modification (e.g. all fittings and couplings need to be compatible).

Sufficient spacing between stockpiles will be maintained to allow access, in case of emergency, and to help prevent the spread of fire. This spacing should at least be equal to the height of the stockpile or adequate for emergency vehicle access, whichever is the greater.

It is recommended REMONDIS provide an emergency tipping area, such as the undeveloped areas on site 21F, at least 10 metres away from parked vehicles and within hydrant water throw, for waste loads identified to be on fire or otherwise deemed to be an immediate risk.

7.3.1 Portable Fire Extinguishers

Portable fire extinguishers should be installed around the facility near operating machinery and entry/ exit points to the site, processing areas and sheds. Fire extinguishers are to be installed and maintained in conformance with appropriate Australian Standards.

At least 1 x 2A 60B(E), dry chemical powder, 4.5kg fire extinguisher to be installed on each piece of mobile equipment.

Fire protection systems and equipment should be inspected, pressure tested, serviced and recharged as necessary at regular intervals to ensure that it is always fully operational.

7.3.2 Location

Fire extinguishers should be wall mounted on a hook or bracket, or an unlocked cabinet, at a suitable height and with signage. Where the extinguisher could be subject to unauthorised interference, the cabinet may be locked providing it has a glass panel that can be broken to remove the extinguisher in the event of a fire.

Firefighting equipment should be located to achieve the following:

- All personnel, storage areas (including sheds and processing zones), equipment and other items being protected can be directly reached by the firefighting medium;
- It is readily accessible and unobstructed in the event of an incident, preferably adjacent to exit doors or on exit routes;
- It is in a conspicuous position (all firefighting equipment should be clearly marked and labelled in conformity with the relevant Australian Standards);
- All mobile plant is fitted with an appropriate type and size fire extinguisher consistent with its operation;
- All vehicles are fitted with an appropriate type and size fire extinguisher consistent with its operation;
- It is protected from damage (e.g. from vehicle collision and deterioration from the weather); and
- All operators/ site fire crew are trained in the use of fire protection equipment.

7.4 Security

Businesses can protect themselves from fire by:[5]

- Maintaining site security, especially after work hours. Insecure, vacant or easily accessed premises may become a target for the opportunistic arsonist. An arsonist can be motivated by many factors including business rivalry, spite/revenge, vandalism, crime concealment or financial reward.
- Having a safety culture: Simple precautions can prevent many accidental fires. Accidents and neglect, poor housekeeping, discarded cigarettes, hot work equipment, chemicals or unsafe work practices can all have tragic consequences.
- Preparing and practicing an emergency evacuation plan.

8 Detection and Protection

Ensure that maximum quantities of stockpile stored in a given area, based on the specifications of the features (separation walls) of the area, are such that:

- For bays storing combustible materials, the maximum height of the stockpile is maintained at one meter below the height of the walls surrounding the stockpile; and

[5] DFES Safety Information

- For bays storing combustible materials, the length of the stockpile such that the walls surrounding the stockpiles extends two meters beyond the outermost edge of the stockpile.

Ensure that all ignition sources are kept away from the stockpiles:

- Implement the movement of stockpiles as a part of the operational plan to allow flow of air it to maintain low temperatures of the stockpile;
- Ensure that all the equipment being used in this area are regularly inspected and maintained according to the OEM recommendations;
- Ensure that any hot works being carried out has work permits to do so and conduct all of the hot works as far as possible from the combustible materials;
- Train all the staff members, contractors and visitors about the designated smoking area and all the non-smoking areas; and
- Install control equipment that monitors the safety critical parameters of the stockpile such as the core temperature of the stockpile, the moisture content and volume/mass of the stockpile.

Ensure that all the staff, contractors, visitors are well trained and informed on the operational, housekeeping and safety procedures practiced on sites by:

- Implementing robust induction methods;
- Developing documentation for operational and safety procedures that are concise and provides correct instructions to the reader on their respective responsibilities without any ambiguity;
- Develop and implement a robust change management system that allows personnel to identify and implement any changes to the type of materials being stored, quantities, procedures being adapted to carry out tasks;
- Updating relevant documentation capturing any changes such that any discrepancies identified to the content of documentation provided to be communicated in an effective manner;
- Establish an effective communication or reporting system to raise any safety or operational related issues;
- Ensure security system is activated at all times during non-working hours;
- Ensure fire prevention and detection strategies are maintained by install, inspect and maintain the right detection systems such as visual flame detectors, infrared detectors, smoke detectors;
- Installation of the alarm system with multiple layers of protection depending on its readings of the parameter;
- Having firefighting trained staff on site during all working hours and having the right equipment available to stop/prevent escalation of small fires;
- Audit the licenses and skills of the staff, contractors carrying out tasks; and
- Audit the operational, safety procedures, maintenance and inspection documents, any relevant checklists to make sure all changes are being captured.

Based on the location of the potentially combustible materials identified, there are five (5) major fire loads on the site which will require detection and protection to control and manage any fire hazards on site:

- External Tank 5 diesel storage (64 GJ/m^2);
- Building 2 hazardous waste facility (33 GJ/m^2);
- Building 1 PVC skip storage (13 GJ/m^2);
- Building 1 RDF loose storage (13 GJ/m^2); and
- Building 1 shredded wood pallets (13 GJ/m^2).

Detection of fire in these areas:

- Regular inspections of temperature of the stockpiles in these area with a probe and portable thermal cameras to detect high temperatures. This will be incorporated as a part of the operating procedures;
- Installation of permanent thermal camera to identify hot spots (i.e. > 60 C); and
- Relevant work instructions will be developed to be implemented upon identification and notification of temperature higher than normal (i.e. > 60 C).

Additional Protection:

- Building 2 will require the installation of 4 x 36m (DN19) fire hose reels adjacent personal access doors to ensure coverage of the building internal floor area
- 2A 60B(E) 9 kg powder fire extinguishers will be installed on all the vehicles working in the vicinity of these four fire compartments
- 5 x 2A 60B(E) 9 kg powder fire extinguishers inside the recycling plant will be installed

9 Water Supply and Demand

The site has adequate fire hydrant resources on site (refer to Appendix I).

The hydrant system should be tested to ensure a residual pressure of 150kPa at the most hydraulically disadvantaged hydrant, while all required hydrants are in use (minimum flow of 10 litres per second per hydrants).

10 First Aid Fire Protection

First aid firefighting allows control of a fire events in its initial stages by using whatever means is readily available.

This could be as simple as shovelling dirt onto a small fire or using a blanket to smother a flame by reducing oxygen. A pile of burning wood can be pulled apart to diminish the intensity of the flame and the heat.

