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Elan Energy - Tyre Resource Recovery Facility

s38 Referral - Environmental Protection Act 1986 - supporting documentation

Prepared for
Elan Energy Matrix Pty Ltd
by Strategen

July 2016

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ENVIRONMENTAL

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Client: Elan Energy Matrix Pty Ltd

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
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Final Report	1	Agency submission	L Taylor	Electronic	7 July 2016

Filename: EEM16133 01 R003 Rev 1 - 7 July 2016

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List of Appendices

All attachments are in electronic form on a data CD attached inside the back cover of this report.

1. PART A: Information on the proposal and the proponent

1.1 Proponent information

Elan Energy Matrix Pty Ltd (Elan), the Proponent, is a Western Australian-owned and operated full-service tyre disposal company (ABN: 88 611 714 580, ACN: 611 714 580).

Tyre Recyclers WA is a division of Elan and it has been operating a tyre shredding facility from its current site in Lot 106, 101 Dowd St, Welshpool since 2012 under *Environmental Protection Act 1986* (EP Act) Licence L8682/2012/1.

Information on the proponent is detailed in Table 1.

Table 1: Details of the proponent

Proponent information	
Name of the proponent	Elan Energy Matrix Pty Ltd
Joint Venture parties (if applicable)	NA
Australian Company Number(s)	611 714 580
Postal Address	Elan Energy Management Pty Ltd PO Box 245 WELSHPOOL WA 6986
Key proponent contact for the proposal	Ian Bellinge Managing Director Ph:+61 8 6230 220 Ian.Bellinge@elanem.com.au
Consultant for the proposal	Strategen Environmental Level 1, 50 Subiaco Square Road SUBIACO WA 6008 Ph: 9380 4608

1.2 Proposal overview

Elan is looking to expand its tyre management operations by incorporating a Tyre Resource Recycling Facility (TRRF) to recover valuable resources from used tyres (the Proposal). The TRRF will be operated at Lot 60, 9 Fargo Way, Welshpool, within the City of Canning approximately 12 km southeast of the Perth CBD (the Proposal site). The Proposal site is shown in Figure 1.

The Proposal involves processing of shredded waste tyres using an indirect fired Thermal Conversion Unit (TCU) to produce carbon black, steel wire, oil and process gas. The residual carbon from thermal processing of the tyres (known as char) and the oil will be recovered, with the char upgraded to carbon black. Recovered products will be sold to Australian or international markets.

The residual process gas stream containing hydrogen, carbon monoxide and methane will be combusted in a high efficiency thermal oxidiser with heat recovery installed to preheat combustion air for the TCU operation. Exhaust gases from the process will be discharged to atmosphere via a 15 m tall stack.

The Proposal is scheduled to commence December 2016 and operate for a period of approximately 20-30 years.

Figure 1: Proposal area – Lot 60, 9 Fargo Way, Welshpool.

Scale 1:2,000 at A4

0 10 20 30 40 50 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 12/05/2016
Author: JCrute
Source: Aerial image: ESRI, approx. 2012. Existing cadastre: SLIP, Landgate 2016.

Legend

Lot 60 boundary
Existing cadastre
Roads

strategen ENVIRONMENTAL
info@strategen.com.au
www.strategen.com.au

Path: Q:\Consult\2016\EEM\EEM16113\ArcMap_documents\R002\EEM16113_01_R002_RevA_F001.mxd

1.3 Key proposal characteristics

A summary of the key Proposal characteristics is provided in Table 2.

Table 2: Key Proposal characteristics

Summary of the Proposal		
Proposal Title	Elan Energy Matrix Tyre Resource Recovery Facility Thermal Processing Unit	
Proponent name	Elan Energy Matrix Pty Ltd	
Life of Proposal	20-30 years	
Short description	The Proposal is to recycle used ("end-of-life") tyres using a TCU within a TRRF to be located in existing buildings at 9 Fargo Way Welshpool, approximately 12 km southeast of the Perth CBD and a within a 'General Industry' zone in the City of Canning. The Proposal will involve thermal processing of used tyres to produce carbon black, steel wire, oil and gas using an indirect fired TCU. Carbon black and oil will be sold to Australian and International markets. Process gas will be combusted in a thermal oxidiser and exhaust gases from the TCU and oxidiser discharged to atmosphere via a 15 m tall stack. Heat recovery will be included to maximise energy efficiency of the Proposal.	
Physical and operational elements of the Proposal		
Element	Location	Extent
Tyre Resource Recovery Facility	9 Fargo Way, Welshpool, as shown in Figure 1	No clearing/disturbance required.
Waste tyres processed		60 tonnes per day of shredded tyres
Emissions stack		15 m high stack

1.4 Process description

1.4.1 Inputs and outputs

A process flow chart for the TRRF is presented in Figure 2.

Inputs to the process include:

- shredded used tyres
- natural gas
- water
- hydrochloric acid

Outputs (resource recovery) from the process will comprise:

- carbon black
- wire
- oil
- process gas

Outputs (wastes/emissions) will comprise:

- solid waste
- char upgrade process waste water
- exhaust gases to atmosphere.

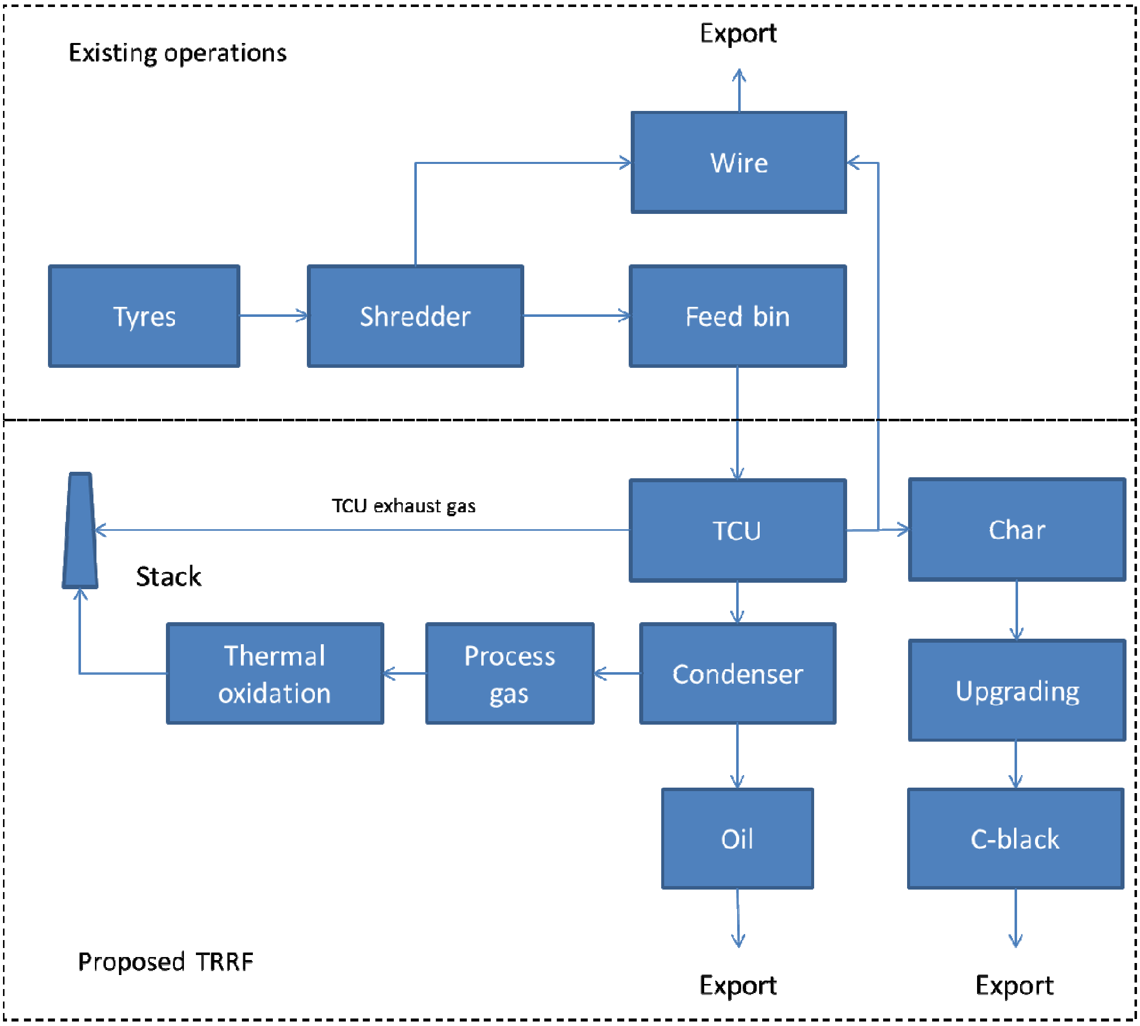

Figure 2: Process flow chart

1.4.2 Feed system

Shredded tyre of nominal 70-80 mm size is conveyed from the shred storage bin to the TCU via a serious of valves and a feed screw. The feed rate is controlled by the screw rotation speed which is continually monitored and adjusted to accommodate any variability in shed size. A target feed rate of 60 t/day is proposed for the TRRF.

The typical composition of waste tyre material is shown in Table 3. This is based on combination of passenger car, trucks and OTR ('off the road' – heavy machinery tyres) tyres typically observed in a waste tyre stream.

Table 3: Shredded waste tyre typical composition

Component	Composition
Rubber	46%
Fibre (polyester)	6%
Wire	18%
Carbon black	22%
Zinc oxide	2%
Total carbon	72%
Total sulfur	1%

1.4.3 Thermal Conversion Unit

The TCU comprises of an indirect fired heat tube which is enclosed in a refractory lined combustion chamber with heat energy supplied from natural gas fired, low NOx burners. The shredded tyre material within the heat tube undergoes thermal decomposition in the absence of oxygen at approximately 550 to 650°C to generate process gas, char and wire. The process gas separates from the char and wire in the heat tube discharge chamber for downstream processing. Table 4 outlines the TCU specifications.

Table 4: TCU specifications

Aspect	Specification
Feed rate (normal operation)	Nominal 2500 kg/h (60 t/d)
Heat tube operating temperature range	550-750 ˚C
Maximum heat tube temperature	900 ˚C
Process gas production rate	Approximately 880 kg/h
Char production rate	Approximately 540 kg/h
Wire recovery rate	Approximately 250 kg/h

1.4.4 Oil and process gas recovery

The process gas from the discharge chamber is passed into a Condenser and cooled to approximately 20 to 30 °C. Hydrocarbons are condensed to produce an oil fraction, leaving behind a residual gas fraction comprised of hydrogen, carbon monoxide, methane and other light hydrocarbons; which separate from the oil.

A 100 000 litre oil storage tank is to be installed in a bunded area to hold up to one week of oil production from the proposed TRRF. It is anticipated that oil would be exported from the TRRF via road tanker every 1-2 days to ensure suitable storage capacity at all times. The residual process gas is combusted in the thermal oxidiser.

1.4.5 Char and wire recovery

The char and wire exits the TCU at high temperatures and is placed on a cooling conveyor that both transports and air cools the solids prior to separation of the steel wire. The wire is combined with wire recovered from the shredding process for sale to scrap metal merchants. Water sprays may also be used to assist the cooling process. The char is conveyed to the char upgrading plant for further processing to carbon black.

1.4.6 Thermal oxidiser

Residual process gas is directed to a thermal oxidiser for combustion with heat recovered into the combustion air for the TCU combustion chamber and the thermal oxidiser. Staged air flow is used to encourage turbulence within the unit to maximise both mixing and temperature to achieve complete combustion. Exhaust from the thermal oxidiser is delivered to the exhaust stack to combine with exhaust gases from the TCU combustion chamber and thermal oxidiser specifications are outlined in Table 5.

Table 5: Thermal oxidiser specifications

Aspect	Specification
Fuel (pilot burner)	Natural gas
Process gas flow	140 kg/h
Maximum process gas flow	880 kg/h
Gas residence time	2 s
Combustion temperature	850˚C
Exhaust gas temperature to stack	400˚C

The maximum process gas flow specification is based on a loss of cooling efficiency in the condenser, which means all process gas formed in the TCU would report to the thermal oxidiser. Under those conditions, the tyre shred feed and the TCU burners are shut down to stop the thermal conversion processes and production of process gas. The fault with the condenser is then rectified and plant operations restored. This provides a safe route for disposal of the process gas in the event of cooling efficiency in the condenser.

1.4.7 Main stack

Exhaust gases from the TCU combustion chamber and thermal oxidiser will be combined and discharged to atmosphere through a 15 m tall stack. Details of the stack emissions are presented in Section 3.1.

1.4.8 Char upgrading

The char produced from thermal decomposition of tyres contains carbon black (from tyre manufacturing) and char from decomposition of rubber and fibres in the tyres. In addition, the char will contain minerals including zinc oxide (ZnO) and silica (added during manufacturing), mineral sulfides (from sulfur in the tyres) and soils/sand that may be present depending on the source of the waste tyres.

Upgrading of the char is therefore required to remove impurities and produce an appropriate particle size carbon black suitable for sale into Australian and international carbon black markets. An upgrading plant is proposed which will involve acid (HCl) and caustic ($NaOH$) leaching at < 100 °C, with the leached char washed, dried and pulverised to generate a carbon black product. The resulting product is bagged and exported by truck for shipment to markets.

Waste leach solutions recovered from the upgrading plant will be collected and stored on-site for transport and disposal off-site by a licensed liquid waste contractor in accordance with the Controlled Waste Regulations. Solids (minerals and grit) will also be collected and stored on site prior to off-site disposal to an appropriate landfill facility.

1.4.9 Utilities and plant services

The plant will require:

- Water (mains)
- natural gas (mains)
- electrical power (mains and backup generator)
- cooling water (from a cooling tower)
- plant air and instrument air compressors.

Plant services equipment required include:

- dust extraction systems
- fire water supply
- control room
- maintenance workshop
- office equipment and support facilities
- wastewater consolidation and export.

All aspects of the plant will be located within the buildings. Dust extraction systems will be installed on the char and carbon black handling circuits to manage risks of fugitive emissions from the equipment. Exhaust air from the extraction systems will be filtered in a baghouse before discharge from the building

1.4.10 Pollution control equipment

The key pollution control equipment incorporated into the design of the Proposal is outlined below. Consideration of additional pollution control equipment has been informed by the outcomes of the air emissions assessment outlined in detail in Section 3.

Low NOx TCU burners

Low-NOx burners will be installed in the TCU combustion chamber and thermal oxidiser to minimise NOx emissions.

Condenser

Aside from recovery of oil, the condenser also removes the majority of sulfides from the process gas, which reduces the level of sulfur reporting to the thermal oxidiser for combustion to generate SO_2.

Stack

Gaseous emissions from both TCU and thermal oxidiser will report to the single 15 m tall emission stack for discharge to atmosphere. The gas temperature will be in the order of 400 °C (depending on the extent of heat recovery) which will assist to ensure efficient dispersion of exhaust gases.

Thermal oxidiser

Excess process gas will report to the thermal oxidiser for high efficiency combustion before discharge of combustion products to the atmosphere via the main stack.

1.4.11 Technology providers

The proposed plant will utilise proven technologies from well-established suppliers with extensive experience in the field.

The TCU, feed system, char handling, oil recovery system and thermal oxidiser will be provided by a Western Australian engineering firm with a demonstrated record of experience in provision of thermal processing equipment. Suppliers of the char upgrading plant and equipment for utilities are currently being identified.

1.4.12 Proposal rationale

While some re-use and recycling options exist in Western Australia for used tyres, these options are not sufficient to manage the volume of used tyres generated per year. Any used tyres that are not being re-used or managed by existing tyre recyclers are currently either being stored in dedicated tyre storage facilities, disposed of in approved landfills or illegally dumped.

Tyres are approximately 60% hydrocarbon, and have a higher calorific value than fuel sources such as wood, coke and brown coal. The need for alternative uses for used tyres has long been recognised along with the need to both preserve valuable resources and to prevent environmental damage due to improper disposal.

The key benefits of the Proposal include the diversion of used tyres from landfill and the recovery, reprocessing and re-use of valuable resources. It is anticipated that the Proposal would have significant environmental and economic benefits. The Proposal, providing for the recycling and reuse of valuable waste tyre resources, is consistent with the objectives of the waste hierarchy (Figure 3).

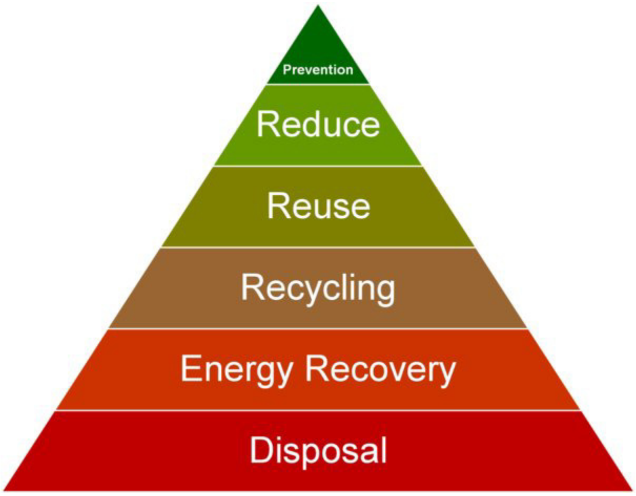

Figure 3: Waste Hierarchy

1.4.13 Strategic / derived proposals

The Proposal is not a strategic or derived proposal.

1.5 Proposal location

The TRRF will be located at Lot 60, 9 Fargo Way, Welshpool, approximately 12 km south east of Perth CBD (Proposal site). The Proposal site is zoned ‘Industry’ under the Metropolitan Region Scheme and ‘General Industry’ zone within the City of Canning Local Planning Scheme No. 40. The location of the Proposal site is shown in Figure 1 and spatial data is provided in the attached CD.

2. Proposal site characteristics

2.1 Existing environment

The Proposal site situated in a general industrial area which contains paved and hard panned lots. The Proposal site does not contain any vegetation and flora or fauna values.

The environment surrounding the premises is largely cleared with remnant patches of native vegetation and exotic grasses amongst the industrial development. A sumpland Multiple Use Wetland (UFI 9044) occurs 250 m east of the premises and is not listed as Bush Forever or as containing species of conservation significance.