Employees are not expected to fight fires unless they have been trained to do so, and the circumstances are manageable. Small fires can often be put out quickly by a well-trained individual with a portable fire extinguisher. However, to do this safely, you must understand the use and limitation of a portable fire extinguisher and the hazards associated with fighting fires.

Do not attempt to extinguish any fire without calling for help. To extinguish a fire with a portable extinguisher, a person must have immediate access to the extinguisher, know how to actuate the unit, and know how to apply the agent effectively.

Attempting to extinguish even a small fire carries some risk. Fires can increase in size and intensity in seconds, blocking the exit path and creating a hazardous atmosphere. In addition, portable fire extinguishers contain a limited amount of extinguishing agent and can be discharged in a matter of seconds.

11 Summary

This Fire Safety Study has considered the impact of proposed on-site activities involving combustible materials against the criteria of the HIPAP 2, and the NSW FR Fire safety guidelines for:

- Access for fire brigade vehicles and firefighters:
  - It has been noted by both BMG (2020) and Affinity Fire Engineering (2020) that emergency vehicle access around the northern end of Building 2 is not deemed to satisfy BCA cl. C2.4, in that the perimeter road is greater than 18 metres from the building in certain locations; and
- Fire safety in waste facilities:

- Building 1 will be fitted with ridgeline exhaust fans capable of extracting smoke at the rate of 18m^3/s within 10 minutes of the fire reaching steady heat release;
- Building 1 will have a minimum 10mm high, heat resistant, perimeter bund around the inside of the building;
- Building 2 will be fitted with ridgeline exhaust fans capable of extracting smoke at the rate of 17m^3/s within 6 minutes of the fire reaching steady heat release;
- Building 2 will have a minimum 16mm high, heat resistant, perimeter bund around the inside of the building;
- Building 3 will be fitted with ridgeline exhaust fans capable of extracting smoke at the rate of 26m^3/s that are interlocked with the fire alarm;
- Building 3 will have a minimum 5mm high, heat resistant, perimeter bund around the inside of the building;
- Internal stockpiles will be arranged to allow for six (6) metres unobstructed access around internal stockpiles; and
- Internal stockpiles will have a maximum volume of 1000m^3.

12 Recommendations

It is recommended that REMONDIS:

- provide an emergency tipping area, such as the undeveloped areas on Site 21F, at least 10 metres from parked vehicles and within a 70 metre radius of hydrant FH5;
- use portable infrared detectors to check for thermal hotspots;
- Install fixed infrared cameras with audible alarm at five (5) identified high fire load locations;
- Install automatic sprinkler system in Building 2;
- Building 2 will require the installation of 4 x 36m (DN19) fire hose reels adjacent personal access doors to ensure coverage of the building internal floor area;
- 2A 60B(E) 9 kg powder fire extinguishers will be installed on all the vehicles working in the vicinity of the fire compartments; and
- 5 x 2A 60B(E) 9 kg powder fire extinguishers to be inside the recycling plant.
- Lithium batteries must be stored in accordance with the Dangerous Goods Code and AS/NZS 4681:2000 The storage and handling of Class 9 (miscellaneous) dangerous goods and articles.
- Plastics will be removed on a regular basis to ensure that individual storage areas, no greater than 20m^2 and 2 metres high, are separated from adjoining storages by no less than 2.4 metres.

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Appendix A - Waste Composition (Combustible)

Waste Stream	Composition (mass %)	Bulk Density (kg/m^3)	MJ/tonne$_{(dry)}$
Mixed C&I (NSW)[6]	**78%**	**298**	**12,502**
Plastic	4.7%	69	2,033
Polyethylene terephthalate (PET)	2.2%	70	24,130
Expanded polystyrene (EPS)	0.5%	30	43,650
Polyethylene (LDPE/HDPE)	0.9%	80	47,740
Rigid, including PVC	1.1% (not to be used for RDF)	80	39,230
Wood / Pallets	19.5%	156	17,384
Rubber	0.8%	553	50,533
Vegetation	4.7%	139	17,384
Textiles	4.7%	775	22,935
Paper	10.1%	370	13,820
Cardboard (loose)	32.8%	79	16,200
Gyprock	0.8%	286	966
Packaged Food	**0.51%**	**25**	**93**
PET	0.2%	70	24,130
Paper/Cardboard	0.3%	79	15,010
Copper Wire Insulation	**0.46%**	**46**	**188**
PVC	0.12%	80	39,230
Polyethylene	0.03%	30	47,740
Hazardous Wastes	**21%**		**12,190**
Rags, absorbents	6.3%	775	22,935
Lithium batteries (as hydrogen)	0.004%	1200	141,800
Lube oils, oil filters	1.7%	880	41,394
Aerosols	4.2%	100	50,329
Coolant	1.7%	880	169
Paper	2.8%	370	13,820

[6] NSW Department of Environment and Conservation 2003

A.1 Product Parameters (Combustible)

Product Stream	Bulk Density (kg/m^3)	MJ/tonne$_{(dry)}$
Residue derived fuel	290	18,118
Old corrugated container (baled)	600	16,200
Shredded wood	250	17,384
Heavy fraction	298	8,343
Fines	146	8,343
PVC mixed	180	39,230

A.2 Consumable Parameters (Combustible)

Consumable Stream	Density (kg/m^3)	MJ/tonne
Diesel	840	42,000
Natural/Butadiene rubber (conveyor)	600	50,533

Appendix B - Fire Characteristics

Material	$\dot{m}$ (kg/m^2.s)	H_c (MJ/kg)	HRR (kJ/m^2.s)	T_f (K)	H_f (m)	Q_r (kW/m^2)	Q_{conv} (kW/m^2)	TNT_{eq} (kg)
NB rubber	2.81 x 10^{-2}	50.5	1,420	2,185	15	155	193	-
Textiles	2.73 x 10^{-3}	22.9	63	375	1	0.05	1	-
Diesel	7.00 x 10^{-3}	52.1	364	1,991	3	107	137	-
Mineral oil	3.40 x 10^{-2}	43.3	1,471	1,615	9	50	69	-
PVC	6.05 x 10^{-2}	39.2	2,374	3,539	7	978	1129	-
PE	1.10 x 10^{-3}	26.4	29	973	1	5	12	-
MEG	3.10 x 10^{-3}	15.2	47	975	3	7	14	-
PET	2.81 x 10^{-2}	23.2	550	973	7	5	12	-
EPS	8.12 x 10^{-3}	40	325	923	2	4	11	-
Wood (mulched)	1.78 x 10^{-2}	16.3	290	1,300	4	204	255	-
Wood	2.81 x 10^{-2}	16.3	458	1,300	11	204	255	-
Vegetation	2.13 x 10^{-3}	9.3	19.9	1,300	3	204	255	-