No areas of conservation significance occur within 500 m of the Proposal site. A Conservation Category Wetland (UFI 7640) occurs within 1000 m southeast of the Proposal site. These surrounding wetlands will not be impacted by the operation of the TRRF at this location.

2.2 Social

2.2.1 Surrounding land use

The surrounding land uses in the area comprises of larger and smaller industrial warehouses, factories, workshops and offices. Among others, the area supports transport business and equipment storage facilities.

A review of surrounding industrial premises has shown existing premises to be all low emissions generating activities. The majority of premises are logistics, transport, manufacturing, scrap metal recycling and mining equipment businesses. Some fugitive dust emissions are generated from scrap metal and materials handling businesses. The Suez Medical Waste incinerator is located approximately 750 m from the Proposal premises. The emissions from that facility are managed and controlled under a DER operating licence.

The Proposal is located in close proximity to major transport routes such as Roe Highway, Welshpool Rd and Orrong Rd.

The issue of cumulative emissions impacts from combination of Proposal emissions and emissions from existing industrial emissions sources in proximity to the Proposal has been considered in the air quality assessment.

2.2.2 Sensitive receptors

Residential premises are located approximately 600 m and 800 m to the south and east of the Proposal site within Wattle Grove and East Cannington, respectively.

Two Bush Forever Areas (BFA) occur within the vicinity of the Proposal site. The nearest, BFA 282: Tomah Road Bushland, Wattle Grove, is located 640 m to the east and the other, BFA 50: Welshpool Road Bushland, Wattle Grove, is located 800 m to the south west.

2.3 Significance test and environmental factors

2.3.1 Significance test

The EPA may have regard to various factors in reaching a decision as to whether a proposal is likely to have a significant effect on the environment, whether it is likely to meet its objectives for environmental factors and consequently, whether a referred Proposal should be assessed. Those factors include:

- values, sensitivity and quality of the environment which is likely to be affected

- extent (intensity, duration, magnitude and geographic footprint) of the likely impacts
- consequence of the likely impacts (or change)
- resilience of the environment to cope with the impacts or changes
- cumulative impact with other projects
- level of confidence in the prediction of impacts and the success of proposed mitigation
- objects of the Act, policies, guidelines, procedures and standards against which a Proposal can be assessed
- presence of strategic planning framework
- presence of other statutory decision-making processes which regulate the mitigation of the potential effects on the environment to meet the EPA objectives and principles for EIA
- public concern about the likely effect of the Proposal, if implemented, on the environment
- a significance test for the Proposal has been undertaken against each of these criteria.

A significance test has been conducted to determine whether the Proposal is likely to:

- have a significant effect on the environment
- meet its objectives for environmental factors
- require formal assessment.

The outcomes of the significant test are outlined in Table 6.

Table 6: Significance test

Criteria	Assessment
Values, sensitivity and quality of the environment which is likely to be impacted	No clearing or disturbance is associated with the implementation of the Proposal. The proposed site is located within the Welshpool industrial area and is zoned 'General Industry'. The site was previously utilised for a storage and wholesaling business and contains paved and hard panned lots.
Extent (intensity, duration, magnitude and geographic footprint) of the likely impacts Consequence of the likely impacts (or change) Resilience of the environment to cope with the impacts or changes	Air emissions modelling has demonstrated that air emissions impacts from the Proposal are well within relevant guidelines and standards. Local air quality will not be adversely affected by the implementation of the Proposal.
Cumulative impact with other projects	Air emissions modelling has taken into account estimates of cumulative impacts from background pollutant concentrations. The assessment has shown that incremental air emissions impacts from the Proposal are insignificant and the cumulative GLCs are well within relevant guidelines and standards. Local air quality will not be adversely affected by the implementation of the Proposal.
Level of confidence in the prediction of impacts and the success of proposed mitigation	The TRRF will utilise 'state-of-art' technology, designed for processing used tyres to recover valuable materials. The various elements of the tyre resource recovery process technology are proven in various forms around the world. Emission rates for modelling have been derived from a mass balance and emissions testing from a trial plant. Dispersion model predictions show GLCs of air emissions are well below the air quality standards under worst-case meteorological conditions. Ongoing operational monitoring will be undertaken to demonstrate achievement of emissions predictions and compliance with relevant standards and guidelines.
Objects of the Act, policies, guidelines, procedures and standards against which a proposal can be assessed	Relevant legislation, policies, guidelines, procedures and standards have been considered in the design of the plant and the impact assessment undertaken with respect to air emissions.
Presence of strategic planning framework	Not applicable.

Criteria	Assessment
Presence of other statutory decision-making processes which regulate the mitigation of the potential effects on the environment to meet the EPA objectives and principles for EIA	A number of key regulatory controls can be applied to the Proposal to ensure appropriate management including (but not limited to): • works approval and licence under Part V of the EP Act • planning approval.
Public concern about the likely effect of the proposal, if implemented, on the environment	A comprehensive stakeholder consultation plan was developed during the early design of the Proposal to identify and address concerns. Stakeholder consultation is ongoing. The Proposal is considered to be of local significance and is not expected to generate a high level of public concern.

The Proposal is being referred to the EPA for a decision on whether or not formal environmental assessment is required. The outcome of the significance test suggests that the Proposal meets the EPA objectives and is unlikely to warrant formal environmental assessment.

2.3.2 Environmental factors

The Proposal site was previously utilised for a storage and wholesaling business and contains paved and hard panned lots. An existing warehouse occupies approximately half of the site. No additional clearing or disturbance is required to facilitate implementation of the Proposal. A preliminary assessment of relevant environmental factors associated with the Proposal is summarised in Table 7.

Table 7: Preliminary assessment of environmental factors

Factor	Summary of issues	Environmental considerations
Air quality and atmospheric gases	Air emissions from combustion of natural gas and/or process gas would be discharged from a single tall stack.	Composition and quantity of emissions. Location of sensitive receptors Existing air quality (cumulative impacts).
	Dust emissions will be minimised by processing end-of-life tyres within the enclosed buildings, with dust extraction systems and filtration units installed on the tyre feedstock processing equipment and the solid product (carbon black) recovery system. The site is fully hardstand and therefore fugitive dust emissions from vehicle movements are expected to be insignificant.	No further detailed consideration required (Other Factor).
Amenity (noise)	Noise from heavy vehicle movements, process fans and equipment, reversing alarms from moving equipment. Noise emissions from the plant will be required to achieve the *Environmental Protection (Noise) Regulations 1997.*	No further detailed consideration required (Other factor).
Amenity (odour)	The primary source of odour from thermal treatment of tyres is the presence of sulfides in process gases. These gases are not released to atmosphere and as such odour will not be an issue for the Proposal.	No further detailed consideration required (Other factor).
Terrestrial Environmental Quality / Inland Waters Environmental Quality (waste water)	Waste water will be produced from the char upgrading plant. The waste water will recycled as far as possible within the process with a bleed stream neutralised and removed from the site via a licensed liquid waste contractor for disposal in an approved liquid waste facility.	Wastewater can be readily managed and regulated through other mechanisms. No further detailed consideration required (Other Factor).

Factor	Summary of issues	Environmental considerations
Terrestrial Environmental Quality / Inland Waters Environmental Quality (chemical / hydrocarbon storage)	Significant quantities of chemicals, liquid fuels or solvents will not be stored on the Proposal site. In addition, the Proposal site is covered by concrete and/or bitumen.	No further detailed consideration required (Other Factor).
Terrestrial Environmental Quality / Inland Waters Environmental Quality (solid wastes)	Insoluble mineral salts and grit from the char upgrading circuit will be removed from the site via licensed waste contractor for disposal in an approved solid waste facility.	Solid wastes can be readily managed and regulated through other mechanisms. No further detailed consideration required (Other Factor).

Of the indicated factors, potential impacts from air emissions are likely to be the most significant issue to address in the environmental approvals process. A detailed air emissions assessment has therefore been undertaken to demonstrate air quality impacts from the project are environmentally acceptable (Section 3.1).

2.4 Confidential information

The information provided in this document is not confidential.

2.5 Regulatory considerations

Implementation of the Proposal would require compliance with Australian legislation and regulations. Further to these statutory requirements, a range of other guidelines, standards and policies are also relevant to the Proposal. These are discussed below.

2.5.1 Environmental Protection Act 1986

This Proposal is being referred under s 38 of the EP Act for a decision on whether or not the Proposal requires assessment.

The Proposal will require a prescribed premises works approval and licence under Part V of the EP Act.

The TRRF is likely to be “prescribed” under Schedule 1 of the Environmental Protection Regulations 1987 as:

- **Category 37** - Char manufacturing: premises on which wood, carbon material or coal is charred to produce a fuel or material of a carbonaceous nature of enriched carbon content
- **Category 57** – used tyre storage (general): premises (other than premises within category 56 on which used tyres are stored).

2.5.2 Other State environmental legislation

Other key Western Australian legislation relevant to the Proposal includes:

- Environmental Protection (Controlled Waste) Regulations 2004
- Environmental Protection (Noise) Regulations 1997
- *Health Act 1911.*

2.5.3 Environment Protection and Biodiversity Conservation Act 1999 approvals

The Proposal does not involve an action that may be or is a controlled action under the *Environmental Protection and Biodiversity Conservation Act 1999*.