Material	$\dot{m}$ (kg/m^2.s)	H_c (MJ/kg)	HRR (kJ/m^2.s)	T_f (K)	H_f (m)	Q_r (kW/m^2)	Q_{conv} (kW/m^2)	TNT_{eq} (kg)
Paper	2.81 x 10^{-2}	13.8	388	1,950	1	115	148	-
Cardboard (loose)	7.6	16.2	123,120	2,200	22	186	233	-
Cardboard (baled)	2.81 x 10^{-2}	16.2	455	2,200	14	186	233	-
Cable insulation	4.4 x 10^{-3}	25.1	110	3,539	13	978	1,129	-
Hydrogen		141.8		2,525	VCE	-	-	8.1
Propane		50.3		2,173	VCE	-	-	2.2

Appendix C - Distance to Boundaries

Location	Distance To boundary			
	West (m)	East (m)	North (m)	South (m)
Building 1				
Bay 1	13	133	111	154
Bay 3	17	133	140	136
Bay 5	28	133	162	118
Bay 6	23	133	167	107
Bay 7	15	133	182	90
Conveyors	11	148	122	109
Area 1	20	133	204	66
Area 2	24	109	204	66
Area 3	40	109	226	52
Area 4	27	109	183	91
Area 5	25	109	171	105
Area 6	30	109	132	125
Area 7	30	109	122	155
Area 8	12	146	202	66
Area 9 - diesel	30	99	115	148
Building 2				
Area 1	7	109	25	55
Area 2	32	93	25	68
Area 3	32	141	65	42
Area 4	32	150	88	25

Location	Distance To boundary			
	West (m)	East (m)	North (m)	South (m)
Building 3				
Maintenance	65	68	61	192
Oil Tank	64	52	55	214
Coolant Tank	64	52	55	214

Appendix D - Model Outputs

	BUILDING 1	S (m)	1	1.5	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150
		75 kW/m²	75																																														
Bins		23 kW/m²	23																																														
1	ferrous scrap	12.6 kW/m²	12.6																																													
2	concrete rubble	4.7 kW/m²	4.7																																													
3	ferrous scrap	1.7 kW/m²	1.7																																													
4	PVC waste		303.3	228.0	155.6	137.9	137.9	137.9	53.8	53.8	53.8	53.8	53.8	27.4	27.4	27.4	27.4	27.4	27.4	16.6	7.8	5.9	3.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Bays																																																
1	MRF input		32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	15.3	15.3	15.3	15.3	15.3	15.3	15.3	6.3	6.3	6.3	4.7	4.7	4.7	4.7	3.5	3.5	3.5	3.5	2.7	2.7	2.7	2.3	2.3	2.3	2.3
2	glass fines < 50mm diameter																																															
3	shredded wood pallets		87.3	63.4	41.7	36.8	32.5	28.8	28.8	28.8	28.8	11.2	11.2	11.2	11.2	11.2	11.2	11.2	5.7	5.7	3.5	2.2	1.2	1.0	0.8	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
4	heavy																																															
5	RDF loose		35.4	35.4	17.1	13.8	13.8	11.4	9.5	8.0	6.9	6.9	6.9	6.9	6.9	6.9	2.2	2.2	2.2	2.2	1.1	0.7	0.5	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
6	plastic film (PET) -recycled		2.1	2.1	1.6	1.3	1.2	1.0	1.0	0.9	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.3	0.3	0.3	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	EPS		1.3	1.1	0.6	0.5	0.5	0.5	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	HDPE/LDPE		1.5	0.7	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	other		303.3	228.0	155.6	137.9	137.9	137.9	53.8	53.8	53.8	53.8	53.8	27.4	27.4	27.4	27.4	27.4	27.4	16.6	7.8	5.9	3.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
7	carboard loose storage		96.3	96.3	79.4	79.4	79.4	79.4	57.6	57.6	49.8	49.8	49.8	43.3	43.3	43.3	37.9	37.9	37.9	33.5	33.5	29.6	26.2	10.2	10.2	5.2	5.2	5.2	3.2	3.2	2.0	2.0	1.5	1.5	1.5	1.1	1.1	1.1	0.9	0.9	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	conveyor rubber		80.1	80.1	80.1	65.9	65.9	65.9	65.9	65.9	65.9	65.9	47.1	47.1	47.1	40.5	40.5	40.5	35.0	35.0	23.4	20.8	20.8	7.8	7.8	7.8	3.9	3.9	3.9	3.9	2.3	2.3	2.3	1.6	1.6	1.6	1.1	1.1	1.1	1.1	0.8	0.8	0.8	0.6	0.6	0.6	0.6	0.5
Area																																																
1	cardboard bale storage 1		96.3	96.3	79.4	79.4	79.4	79.4	79.4	57.6	57.6	49.8	49.8	49.8	43.3	43.3	37.9	37.9	37.9	33.5	26.2	10.2	10.2	10.2	5.2	5.2	5.2	3.2	3.2	2.0	2.0	2.0	1.5	1.5	1.1	1.1	1.1	0.9	0.9	0.9	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6
2	cardboard bale storage 2		96.3	96.3	79.4	79.4	79.4	79.4	79.4	57.6	57.6	49.8	49.8	49.8	43.3	43.3	37.9	37.9	37.9	33.5	26.2	10.2	10.2	10.2	5.2	5.2	5.2	3.2	3.2	2.0	2.0	2.0	1.5	1.5	1.1	1.1	1.1	0.9	0.9	0.9	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6
3	OCCBSO		95.7	95.7	95.7	95.7	95.7	78.4	78.4	78.4	78.4	78.4	78.4	78.4	78.4	78.4	55.2	55.2	55.2	55.2	40.3	26.4	23.2	21.2	21.2	8.4	8.4	8.4	8.4	4.3	4.3	4.3	4.3	4.3	2.6	2.6	2.6	2.6	1.7	1.7	1.7	1.7	1.1	1.1	1.1	1.1	1.1	1.1
4	OCC tipping and inspection		96.1	96.1	79.0	79.0	79.0	79.0	79.0	79.0	55.5	55.5	55.5	48.5	48.5	48.5	42.0	42.0	42.0	36.4	24.9	24.9	9.3	9.3	9.3	4.6	4.6	4.6	2.8	2.8	1.9	1.9	1.9	1.3	1.3	1.3	0.9	0.9	0.9	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6
5	mobile equipment storage		70.2	70.2	57.7	57.7	57.7	57.7	57.7	57.7	41.3	41.3	41.3	35.5	35.5	35.5	30.7	30.7	30.7	26.6	18.2	18.2	6.8	6.8	6.8	3.4	3.4	3.4	2.0	2.0	2.0	1.4	1.4	1.4	1.0	1.0	1.0	0.7	0.7	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4
6	RDF loose pre-baler		30.9	30.9	30.9	16.5	16.5	16.5	16.5	16.5	16.5	16.5	7.1	7.1	7.1	7.1	5.2	5.2	5.2	4.0	2.6	1.9	1.9	0.6	0.6	0.6	0.6	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
7	wood pallet input		105.9	105.9	87.3	87.3	87.3	63.4	63.4	54.8	54.8	47.6	47.6	41.7	41.7	36.8	36.8	36.8	32.5	32.5	28.8	11.2	11.2	5.7	5.7	3.5	3.5	2.2	2.2	1.6	1.6	1.2	1.2	1.0	1.0	1.0	0.8	0.8	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
8	Bale wrapper		96.3	96.3	79.4	79.4	79.4	57.6	57.6	49.8	49.8	43.3	43.3	37.9	37.9	33.5	33.5	29.6	29.6	26.2	26.2	10.2	10.2	5.2	5.2	3.2	3.2	2.0	2.0	1.5	1.5	1.1	1.1	0.9	0.9	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
9	Tank 5 (yard), diesel/addblue		42.6	42.6	27.4	22.2	22.2	18.4	15.3	12.9	12.9	11.0	9.5	9.5	9.5	9.5	9.5	9.5	9.5	3.2	3.2	1.6	1.0	0.6	0.6	0.4	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	BUILDING 2																																																
Area																																																
1	PFRP		29.4	29.4	19.2	19.2	19.2	19.2	19.2	19.2	9.5	9.5	9.5	7.1	7.1	7.1	5.6	5.6	5.6	4.5	2.6	2.6	0.8	0.8	0.8	0.4	0.4	0.4	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	GOPPA		105.7	105.7	86.9	86.9	86.9	86.9	62.2	62.2	53.4	53.4	53.4	46.2	46.2	40.1	40.1	40.1	35.2	35.2	27.4	10.2	10.2	10.2	5.1	5.1	3.1	3.1	2.0	2.0	2.0	1.4	1.4	1.0	1.0	1.0	0.8	0.8	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	BUILDING 3																																																
Area																																																
1	Outside NE																																																
	Tank 1 (oil)		159.9	159.9	116.1	100.3	100.3	87.2	70.4	67.4	67.4	59.5	52.8	52.8	52.8	52.8	52.8	52.8	52.8	20.6	20.6	10.5	6.4	4.1	4.1	3.0	2.2	1.9	1.9	1.5	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
	Tank 2 (coolant)		99.0	99.0	81.6	81.6	81.6	59.2	59.2	51.2	51.2	51.2	44.5	44.5	39.0	39.0	34.4	34.4	30.4	30.4	26.9	10.5	10.5	5.4	5.4	3.2	3.2	2.1	2.1	2.1	1.5	1.5	1.1	1.1	1.0	1.0	0.8	0.8	0.8	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
2	Truck fleet maintenance		24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	4.5	4.5	4.5	4.5	4.5

	BUILDING 2	S (m)	1	1.5	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	15	20	25
		75 kW/m²	75																				
		23 kW/m²	23																				
		12.6 kW/m²	12.6																				
		4.7 kW/m²	4.7																				
		1.7 kW/m²	1.7																				
Legend																							
1			1.0																				
3			2.1	1.6																			
4			26.9	26.9	19.5	16.9	16.9	14.7	12.8	11.3	11.3	10.0	8.9	8.9	8.9	8.9	8.9	8.9	8.9	3.5	3.5	1.8	1.1
8			4.3	2.6	0.9																		
9			0.4																				
11		2.01	22.1	14.5	14.5	7.1	7.1	5.4	5.4	4.2	3.4	3.4	2.8	2.8	2.3	2.0	2.0	2.0	2.0	2.0	0.6		
12		1.30	14.5	7.1	4.2	2.8	2.3	2.0	2.0	2.0	2.0	0.6											
13		z	15.5	11.7	7.1	7.1	7.1	2.8	2.8	2.8	2.8	1.4											
14			20.0	20.0	12.8	10.4	8.6	7.2	7.2	6.1	5.2	4.5	4.5	4.5	4.5	4.5	4.5	4.5	1.5				
16			0.9																				

Appendix E - Acceptable Solution

Performance Requirement	Provision	Guideline Reference	Acceptable Solution
CP9	'Specialist fire appliance' access is provided to satisfy performance requirement CP9 of the NCC and FRNSW guideline *Access for fire brigade vehicles and firefighters*	cl.7.4.1	The vehicle access travels more than 18m from Building 2 on the south side. A fire engineered performance solution, in conjunction with the FRNSW will be used to address this requirement
CP9	Adequate firefighter access is provided to the building, fire safety system and equipment	cl.7.4.7	The travel distances within Buildings 1 and 2 exceed the maximum (cl.D1.4) travel distance of 40m. Travel distances will need to be reviewed in conjunction with the proposed works in order to verify the viability of any proposed performance solution
EP1.3	A fire hydrant system is installed to Australian Standard AS 2419.1 and provides coverage for both internal and external stockpiles	cl.7.5.1	Affinity Fire Engineering have stated that the site is provided with a fire hydrant system to AS 2419.1-2005. Blackett Maguire +Goldsmith (BMG) note that number of fire hydrants are located <10m from Building 1 and 2. However, adequate alternate fire hydrants (three) are available to cover all parts of each building
EP1.3	The fire hydrant system incorporates enhanced standard of performance for external stockpiles (ie. one additional hydrant to flow)	cl.7.5.3	Adequate numbers of hydrants are available. BMG note that the Annual Fire Safety Statement notes the fire hydrant system is compliant with AS 2419.1-2005