2.5.4 Civil Air Safety Authority guidelines

The TRRF stack is located approximately 4.2 km SSE from Perth Airport Runway 03, outside the current approach and departure paths (Perth Airport 2015). As a consequence the Proposal will not impact upon existing aviation operations.

However, the location of the future third runway is such that the stack will be inside the PANS-OPS approach and departure surface with a lowest horizontal altitude of 95.8 m.[1] The proposed TRRF stack height of 15 m is well below that critical height and will not physically intrude into the flight envelope for the future runway. In addition, the vertical velocity at that altitude of the stack plume is expected to be well below the 4.3 m/s Critical Plume Velocity as specified in airspace regulations for exhaust plumes from stationary sources located below the PANS-OPS critical surface. This expectation is based on plume rise modelling conducted for the EMRC Hazelmere Wood Waste to Energy project, which involved an 18 m stack located approximately 3 km from Runway 24. In that case, the modelling showed a very low probability (0.0024%) of exceedance of the critical plume velocity at an Obstacle Limiting Surface (OLS) altitude of 60 m, and that the critical plume height (where the velocity was below 4.3 m/s at all times) was 86 m. That outcome was considered by CASA to be acceptable for the EMRC project. The key stack plume characteristic that drives vertical lift is temperature and that is equivalent for the two proposals, i.e. both will discharge emissions at 400 °C. On that basis, the Proposal is highly unlikely to pose a risk to aircraft movements from the future 3rd runway at Perth Airport.

2.5.5 Standards, guidelines and policies

Assessment of the environmental impacts of the Proposal is based on various Position Statements and Guidance Statements. Standards, guidelines and policies related to specific environmental factors or individual aspects of the Proposal are listed in the individual sections relevant to the environmental factor being addressed. The generic documents considered relevant to assessment by the EPA and considered in the referral of this Proposal include:

- *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2012*
- EPA Position Statement No. 7: *Principles of Environmental Protection* (EPA 2004)
- Environmental Assessment Guideline No. 1: *Environmental Assessment Guideline for Defining the Key Characteristics of a Proposal Environmental Protection Act 1986* (EPA 2009)
- Environmental Assessment Guideline No. 8: *Environmental Assessment Guideline for Environmental Factors and Objectives* (EPA 2013a)
- Environmental Assessment Guideline No. 9: *Application of a significance framework in the environmental impact assessment process, Focussing on key environmental factors* (EPA 2015a)
- Environmental Assessment Guideline No. 16: *Referral of a proposal under s38 of the Environmental Protection Act 1986* (EPA 2015b)

Other specific policy considered as part of this referral include:

- Guidance Statement No. 3 Separation Distances between Industrial and Sensitive Land Uses (EPA 2005)
- Draft Environmental Assessment Guideline for Separation distances between industrial and sensitive land uses (EPA 2015)
- Advice of the Environmental Protection Authority to the Minister for the Environment under Section 16(e) of the Environmental Protection Act 1986, Environmental and health performance of waste to energy technologies.

These specific policies and their relevance to the Proposal are discussed further below.

[1] PANS-OPS surfaces define the airspace related to aircraft operations that are reliant on instrument navigation. PANS-OPS surfaces are not to be permanently infringed in any circumstance.

Separation Distances between Industrial and Sensitive Land Uses

The EPA 2005 guidance for separation distances for a used tyre storage facility, used tyre recycling facility and char production are 100-200 m, 500-1000 m and 1000 m, respectively (EPA 2005). The draft 2015 Guidelines no longer include tyre recycling as an industry category and specify 1000 m separation distance for used tyre storage (EPA 2015). That distance is therefore considered relevant to the Proposal.

Relevant considerations identified for these categories are:

- gaseous emissions
- noise
- dust
- odour
- risk.

The Proposal site is located within an existing industrial area and is approximately 600 m from the nearest residential areas. An assessment has therefore undertaken within this document to ensure that the risks to public health and amenity are acceptable and can be appropriately regulated and managed. Details of the findings from the assessments are presented in Section 3.

Environmental and health performance of waste to energy technologies (Section 16(e) advice

The Proposal is a resource recovery project, whereby valuable materials are recovered for re-use and recycling, which are more desirable options for waste tyres on the waste hierarchy than energy recovery. Notwithstanding this, justification for why the Proposal is not a 'Waste to Energy' technology and therefore is not subject to the advice and recommendations within EPA Report 1468 *Environmental and health performance of waste to energy technologies (Section 16(e) advice)*, is discussed below.

EPA Report 1468 defines waste to energy as:

> *'the process of converting waste products into some form of energy. This energy could be heat, steam or synthetic gas (syngas). These primary energy sources can either be used directly or further converted into products such as electricity or synthetic fuels.'*

This Proposal does not covert waste products into energy. Valuable resources (oil, carbon black and wire) are recovered from waste tyres for on-selling to appropriate markets. There are a range of downstream uses that these products may be utilised for. Furthermore:

- the Proposal will not produce heat, steam or syngas for generation of electricity or synthetic fuels
- the material of greatest commercial value is carbon black and as such, the process is optimised to maximise recovery of char for upgrading to high quality carbon black
- the oil is recovered for sale to an chemicals manufacturer and/or oil refinery or as a feedstock for production of solvents, specialty chemicals, or for blending into refinery stream for conventional liquid hydrocarbon production
- the oil will not be converted to a synthetic fuel as part of the Proposal
- the wire is recovered for sale to the scrap metal recycling market
- the residual process gas will not be upgraded to high quality synthesis gas.
- recuperative heat recovery to combustion air will be employed on TCU and thermal oxidiser exhaust streams to improve the thermal efficiency of the process but not to generate steam.

Given the above, the advice and recommendations within EPA Report 1468 are not considered applicable to this Proposal. Detailed assessment in respect of each of the recommendations within the EPA report is therefore not required.

2.5.6 Planning Context

The Proposal site is zoned Industry under the Metropolitan Region Scheme and 'General Industry' zone within the City of Canning Local Planning Scheme No. 40 and no change to this current zoning is required. The Proponent will be required to submit a Development Application to the City of Canning for approval.

2.6 Stakeholder consultation

A comprehensive Stakeholder Engagement Strategy was developed to identify and inform stakeholders in relation to the Proposal. Targeted consultation was initiated in October 2015 to inform stakeholders on details of the Proposal and to enable stakeholder concerns and comments to be considered in the development of the Proposal. Consultation has engaged the local members of parliament, local government (on behalf of the local community), State Government and nearby industrial businesses. A summary of the consultation program for the Proposal is presented in Table 8 below.

Table 8: Consultation summary

Stakeholder/date of consultation	Consultation	Purpose / key discussion Response to issues	Relevant section
Environmental Protection Authority (EPA)/ Office of EPA (OEPA)	Meeting on 12 November 2015 between Elan and EPA (Dr Tom Hatton, Kim Taylor, Anthony Sutton	Initial engagement to provide an overview of the proposal and gain an understanding of the regulatory processes. Elan will need to: • provide process flow diagram • demonstrate 'proven' technology • identify waste products and emissions data • consider zoning and buffers in siting decision.	Section 1.4 Section 1.5 Section 3
	Meeting on 8 June 2016 between Elan, OEPA and Strategen Environmental.	An overview of the Proposal including: location, process flow, environmental investigations and assessment. Key matters to be addressed/considered: • EPA Report 1468 on waste to energy • separation distance guidance • consultation with DER and other stakeholders.	Section 2.5.4 Section 2.6.
Department of Environment Regulation (DER)	Meeting on 21 October 2015 between Elan and DER (Ms Kerry Laszig and Mr Ed Schuller)	Initial engagement to provide an overview of the proposal and gain an understanding of the regulatory processes.	N/A
	Meeting on 14 June 2016 between Elan DER (Mr Jonathan Bailes, Ms Christine West) and Strategen Environmental	An overview of the Proposal including: location, process flow, environmental investigations and assessment. Discussions around application logistics. Key matters to be addressed/considered: • further information on carbon black upgrading process (may affect prescribed premises categories) • emissions limits will be derived from commissioning data (works approval process) • consideration of Suez incinerator in terms of background air quality • full assessment and characterisation of emissions. DER also questioned on whether any active local individuals or groups in the area that it may be aware of that should be consulted. No individuals/groups identified.	Section 1.4.8 Section 3