Performance Requirement	Provision	Guideline Reference	Acceptable Solution
EP1.3	Fire hydrants are not located within 10m of any stockpiled storage (or vice versa), whether being internal or external	cl.7.5.4	Affinity Fire Engineering have stated that the site is provided with a fire hydrant system to AS 2419.1-2005. Blackett Maguire +Goldsmith (BMG) note that number of fire hydrants are located <10m from Building 1 and 2. However, adequate alternate fire hydrants (three) are available to cover all parts of each building
EP1.3	The fire hydrant system delivers the required number of fire hydrants to flow simultaneously for a minimum of four hours duration	cl.7.5.7	Adequate numbers of hydrants are available. BMG note that the Annual Fire Safety Statement notes the fire hydrant system is compliant with AS 2419.1-2005
EP1.3	A fire brigade booster connection is installed within sight of the designated site entry point	cl.7.5.6	A booster unit is available, approximately 125m to the southwest of Gate 1
EP1.1	A fire hose reel system is installed to Australian Standard AS 2441 and provides coverage for both internal and external stockpiles	cl.7.5.8	Affinity Fire Engineering have stated that the site is provided with fire hose reels to AS 2441-2005. 4 x fire hose reels are required for Building 2.
EP1.4	An automatic fire sprinkler system is installed to Australian Standard AS 2118.1 and designed for special hazard (eg. ‘high hazard class’)	cl.7.6.1	Affinity Fire Engineering have stated that Building 1 is provided with an automatic sprinkler system to AS 2118.1-1999. It is proposed that an automatic sprinkler system will be installed in Building 2. Activation of the sprinkler system is required to activate the BOWS and notify the FRNSW

Performance Requirement	Provision	Guideline Reference	Acceptable Solution
EP1.4	A fire brigade booster connection is installed for the automatic fire sprinkler system and is co-located with the hydrant system booster	cl.7.6.5	Affinity Fire Engineering have stated that a hydrant booster is located at the front of the site
EP1.4	The fire sprinkler system delivers not less than the total hydraulic demand for a minimum of two hours duration	cl.7.6.6	BMG note that a hydraulic consultant will need to confirm system compliance to AS 2118.1-2017
EP2.2	A fire detection and alarm system is installed to Australian Standard AS 1670.1 and designed for the fire scenarios and environment (eg. Visual flame detectors, infrared detectors, heat detectors/probes)	cl.7.7.1	Affinity Fire Engineering have stated that an automatic fire detection and alarm system to AS 1670-2004 is installed in Building 2. BMG note that smoke detection and occupant warning system, including signage, is required to be extended to throughout all buildings by a certified fire services contractor
EP2.2	Manual alarm points are installed for staff to initiate alarm of fire	cl.7.7.4	The control and indicating equipment to be installed to AS 1670.3-2018 and AS 4428.6
EP2.2	An automatic smoke hazard management system is installed and designed so the smoke layer does not descend below 4m above floor level	cl.7.8.1	Automatically activated smoke extraction fans, with minimum flow to control internal smoke layer: Building 1 – 18m^3/s Building 2 – 17m^3/s Building 3 – 26m^3/s

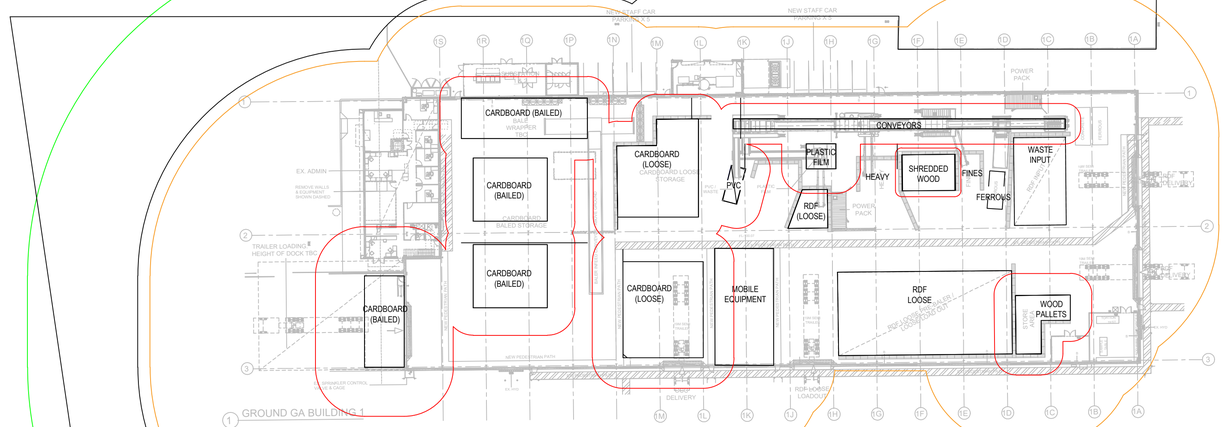
Performance Requirement	Provision	Guideline Reference	Acceptable Solution
EP2.2	Low level openings (eg. roller doors) on two or more walls to assist with venting de-stratified smoke	cl.7.8.3	Low level openings (vents and roller doors are available on two walls in all buildings
EP2.2	The automatic smoke hazard management system is capable of continuous operation for a minimum of two hours duration	cl.7.8.4	Automatic smoke extractions fans will be designed to allow a minimum of two hours smoke extraction
N/A	An automatic fire water run-off containment system is provided and designed to contain the total hydraulic demand of the fire hydrant and fire sprinkler systems	cl.7.9.1	Fire water will be contained within each building using concrete bunds: Building 1 – 51m^3 containment, minimum 10mm high concrete bund wall and roll-over access Building 2 – 51m^3 containment, minimum 16mm high concrete bund wall and roll-over access Yard – 135m^3 containment, bund walls minimum of 4.15m high or alternatively, double wall tanks will be used
N/A	Pollution control equipment is provided to divert fire water run-off and isolate stormwater drainage in the event of fire	cl.7.9.6	Fire water will be contained within the relevant building
NSW PBP	The waste facility complies with NSW RFS *Planning for bush fire protection* when located on bush fire prone land	7.10.1	The site is located within bush fire prone land. Bushfire attack does not form part of this study
CP2	Any separating masonry wall, revetment or pen is to extend at least 1m above and at least 2m beyond the stockpile	cl.8.2.6	Separating masonry walls are designed to extend at least 1m above and at least 2m beyond the stockpile

Performance Requirement	Provision	Guideline Reference	Acceptable Solution
N/A	Any stockpile prone to self-heating is to be monitored and rotated as necessary to dissipate any hotspots	Section 8.3	Stockpiles of shredded green waste and timber waste will be monitored with mobile thermal imaging units and stockpiles aerated or removed as necessary
CP2	Any external stockpile is to be limited in size and maintain minimum separations to prevent fire spread, including reduced separation when protected by a masonry wall or an automatic fire sprinkler system	Section 8.4	No external stockpiles
CP9	Fire brigade vehicle access is provided between external stockpiles	cl.8.4.11	No external stockpiles
CP2	Each internal stockpile is to be limited in size to 1000m^3	cl.8.5.2	Internal stockpiles will be limited in size to 1000m^3
CP9	Internal stockpiles are to be maintained a minimum of 6m unobstructed access on each accessible side	cl.8.5.3	Stockpiles will have a minimum of 6m unobstructed access on each accessible side.
N/A	An operation plan is to be documented and implemented for stockpile management and a copy is to be included within the Emergency Services Information Package (ESIP)	Section 8.6	REMONDIS will prepare and implement a stockpile operations management plan. REMONDIS will prepare and include the stockpile management plan within an ESIP
WHS Reg.	An emergency plan is to be provided for staff and other persons at the waste facility in the event of fire	Section 9.3	REMONDIS will prepare and implement a site specific emergency plan for the site

Performance Requirement	Provision	Guideline Reference	Acceptable Solution
N/A	An Emergency Services Information Package (ESIP) is provided for firefighters in accordance with FRNSW guideline *Emergency services information package and tactical fire plans*	Section 9.4	REMONDIS will prepare the ESIP in conformance with the relevant guideline
EP&A Reg.	Fire safety systems are to be inspected and maintained with corresponding fire safety statements being issued; The provision of maintenance should be covered in any leasehold contract	Section 9.5	Annual fire safety statements will be prepared by an Accredited Practitioner (Fire Safety), as required by Section 166 of the regulations.

Appendix F - Thermal Radiation Contours

RADIANT HEAT SCHEDULE					
LOCATION	>75 kW/m²	>23 kW/m²	>12.6 kW/m²	>4.7 kW/m²	>1.7 kW/m²
	RED	ORANGE	BLACK	GREEN	BLUE
PVC WASTE	4	9.5	10	20	40
WASTE INPUT	-	25	60	95	120
SHREDDED WOOD	1	5.5	6	10	20
RDF LOOSE	-	1.5	3.5	8	10
PLASTIC FILM	4	9.5	10	20	40
CARDBOARD LOOSE	4	15	17	40	60
CARDBOARD (BAILED)	4.5	15	17	45	70
CARDBOARD (BAILED)	4.5	15	17	45	70
CARDBOARD (BAILED)	8	35	37	55	110
CARDBOARD (LOOSE)	5	20	22	35	80
MOBILE EQUIPMENT	-	10	20	35	65
RDF (LOOSE)	-	2.5	6	9.5	25
WOOD PALLETS	3.5	15	17	35	55
CARDBOARD (BAILED)	3.5	15	17	35	55
CONVEYOR RUBBER	2.5	15	25	40	75



3RD ANGLE PROJECTION
DO NOT SCALE

This drawing has been assigned an electronic code that signifies the drawing has been checked and approved by:

Issue	Description	Date	Drawn	Approved
B	ISSUE FOR INFORMATION	07.08.20	AC	MW
B	ISSUE FOR INFORMATION	07.08.20	AC	MW
A	ISSUE FOR INFORMATION	17.07.20	AC	MW

0.5 0 1cm at full size 2cm 10cm

North

Client

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Project
REMONDIS RECYCLING FACILITY

TOMAGO
NSW

Drawing Title
RECYCLING FACILITY
DANGEROUS GOODS
RADIANT HEAT ANALYSIS - BUILDING 1

Drawn	Date	Scale A1	Q.A. Check	Date
AC	JULY_2020	1:500	-	
Designed	Project No.		Dwg. No.	Issue
MW	PE200002		DG.01	C

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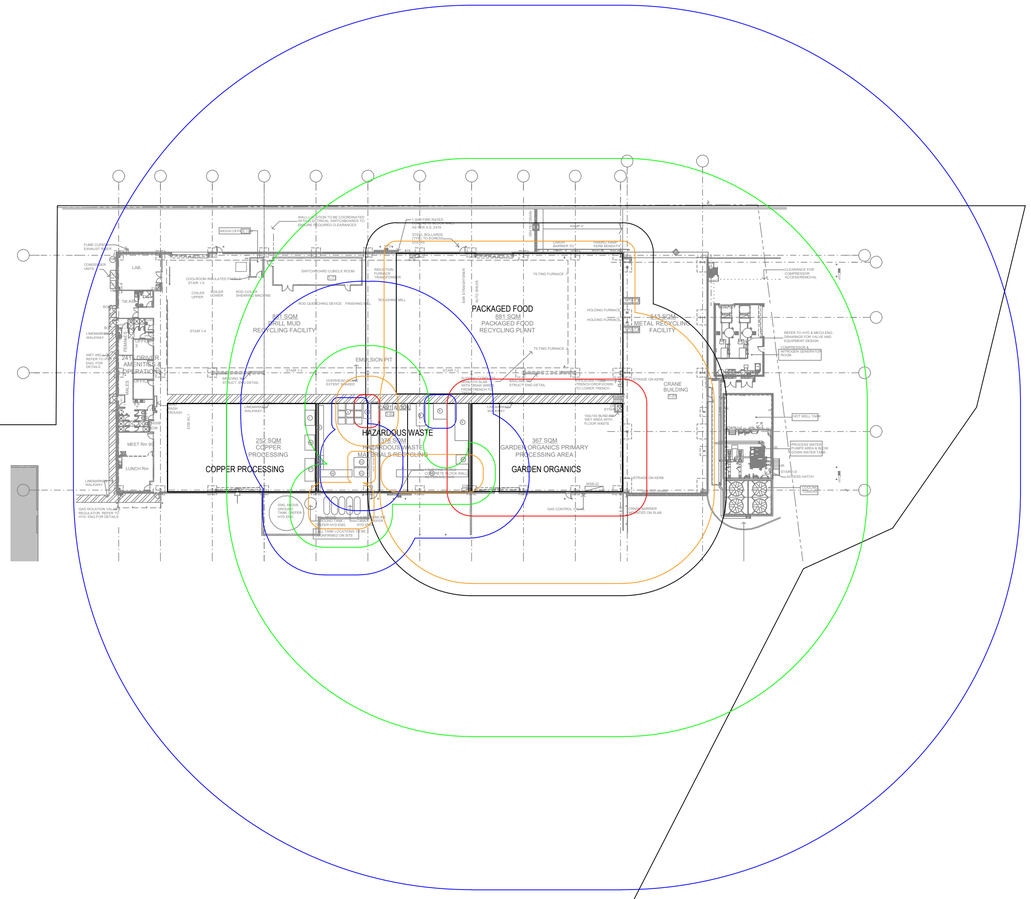
Aug 26, 2020 11:58am