Stakeholder/date of consultation	Consultation	Purpose / key discussion Response to issues	Relevant section
Office of the Minister for Environment (Hon Albert Jacob MLA)	Meeting on 10 December 2015 between Elan and Policy Adviser, Ms Belinda Walker	Initial engagement to provide an overview of the Proposal.	N/A
	Meeting on 17 May 2016 between Elan and Policy Adviser, Ms Belinda Walker.	Additional information and detail on the location of the proposal process design and key environmental outcomes.	N/A
Local government – City of Belmont	Meeting on 15 December 2015 between Elan and Liberal Member for Belmont, Mrs Glenys Godfrey MLA	Initial engagement to provide an overview of the Proposal.	N/A
	Meeting 1 June 2016	Follow-up meeting to update and provide further information on the Proposal.	
Shadow Environment Minister	Meeting on 22 December 2015 between Elan and Shadow Minister for Environment, Mr Chris Tallentire MLA	Initial engagement to provide an overview of the Proposal.	N/A
	Meeting on 23 May 2016 between Elan and Shadow Minister for Environment, Mr Chris Tallentire MLA	An overview of the Proposal including: location, process flow, environmental investigations and assessment. Positive feedback and response.	N/A
Department of Planning	Letter on 12 May 2016 from Elan to the DoP, Minister for Planning, Shadow Minister for Planning and Western Australia Planning Commission	Response received from DoP on 30 May 2016. Advised that matter will be dealt with by City of Canning.	Section 2.5.6
Shadow Minister for Planning	Meeting on 21 January 2016 between Elan and Shadow Minister for Planning, Ms Rita Saffioti MLA	Initial engagement to provide an overview of the Proposal.	N/A
Member for East Metropolitan Region	Meeting on 18 March 2016 between Elan and Labor Member for East Metropolitan Region, Hon Samantha Rowe MLC.	Initial engagement to provide an overview of the Proposal.	N/A
	Correspondence sent on 30 June 2016	Follow-up correspondence to update and provide further information on the Proposal.	
Minister for Health / Department of Health	Letter sent on 12 May 2016	Initial engagement to provide an overview of the Proposal. DoH response received 20 May 2016. Positive response. DoH assists DER in assessment of proposed technologies that may impact on public health.	N/A
Civil Aviation Safety Authority (CASA)	Letter sent on 12 May 2016	Overview of the Proposal provided. No response received to date.	N/A
Perth Airport	Letter sent on 12 May 2016	Overview of the Proposal provided. No response received to date.	N/A
Kewdale Freight Terminal	Letter sent on 12 May 2016	Overview of the Proposal provided. No response received to date.	

Stakeholder/date of consultation	Consultation	Purpose / key discussion Response to issues	Relevant section
Councillors, City of Canning	Meeting on 13 June 2016 between Elan and Mr Jesse Jacobs, Ms Ayse Martli	Overview of the Proposal provided. Positive feedback and response to initiative.	N/A
	Correspondence to all councillors July 2016	Overview of the Proposal provided.	N/A
City of Canning, Planning and Development Manager	Meeting on 14 June 2016 between Elan and Mr Graeme Bride and Clint Burdett	Overview of the Proposal provided. Positive feedback and response to initiative. Elan queried whether there are any local groups (e.g. ratepayer associations) that should be consulted. City of Canning officer advised that they are not aware of any local groups that should be contacted.	N/A

Elan will continue to consult with specific agencies and other stakeholders throughout assessment and implementation of the Proposal.

3. PART B: Environmental Factors

Of the indicated factors, potential impact from air emissions is the only factor that requires more detailed consideration. A comprehensive air emissions assessment has therefore been undertaken to demonstrate air quality impacts from the project are environmentally acceptable (Section 3.1).

Other factors relevant to the Proposal are briefly described in Section 3.5.

3.1 Air quality

The EPA's objective for air quality is:

To maintain air quality for the protection of the environment and human health and amenity.

3.1.1 Guidance, policies and standards

The regulation of air quality is covered by the *Environmental Protection Act 1986* (EP Act).

The following EPA guidance and position statements set the framework for identification and assessment of impacts to air quality:

- Air Quality Modelling Guidance Notes (DoE 2006)
- EPA Guidance Statement No. 55, Implementing Best Practice in proposals submitted to the Environmental Impact Assessment process (EPA 2003)
- National Environment Protection Measure standards and goals (NEPC 2003)
- World Health Organisation (WHO) Air Quality and Health guidelines (WHO 2000, 2005)
- Department of Health (DoH) relevant policy and air quality guidelines.

3.1.2 Baseline studies and investigations

A study of air emissions from the single point source emissions stack has been carried out using dispersion modelling in accordance with guidance notes provided by Department of Environment Regulation (DER) (2006). The assessment included direct impacts of emissions as well as cumulative impacts, whereby the background air quality is considered in conjunction with the additional emissions Proposal. Key elements of the assessment included:

- construction of a process mass balance to determine emissions from the single point source (emissions stack)
- collation of background air quality data for the cumulative impact assessment
- assembly of air quality standards (assessment criteria) relevant to impacts
- identification of sensitive receptors
- air dispersion modelling to generate predicted ground level concentrations (GLCs) of air emissions
- comparison of predicted GLCs with air quality standards for direct and cumulative impact assessments.

The results from this study which forms the basis for the assessment of the air quality factor are described in the following sections.

3.1.3 Potential sources of impact

Atmospheric emissions from the Proposal have the potential to affect air quality, with a consequent impact on the health and amenity of persons at residential areas and neighbouring premises within the dispersion zone. The nearest sensitive receptors are located in the residential area approximately 600 m to the east of the Proposal site. Key emissions of relevance from the Proposal include:

- oxides of nitrogen (NOx)
- sulfur dioxide (SO_2)
- carbon monoxide (CO)
- particulates.

As previously indicated in Table 3, tyres nominally contain 2% ZnO. Other heavy metals are also present in tyres, typically as contaminants in the ZnO used for tyre manufacturing. A range of metals were therefore considered in the emissions assessment.

Trace levels of elemental chlorine and fluorine are reported in the literature as being present in tyre rubber, therefore emissions of hydrogen chloride (HCl) and hydrogen fluoride (HF) were also considered in the assessment.

Dioxins are not reported as constituents of tyre rubber but may be formed from combustion of natural gas in the TCU burners or waste process gas in the thermal oxidiser. As such, the assessment has considered dioxins emissions.

Low levels of volatile organic compounds (VOCs) may be emitted from combustion of natural gas and residual process gas. Estimates of VOC emissions as C2 to C6 hydrocarbons (i.e. ethane to hexane), benzene and toluene have been made using USEPA AP42 emission factors, with the assumption made that similar emission rates occur for combustion of process gas as for natural gas.

3.1.4 Operating scenarios

Three scenarios are expected for the operation of the Proposal – normal, start-up and shutdown operations. The emissions impact assessment has considered emissions from normal operations only, since these represent the vast majority of potential environmental risk for the Proposal. Details of the normal operations have been described in Section 1.4. Details of the start-up and shutdown operations are provided below.

Start-up

The plant start-up involves the following operations:

- pre-start check of all operating control systems and resolution of any fault situations
- feed bin is charged with shredded tyre material
- TCU and thermal oxidiser combustion air fans are started
- cooling water flow is commenced
- thermal oxidiser burner ignited and stable combustion conditions established
- TCU burners ignited and temperature increased to 450 °C
- solids discharge screw rotation commenced
- solids conveyers started
- magnetic separator energised
- char upgrade plant started
- shredded tyre feed commenced
- TCU heat tube temperature stabilised at nominal 600 °C as feed rate increased to normal operation set point
- thermal oxidiser combustion conditions adjusted to maximise efficiency and minimise emissions
- char upgrade operations stabilised as char feed rate stabilises.

Air emissions during start-up are initially from combustion of natural gas and are then augmented from combustion of residual process gas. The test plant program has indicated TCU start-up will take in the order of 30 to 45 minutes to reach normal operating conditions. As such, the emissions impacts from start-up are considerably less than for normal operations, and the emissions profile for normal operations represent a conservative prediction of impacts during start-up.

Shutdown

Plant shutdown will be required for planned and unplanned maintenance, and outages of equipment, and will involve the following operations:

- shutdown feed to feed hopper and TCU
- isolate TCU burners to cease heat input
- cease rotation of the heat tube when the TCU combustion chamber temperature reaches nominal 150 °C
- continue thermal oxidiser operation until the residual process gas flow ceases
- shut down thermal oxidiser
- shut down cooling water
- isolate conveyers and de-energise magnetic separator as necessary
- shut down char upgrading plant if necessary

Note that the char upgrading plant can run independently to the TCU until the char inventory is run down. Similarly, the TCU can operate for some time without the char plant on-line to build an inventory of char for processing.

Air emissions during shutdown will decline rapidly as the generation of residual process gas ceases. The test plant program indicated process gas generation is completed within 15 minutes after cessation of feed to the TCU and isolation of TCU burners. At that stage the emissions are from combustion of natural gas in the thermal oxidiser. As such, the emissions impacts from shutdown are considerably less than for normal operations, and the emissions profile for normal operations represent a conservative prediction of impacts during shutdown.

3.2 Assessment of likely direct and indirect impacts

3.2.1 Mass balance

A comprehensive mass balance has been developed from consideration of reported compositional data for waste tyre materials, the proposed feed rate of those materials (2500 kg/h), and key process design parameters that influence the formation and fate of air emissions within the process.

Chemical compositional data for waste tyres were obtained from the literature (EER 2006, NZ MfE 2016, Susa and Haydary 2012, CalRecovery 1995). The fate of these substances within the TRRF process is determined from the chemical and physical conditions at each stage of the process. For example, sulfur containing additives in tyre rubber are volatilised in the initial stages of thermal processing with residual sulfur reduced to H_2S at higher temperatures. These volatile sulfur species predominately report to the process gas stream, which when condensed report to the oil stream. Some sulfur species also absorb onto or within the char. Only the sulfur species which survive in the residual process gas are oxidised to generate SO_2 in the SACTO.