RADIANT HEAT SCHEDULE					
LOCATION	>75 kW/m²	>23 kW/m²	>12.6 kW/m²	>4.7 kW/m²	>1.7 kW/m²
	RED	ORANGE	BLACK	GREEN	BLUE
PACKAGED FOOD	-	2	5	9.5	20
GARDEN ORGANICS	4	15	17	40	65



3RD ANGLE PROJECTION
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D	ISSUE FOR INFORMATION	24.11.20	CA	MW
C	ISSUE FOR INFORMATION	26.08.20	AC	MW
B	ISSUE FOR INFORMATION	07.08.20	AC	MW
A	ISSUE FOR INFORMATION	17.07.20	AC	MW

North

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REMONDIS RECYCLING FACILITY

TOMAGO
NSW

Drawing Title
RECYCLING FACILITY
DANGEROUS GOODS
RADIANT HEAT ANALYSIS - BUILDING 2

Drawn	Date	Scale A1	Q.A. Check	Date
AC	JULY_2020	1:500	-	
Designed	Project No.		Dwg. No.	Issue
MW	PE200002		DG.02	C

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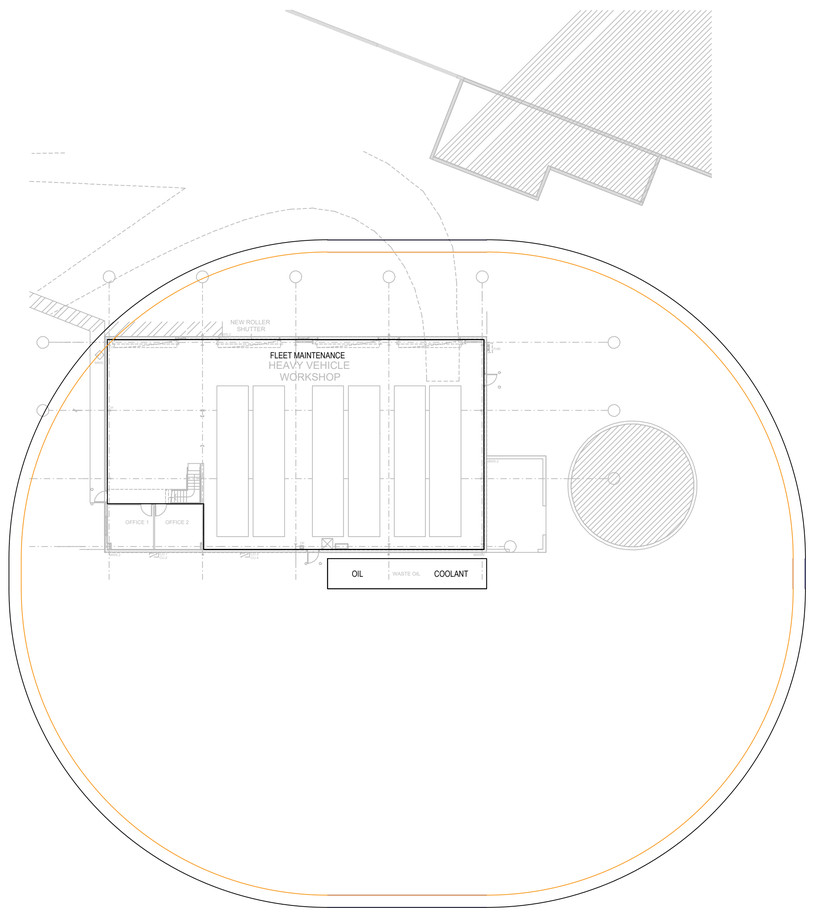
Nov 25, 2020 - 8:34am

RADIANT HEAT SCHEDULE					
LOCATION	>75 kW/m²	>23 kW/m²	>12.6 kW/m²	>4.7 kW/m²	>3 kW/m²
	RED	ORANGE	BLACK	GREEN	BLUE
OUTSIDE NE. TANK 1 (OIL)	-	-	3	8.5	10
OUTSIDE NE. TANK 2 (COOLANT)	-	50	52	125	150



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Issue	Description	Date	Drawn	Approved
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B	ISSUE FOR INFORMATION	07.08.20	AC	MW
A	ISSUE FOR INFORMATION	17.07.20	AC	MW

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REMONDIS RECYCLING FACILITY

TOMAGO
NSW

Drawing Title
RECYCLING FACILITY
DANGEROUS GOODS
RADIANT HEAT ANALYSIS - BUILDING 3

Drawn	Date	Scale A1	Q.A. Check	Date
AC	JULY_2020	1:200	-	
Designed	Project No.		Dwg. No.	Issue
MW	PE200002		DG.03	C

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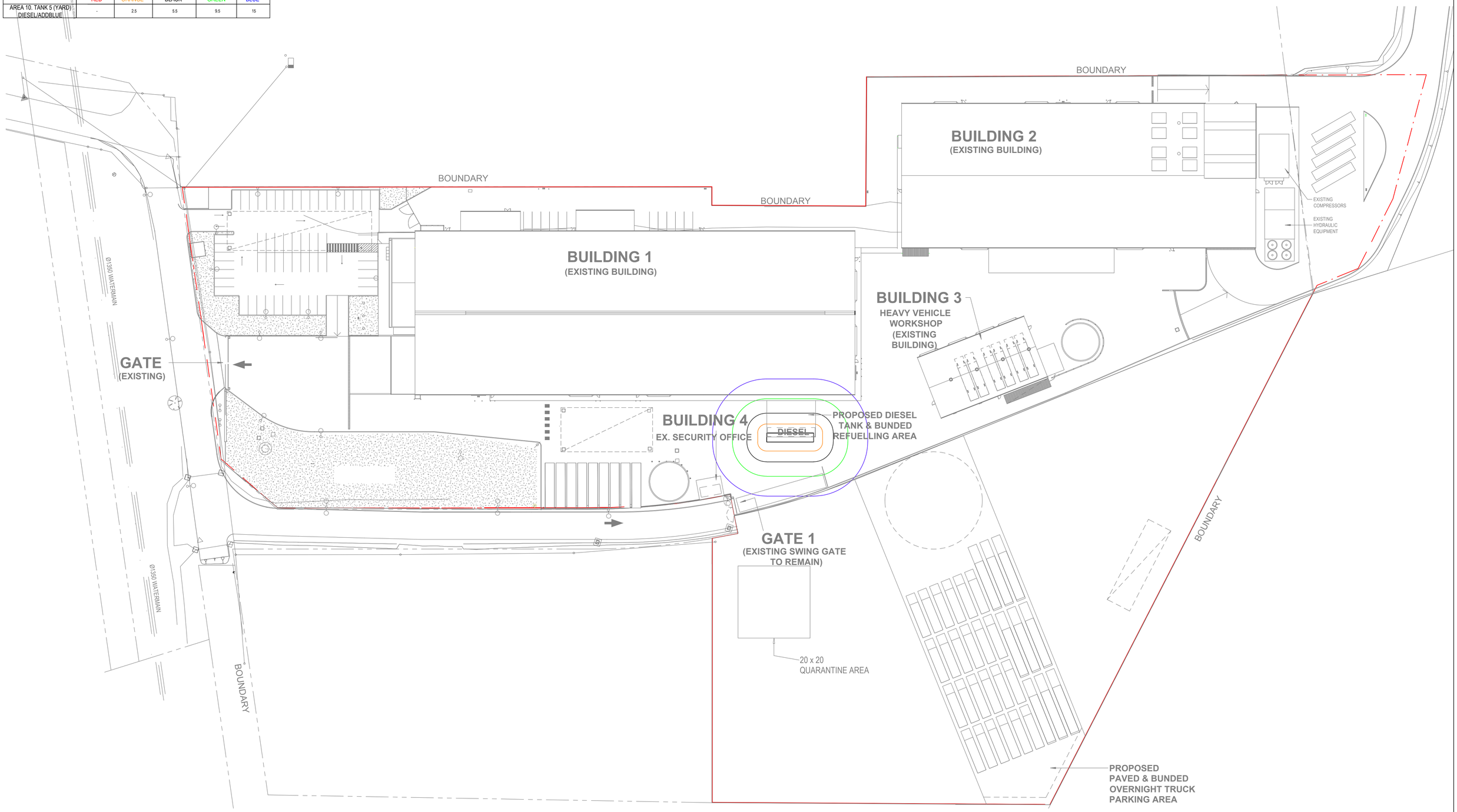
Apr 26, 2021 - 11:07pm