Similar process considerations have been made of the respective chemistries of other chemical components of the shredded tyre materials to calculate the air emissions of other relevant parameters from the TRRF plant.

If required, a copy of the mass balance calculations can be provided.

3.2.2 Test plant trial

Demonstration scale tests of tyre thermal processing were carried out at an established test plant, with samples of char, wire, oil and residual process gas obtained for analysis and characterisation. In addition, air emissions from a thermal oxidiser were tested for NOx, CO, SO_2, CO_2, O_2, particulates and acid gases.

The test data were used to verify some aspects of the mass balance and also confirm the sulfur mass flows used for the impact assessment. Samples of char have been examined by CSIRO to develop the process flowsheet for the char upgrading plant. Oil samples have been analysed by the Centre for Energy (CfE) at the University of Western Australia to determine the composition and key physical characteristics. The residual process gas was also analysed by CfE to confirm the composition and identify concentration of sulfur species.

Key process data including temperatures, pressures, feed rates and associated operational performance data were obtained to assist in the detailed design of the commercial plant for the Proposal.

3.2.3 Emissions data

The emissions data obtained from the mass balance and test plant trials are presented in Table 9. These data have been used in dispersion modelling undertaken for the Proposal (Section 3.2.6).

Table 9: Emissions data for dispersion modelling

Emission	Units	Value
NOx	g/s	2.85E-01
SO_2	g/s	6.87E-01
CO	g/s	1.21E-01
HCl	g/s	3.58E-02
HF	g/s	4.02E-04
Hg	g/s	2.92E-06
Cd	g/s	2.29E-05
Tl	g/s	0.00E+00
Sb	g/s	1.53E-05
As	g/s	6.63E-06
Cr	g/s	3.09E-05
Co	g/s	9.82E-05
Cu	g/s	1.21E-04
Pb	g/s	6.16E-04
Mn	g/s	1.63E-05
Ni	g/s	2.00E-04
V	g/s	7.64E-06
Particulates	g/s	1.92E-02
Dioxins	g TEQ/s	6.43E-13
Ethane	g/s	7.39E-03
Propane	g/s	3.82E-03
Butane	g/s	5.01E-03
Pentane	g/s	6.20E-03
Hexane	g/s	4.29E-03
Benzene	g/s	5.01E-06
Toluene	g/s	8.11E-06

Note: values are displayed using Excel scientific format, where (for example) 2.85E-01 refers to 2.85 x 10^{-1}.

3.2.4 Other emission sources external to the Proposal

Traffic emissions are likely to be a significant contributor to background air quality in the area due to the proximity of major transport routes. As an example, a first order estimate of emissions from 1 km of Roe Highway adjacent to the residential area east of the Proposal suggests NOx emission rate of 140 g/s, a CO emission rate of 430 g/s and SO_2 emission rate of 0.6 g/s for the average 43 seconds each vehicle takes to travel 1 km at 7 am peak hour.[2] The NOx and CO rates are 3 and 4 orders of magnitude greater than the Proposal emissions rates, respectively. The SO_2 emission rate is comparable with that from the Proposal. This example only considers emissions from traffic using 1 km of Roe Highway and does not include emissions from all other transport routes in the vicinity of the Proposal. As such the overall emissions burden from traffic on the transport routes is almost certainly far greater than that from the Proposal.

Another industrial source of air emissions is the Suez Medical Waste incinerator, which is located approximately 700 m from the Proposal premises. The emissions from that facility are managed and controlled under a DER operating licence. As such it is reasonable to expect that those limits are protective of ambient air quality values in the surrounding area. An estimate of the worst case contribution of emissions from the incinerator to the ambient air concentrations has been made using the emission concentration limits in the licence. This has indicated the respective estimated NOx, CO and SO_2 emissions rates from the incinerator operating at licence limit concentrations are in the order of 12, 12 and 2.5 times greater than predicted for the Proposal.

Overall, the contributions of emissions from the Proposal to the ambient air at neighbouring locations are considerably less than other sources of significance.

3.2.5 Background air quality data and ambient air assessment criteria

An assessment of cumulative emissions impacts from the Proposal requires ambient air data from the surrounding area to the Proposal. However, public domain ambient air quality data for the Welshpool area were not identified in searches carried out for this study. As a consequence, published data from DER's monitoring network across the metropolitan area were examined to identify conservative concentrations to use as backgrounds for the cumulative air emissions risk assessment (DER 2015). As indicated in Section 3.2.4. As previously discussed, traffic emissions are likely to be a significant contributor to the background air quality and several of DER's stations are located in close proximity to major traffic routes.

The most recent published data (from 2014 monitoring) was used for the cumulative air emissions assessment to capture the more recent impacts from traffic volumes. The reported concentrations for the respective time averages of regulatory interest from all stations from 2014 were pooled and the maximum values for NOx, SO_2 and CO were used as the background for the cumulative assessment. The 95^{th} percentile PM_{10} and $PM_{2.5}$ concentrations were used for the assessment of those parameters, since the maxima were a consequence of bushfire smoke emissions and are unlikely to be reflective of a background derived from vehicle emissions and other activities in the area.

This approach provides a conservative indication of the potential cumulative impact assessment of the Proposal.

Details of the sources of background data and key influences at the sources are summarised in Table 10. A comparison of the selected background concentrations with air quality standards is shown in Table 11. Aside from $PM_{2.5}$ annual average, the concentrations of these parameters are below the NEPMs.

[2] Estimates based on Main Roads traffic data and 1.3 g NOx per vehicle km travelled (VKT), and 3.9 g CO per VKT from Smit (2014)

Table 10: Background data

Location	Parameters	Influences	Relevance to Proposal
Caversham	NOx, CO, PM_{10}, $PM_{2.5}$	Brickworks, regional transport routes, local traffic, general land-use.	Potentially significant background from industrial sources but likely to be lower than Welshpool due to lower traffic volumes.
Duncraig	NOx, CO, PM_{10}, $PM_{2.5}$	Freeway traffic.	Potentially highest background concentrations from vehicle emissions, similar to Welshpool.
Quinns Rocks	NOx, PM_{10}, $PM_{2.5}$	Coastal (marine) influence, residential area with local traffic influences.	Relatively low background concentrations from vehicle emissions, much less than Welshpool.
Rockingham	NOx, SO_2	Residential and arterial road traffic, Kwinana industrial area emissions.	Potentially significant background concentrations from vehicle emissions, likely to be less than Welshpool. SO_2 measured at this station.
South Lake	NOx, SO_2, CO, PM_{10}, $PM_{2.5}$	Freeway, traffic residential traffic and Kwinana industrial area emissions.	Potentially highest background concentrations from vehicle emissions, similar to Welshpool. SO_2 measured at this station
Swanbourne	NOx, SO_2	Residential and arterial road traffic.	Potentially significant background concentrations from vehicle emissions, probably less than Welshpool. SO_2 measured at this station

Table 11: Air quality assessment criteria and background concentrations

Pollutant	Assessment criteria averaging Period	Assessment criteria (µg/m^3)	WA relevant guideline	Background concentration for impact assessment (µg/m^3)	% of assessment criteria
NO_2	1-hour	246	AAQ NEPM (NEPC 2003)	90	37%
SO_2	1-hour	571.8	AAQ NEPM (NEPC 2003)	160	28%
	24-hour	228.7	AAQ NEPM (NEPC 2003)	26	11%
	Annual	57.2	AAQ NEPM (NEPC 2003)	5	9%
CO	8-hour	11 249	AAQ NEPM (NEPC 2003)	2175	19%
PM_{10}	24-hour	50	AAQ NEPM (NEPC 2003)	29.4	59%
$PM_{2.5}$	24-hour	25	AAQ NEPM (NEPC 2003)	14.1	56%
	Annual	8	AAQ NEPM (NEPC 2003)	8.1	101%

3.2.6 Dispersion modelling

Methodology

Dispersion modelling of emissions from the single point source emissions stack was carried out by SigmaTheta using the AERMOD atmospheric dispersion model. Meteorological data were obtained from the Perth Airport station. Full details of the modelling configuration are provided in the report from SigmaTheta (2016) located in Appendix 1.

The residential areas to east of the Proposal site was identified as sensitive receptors for the emissions impact assessment with industrial premises surrounding the remainder of the Proposal site.

Tabulated results are reported in the following sections for maximum predicted GLCs at sensitive receptors to the Proposal and at the boundary of the Proposal site (which is also the maximum predicted GLC anywhere is the modelling domain).

Results from dispersion modelling – direct impact assessment

The results from the dispersion modelling are summarised in Table 12 for the nearest sensitive receptor and maximum predicted GLC on within the model grid. This includes a comparison with the respective assessment criteria to provide a direct impact assessment for the emissions of interest. Note that the C2-C6 hydrocarbons are not included in this table since air quality assessment criteria are not available for these parameters.

No exceedances of the air quality criteria were observed for these maximum predicted GLCs. The most significant emissions were Ni (annual average) and SO_2 (10 minute and 24-hour), with a maximum predicted GLCs at the Proposal boundary of 52%, 20% and 20% of the respective air quality criteria. The annual average Ni impact is reduced at non-residential areas because persons will not be present for sufficient time over a year to be exposed to emissions at the predicted level.

Of more relevance in respect of risks are the predicted GLCs at residential (sensitive) receptors. All parameters were well below the respective criteria at the nearest sensitive receptor located to the east of the Proposal on the eastern side of Roe Highway, with SO_2 emissions being the most significant, at 1.7% of the 10-minute average criterion. Contour plots showing the dispersion patterns of emissions can be found in the SigmaTheta (2016) report provided in Appendix 1.

Table 12: Maximum predicted GLCs at nearest sensitive receptor and Proposal boundary

Pollutant	Assessment criteria averaging Period	Assessment criteria (µg/m^3)	Nearest sensitive receptor		Proposal boundary	
			Predicted GLC (µg/m^3)	% of criteria	Predicted GLC (µg/m^3)	% of criteria
NO_2	1-hour	246	2.5	1.0%	29	12%
	Annual	61.6	0.04	0.07%	2.5	4.0%
SO_2	10-min	500	8.7	1.7%	99	20%
	1-hour	571.8	6.1	1.1%	69	12%
	24-hour	228.7	2.8	1.2%	47	20%
	Annual	57.2	0.10	0.2%	5.9	10%
CO	15 min	100000	1.4	0.001%	16	0.016%
	30 min	60000	1.2	0.002%	14	0.023%
	1-hour	30000	1.1	0.004%	12	0.040%
	8-hour	11249	0.7	0.006%	10	0.090%
HCl	1-hour	100	0.3	0.3%	3.6	3.6%
HF	1-hour	100	0.003	0.003%	0.04	0.04%
As	1-hour	0.09	0.00002	0.03%	0.0006	0.7%
	24-hour	0.03	0.00003	0.08%	0.0004	1.4%
	Annual	0.003	0.0000008	0.03%	0.00005	1.7%
Cd	1-hour	0.018	0.0002	1.0%	0.002	12%
	Annual	0.005	0.000004	0.08%	0.0002	3.6%
Co	24-hour	0.1	0.0004	0.4%	0.006	6.1%
Cr^{VI}	Annual	0.0002	0.0000003	0.2%	0.00002	9.8%
Cr^{III}	1-hour	10	0.0002	0.004%	0.003	0.03%
	24-hour	0.05	0.0001	0.2%	0.002	3.9%
Cu	24-hour	1	0.0004	0.04%	0.007	0.8%
Hg	1-hour	1.8	0.00002	0.001%	0.0002	0.02%
	Annual	0.2	0.0000003	0.0002%	0.00002	0.01%

Pollutant	Assessment criteria averaging Period	Assessment criteria (µg/m³)	Nearest sensitive receptor		Proposal boundary	
			Predicted GLC (µg/m³)	% of criteria	Predicted GLC (µg/m³)	% of criteria
Mn	1-hour	18	0.0001	0.0007%	0.001	0.008%
	Annual	0.15	0.000002	0.001%	0.0001	0.08%
Ni	1-hour	0.18	0.002	0.9%	0.02	10%
	Annual	0.003	0.00003	0.9%	0.002	52%
Pb	Annual	0.5	0.00008	0.02%	0.005	1.0%
Sb	1-hour	9	0.0001	0.001%	0.001	0.02%
Tl	1-hour	1	0.0	0.0%	0.0	0.0%
	Annual	0.1	0.0	0.0%	0.0	0.0%
V	24-hour	1	0.00003	0.003%	0.0005	0.05%
PM as TSP	24-hour	90	0.09	0.09%	1.5	1.5%
PM_{10}	24-hour	50	0.09	0.2%	1.5	2.6%
$PM_{2.5}$	24-hour	25	0.09	0.3%	1.5	5.3%
	Annual	8	0.003	0.04%	0.2	2.1%
Dioxins (TEQ)	1-hour	1.0E-06	5.7E-12	0.0006%	6.4E-11	0.006%
Benzene	Annual	9.6	0.0000007	0.000008%	0.00004	0.0004%
Toluene	24-hour	3760	0.00003	0.0000009%	0.0006	0.00001%
	Annual	376	0.000001	0.0000003%	0.00007	0.00002%

Results from dispersion modelling – cumulative impact assessment

A cumulative impact assessment has been conducted using the background concentration data (Table 11) and maximum predicted GLCs for direct impacts of the facility. The results of the cumulative impact assessment at the boundary of the Proposal are presented in Table 13.

Aside from $PM_{2.5}$ annual average, no exceedances of the respective air quality criteria are predicted where the emissions from the proposed TRRF are combined with background concentrations. A slight exceedance of the PM_{10} annual NEPM (8 µg/m³) was predicted (8.3 µg/m³) however, that was driven by the high background (8.1 µg/m³) and the contribution from the Proposal was negligible (2.0%).

Table 13: Maximum predicted GLCs at the site boundary – cumulative impact assessment

Emission	Assessment criteria (µg/m³)	Average period	Predicted maximum concentration (µg/m³)	% of assessment criteria
NO_2	246.4	1-hour	119	48%
SO_2	571.8	1-hour	229	40%
	228.7	24-hour	73	32%
	57.2	Annual	11	19%
CO	11249	8-hour	2185	19%
PM_{10}	50	24-hour	30.9	62%
$PM_{2.5}$	25	24-hour	15.6	62%
	8	Annual	8.3	104%

Overall, the predicted air emission impacts from the Proposal are insignificant and are well below air quality standards, even at the boundary of the Proposal. The highest incremental contribution from the Proposal is from SO_2 emissions whereby the maximum 24-hour average SO_2 concentration is predicted to increase from a background of 26 µg/m^3 to 73 µg/m^3 at the Proposal boundary. That increase takes the predicted cumulative impact to 32% of the NEPM. Overall, the background emissions from vehicle exhaust emissions from the major transport routes in the Welshpool area are of far greater significance.

Sensitivity analysis

The predicted GLCs from the dispersion modelling suggest a low risk of air quality impacts from the Proposal. Those results are a reflection of the inputs to the modelling, which include the composition of waste tyres and the process operating conditions.

Key variables in those factors are the feed rate to the TRRF and the homogeneity of the tyre shred in respect of air emissions precursors such as sulfur, nitrogen and heavy metal content. The feed rate will be relatively constant and not expected to vary by more than ±10% from the specified rate (2500 kg/h) once normal operations are established after startup.

The bulk composition of types in terms of rubber, steel wire and fabric content varies from passenger tyres to truck tyres to OTR tyres. For example, typical wire content of passenger tyres is reported to be 16.5%, truck tyres 23% and OTR tyres 12% (EER 2006). The tyres are largely shredded as they are received which suggests some stratification of shredded tyre composition may occur if, for example, a large load of truck tyres is received. However, the Proposal includes a number of stages of shred handling prior to introduction into the TCU, which serves to reduce the variability in shred composition.

The proportion of these types of tyres in waste tyre streams will vary depending on the nature of suppliers who provide the waste tyres. One estimate from a 2009-2010 study shows passenger tyres constitute 42.5% of the waste tyres (as EPUs), truck tyres 30.3% and OTR tyres 27.2% (Hyder 2012). These data provide a basis for assessing the sensitivity of the emission profile to the proportions of the respective types of tyres in the feed to the TCU.

The sensitivity of the emissions rates to the type of tyre shred feed has been assessed as follows:

1. Increase the feed rate by 10% (2500 kg/h to 2750 kg/h) to accommodate upper limit of variability in feed rate
2. Assume feed is 100% passenger tyres (2500 kg/h)
3. Assume feed is 100% truck tyres (2500 kg/h)
4. Assume feed is 100% OTR tyres (2500 kg/h).

As discussed above, the variance in feed rate is not expected to exceed ±10%. As such the sensitivity analysis described below provides a reasonable understanding of the potential impacts during normal operations. In contrast, the likelihood of the Proposal processing entirely one type of tyre at any time is very low, since the tyres are obtained from a large number of sources and the shredding and shred handling processes will serve to mix the shredded material prior to introduction into the TCU. As a consequence, the sensitivity assessment reflects the extremes of possible feed material which are highly unlikely to occur.

The results of these analyses are summarised in Table 14. Key findings are as follows:

A 10% increase in feed rate gives rise to a similar increase in emissions for all parameters except NOx and particulates. NOx emissions increase by 18% from the base case (2500 kg/h) due to the increased energy requirements of the TCU and thermal oxidiser for the higher feed rate, and increased fuel NOx from nitrogen in the tyre rubber. This increase will result in a predicted GLC which is 14% of the NEPM, up from 12% for the base case. Particulate emissions are based on emissions factors for natural gas combustion and increase by 15% in line with the higher gas consumption required for the higher energy requirements.