RADIANT HEAT SCHEDULE					
LOCATION	>75 kW/m²	>23 kW/m²	>12.6 kW/m²	>4.7 kW/m²	>3 kW/m²
	RED	ORANGE	BLACK	GREEN	BLUE
AREA 10. TANK 5 (YARD) DIESEL/ADDBLUE	-	2.5	5.5	9.5	15



3RD ANGLE PROJECTION
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Issue	Description	Date	Drawn	Approved
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A	ISSUE FOR INFORMATION	17.07.20	AC	MW

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REMONDIS RECYCLING FACILITY

TOMAGO
NSW

Drawing Title
RECYCLING FACILITY
DANGEROUS GOODS
RADIANT HEAT ANALYSIS - SITE PLAN

Drawn	Date	Scale	A1	Q.A. Check	Date
AC	JULY_2020	1:500		-	
Designed	Project No.			Dwg. No.	Issue
MW	PE200002			DG.04	B

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Nov 27, 2020 - 11:54am

Appendix G - HIPAP Consequence Criteria

G.1 Thermal Radiation

Heat Radiation (kW/m^2)	Effect
1 .2	Received from the sun at noon in summer
2.1	Minimum to cause pain after 1 minute
4.7	Will cause pain in 1 5-20 seconds and injury after 30 seconds' exposure (at least second degree burns will occur)
12.6	• Significant chance of fatality for extended exposure. High chance of injury • Causes the temperature of wood to rise to a point where it can be ignited by a naked flame after long exposure • Thin steel with insulation on the side away from the fire may reach a thermal stress level high enough to cause structural failure
23	• Likely fatality for extended exposure and chance of fatality for instantaneous exposure • Spontaneous ignition of wood after long exposure • Unprotected steel will reach thermal stress temperatures which can cause failure • Pressure vessel needs to be relieved or failure would occur
35	• Cellulosic material will pilot ignite within one minute's exposure • Significant chance of fatality for people exposed instantaneously

G.2 Probit Exposure Criteria

		TDU			
Intensity	$I^{4/3}$	105	290	1000	1800
kW/m^2		seconds			
75	316.2872	0.3	1	3	6
23	65.40894	2	4	15	28
12.6	29.31978	4	10	34	61
4.7	7.872823	13	37	127	229
1.7	2.028921	52	143	493	887

The Health and Safety Executive (HSE) of Great Britain has proposed the following thermal radiation exposure limits for offshore oil and gas facilities:

- 1% risk of fatality @ 1000 TDU
- 50% risk of fatality @ 2000 TDU
- 100% risk of fatality @ 3500

The risk of exposure is mitigated by the wearing of clothing. Offshore oil and gas workers may, of necessity, be better clothed than industrial workers on the mid north coast of NSW. However, the unclothed body area (the head, neck, arms and hands) is typically approximately 20 per cent of the total body area. A review of actual mortality information[7] indicates that for the 40 to 45 age group, a burn area of 20 per cent would be expected to only result in a fatality probability of 0.1. Average over all age groups, the probability of fatality is approximately 0.14 when clothing is taken into account. The TNO has estimated that a thermal dose of 3600TDU is required to ignite clothing.

[7] Bull, J,P (1971)

Appendix H - Fire Fighting Infrastructure

BOUNDARY

BOUNDARY

BOUNDARY

BOUNDARY

Ø1350 WATERMAIN

Ø1350 WATERMAIN

BUILDING 1
(EXISTING BUILDING)

BUILDING 2
(EXISTING BUILDING)

BUILDING 3
HEAVY VEHICLE WORKSHOP (EXISTING BUILDING)

BUILDING 4
EX. SECURITY OFFICE

GATE
(EXISTING)

GATE 1
(EXISTING SWING GATE TO REMAIN)

FH 1
FH 2
FH 3
FH 4
FH 5
FH 7
FH 8
FH 9
FH 10

FHR 1
FHR 2
FHR 3
FHR 4
FHR 5
FHR 6
FHR 7

EXISTING COMPRESSORS

EXISTING HYDRAULIC EQUIPMENT

DIESEL

PROPOSED DIESEL TANK & BUNDED REFUELLING AREA

20 x 20
QUARANTINE AREA

PROPOSED
PAVED & BUNDED
OVERNIGHT TRUCK
PARKING AREA

LEGEND

FIRE HYDRANT

FIRE HOSE REEL

3RD ANGLE PROJECTION
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Project
REMONDIS RECYCLING FACILITY

TOMAGO
NSW

Drawing Title
RECYCLING FACILITY
DANGEROUS GOODS
FIRE HYDRANT AND HOSE REEL

Drawn	Date	Scale	A1	Q.A. Check	Date
AC	JULY_2020	1:500		-	
Designed	Project No.			Dwg. No.	Issue
MW	PE200002			DG.05	B

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Nov 27, 2020 - 11:54am