Table 14: Results of sensitivity analyses

Emission	Units	2500 kg/h	2750 kg/h		100% passenger tyres		100% truck tyres		100% OTR tyres	
		Emission rate	Emission rate	Change from base case	Emission rate	Change from base case	Emission rate	Change from base case	Emission rate	Change from base case
NOx	g/s	2.88E-01	3.41E-01	18.2%	2.90E-01	0.5%	2.78E-01	-3.6%	2.98E-01	3.6%
SO_2	g/s	6.87E-01	7.56E-01	10.0%	7.09E-01	3.2%	6.74E-01	-1.9%	7.36E-01	7.1%
CO	g/s	1.21E-01	1.33E-01	10.0%	1.21E-01	0.5%	1.17E-01	-3.5%	1.25E-01	3.5%
HCl	g/s	3.58E-02	3.94E-02	10.0%	3.74E-02	4.4%	2.81E-02	-21.7%	5.37E-02	49.9%
HF	g/s	3.65E-04	4.02E-04	10.0%	3.81E-04	4.4%	2.86E-04	-21.7%	5.48E-04	50.0%
Hg	g/s	2.40E-06	2.64E-06	10.0%	2.81E-06	16.9%	2.26E-06	-5.8%	3.76E-06	56.4%
Cd	g/s	1.96E-05	2.16E-05	10.0%	2.19E-05	11.3%	1.71E-05	-12.9%	3.02E-05	53.6%
Tl	g/s	0.00E+00	0.00E+00	0.0%	0.00E+00	0.0%	0.00E+00	0.0%	0.00E+00	0.0%
Sb	g/s	1.39E-05	1.53E-05	10.0%	1.45E-05	4.4%	1.09E-05	-21.7%	2.08E-05	50.0%
As	g/s	5.82E-06	6.40E-06	10.0%	6.32E-06	8.6%	4.87E-06	-16.3%	8.85E-06	52.2%
Cr	g/s	2.66E-05	2.93E-05	10.0%	2.95E-05	10.9%	2.30E-05	-13.4%	4.08E-05	53.3%
Co	g/s	8.92E-05	9.81E-05	10.0%	9.32E-05	4.5%	6.99E-05	-21.6%	1.34E-04	50.1%
Cu	g/s	1.09E-04	1.20E-04	10.0%	1.15E-04	5.3%	8.67E-05	-20.5%	1.64E-04	50.5%
Pb	g/s	5.60E-04	6.16E-04	10.0%	5.85E-04	4.5%	4.39E-04	-21.6%	8.40E-04	50.1%
Mn	g/s	1.44E-05	1.58E-05	10.0%	1.55E-05	7.6%	1.19E-05	-17.6%	2.18E-05	51.7%
Ni	g/s	1.79E-04	1.97E-04	10.0%	1.90E-04	5.8%	1.44E-04	-19.9%	2.71E-04	50.7%
V	g/s	6.94E-06	7.64E-06	10.0%	7.25E-06	4.4%	5.43E-06	-21.7%	1.04E-05	50.0%
Particulates	g/s	2.15E-02	2.47E-02	14.8%	2.16E-02	0.3%	2.11E-02	-2.1%	2.19E-02	2.1%
Dioxins	g TEQ/s	6.43E-13	7.07E-13	9.9%	6.43E-13	0.0%	6.43E-13	0.0%	6.43E-13	0.0%
Ethane	g/s	7.39E-03	8.13E-03	9.9%	7.41E-03	0.3%	7.26E-03	-1.9%	7.53E-03	1.9%
Propane	g/s	3.82E-03	4.20E-03	9.9%	3.83E-03	0.3%	3.75E-03	-1.9%	3.89E-03	1.9%
Butane	g/s	5.01E-03	5.51E-03	9.9%	5.02E-03	0.3%	4.92E-03	-1.9%	5.10E-03	1.9%
Pentane	g/s	6.20E-03	6.82E-03	9.9%	6.22E-03	0.3%	6.09E-03	-1.9%	6.32E-03	1.9%
Hexane	g/s	4.29E-03	4.72E-03	9.9%	4.30E-03	0.3%	4.21E-03	-1.9%	4.37E-03	1.9%
Benzene	g/s	5.01E-06	5.51E-06	9.9%	5.02E-06	0.3%	4.92E-06	-1.9%	5.10E-06	1.9%
Toluene	g/s	8.11E-06	8.92E-06	9.9%	8.13E-06	0.3%	7.96E-06	-1.9%	8.26E-06	1.9%

Processing of 100% passenger tyres is predicted to increase the emission rates from 0.3% for hydrocarbons to 17% for Hg. Small changes were predicted for NOx (0.5% increase) and SO_2 (3.2% increase). These increases are reflected in increases in the predicted GLCs which are not materially significant compared with air quality criteria. For example, the predicted GLC for Hg at the nearest sensitive receptor increases from 0.0012% to 0.0014% of the criterion whereas SO_2 increases from 1.06% to 1.09% of the criterion.

Processing of 100% truck tyres is predicted to decrease emissions by up to 22%. As such the predicted GLCs will also decrease under this scenario.

Processing of 100% OTR tyres is predicted to increase emissions by up to 56%. The most significant increases are predicted for metals and halides, which reflects the higher proportion of rubber and fabric in OTR tyres compared with steel wire. The smaller magnitude of increases for combustion gases reflect the additional emissions from the thermal oxidiser from the larger amount of process gas generated from the increased feed rate of rubber/fabric. The impacts of the increases in emission rates are insignificant, for example predicted SO_2 GLCs at nearest sensitive receptor increasing from 1.73 to 1.85% of the 10-minute average NEPM. Predicted hourly average Hg GLCs increased from 0.0012% to 0.0018% of the air quality criterion.

Overall, the sensitivity analysis has shown variances in feed rate and feed composition will have no significant impacts on the air quality.

Results from dispersion modelling – separation distance to sensitive receptors

Based on the results of the air emissions assessment, the separation distance from the Proposal site to the nearest sensitive receptors is adequate to ensure that health or amenity will not be impacted as a result of the Proposal. In particular, acceptable air quality impacts are predicted at the boundary of the Proposal. As such there is a low risk of unacceptable impacts at the nearest residential area 600 m from the site and essentially no material benefit from implementation of the EPA recommended 1000 m separation distance.

3.3 Management, monitoring and validation of predictions

The assessment of air emission impacts has involved and mass balance emissions assessment and dispersion modelling to predict ground level concentrations of various pollutants. Those predictions will be validated by measurements of emissions from the emission stack once the Proposal is commissioned.

Regulatory instruments (works approval and licence) under Part V of the EP Act can adequately manage and regulate the construction, commissioning and operational phases of the Proposal. Monitoring, management and emission limits can be applied to the Proposal to ensure that emissions achieve relevant standards and guidelines.

3.3.1 Pollution control

Pollution control equipment incorporated into the design of the plant is outlined in Section 1.4.10. The air emissions assessment indicates that these measures are sufficient to ensure acceptable air quality outcomes from the Proposal. In particular:

1. Dispersion modelling for normal operations shows no exceedances of the air quality criteria for the maximum predicted GLCs at the nearest sensitive receptors approximately 600 m from the boundary of the Proposal area.
2. Aside from $PM_{2.5}$, no exceedances of the respective air quality criteria are predicted where the emissions from the proposed TRRF plant are combined with background concentrations.
3. The annual average $PM_{2.5}$ criterion is predicted to be exceeded, however that exceedance is driven by the background concentration which exceeded the NEPM, The maximum contribution from the Proposal is predicted to contribute an additional 2% to the background concentration which is insignificant compared with the background concentration.

Based on the above, additional pollution control measures are not necessary. The Proposal as designed will be sufficiently protective of human health and the environment.

3.3.2 Stack testing for commissioning

Measurements of NOx, CO, SO_2, O_2 and CO_2 will be made during commissioning to assist in the optimisation process. At the completion of commissioning when the facility is operating under optimal conditions, a campaign of stack emission testing will be undertaken to formally validate predictions of emission concentrations and rates of all parameters considered in the air quality impact assessment.

All emissions testing will be carried out using appropriate sampling and analysis methods as approved by DER, with a National Association of Testing Authorities (NATA) accredited emissions testing company engaged for that work. Measurements of combustion gases for process optimisation will be made by Elan operations personnel, using a combustion gas analyser calibrated by a NATA accredited laboratory.

3.3.3 Campaign-based emissions monitoring

The findings from the commissioning stack testing will provide advice on emissions parameters of significance and an appropriate frequency for emissions testing for licensing purposes. Based on the level of risk predicted in the air emissions assessment, the proponent suggests that an appropriate frequency of stack testing (after the commissioning testing) would be biannual in the first year of operation, then annually thereafter should the first year's results be fully compliant with emission limits stated in the operating licence for the facility.

The parameters of interest for testing would be developed in consultation with DER.

3.4 Confidence levels and contingency plans

3.4.1 Confidence levels

Where necessary, assumptions have been made in predicting emission rates in the mass balance and test plant trial. In most cases, those assumptions have been made on a conservative basis. This means that higher emission rates have been predicted than are likely to occur for many parameters. In addition, the emissions were assumed to prevail on a continuous basis, whereas the Proposal is planned to operate only on weekdays. This provides an additional layer of conservatism to the assessment. As a consequence, the proponent is confident of achieving the predicted emissions outcomes, which are well below air quality standards under worst case (poor dispersion) meteorological conditions.

3.4.2 Contingency

Notwithstanding the predicted very low risk of emissions exceeding air quality standards, the Proponent will develop and implement contingency plans in the event that the actual emission rates are significantly higher than those predicted. These plans would include an initial investigation to confirm results were valid and the status of operating conditions for the tests. If necessary, the stack testing would be repeated for relevant parameters (if the initial result was invalid) or repeated for all parameters if the operating conditions were outside normal specifications.

Should the initial investigation indicate that higher than predicted results were valid for normal operating conditions then the Proponent would immediately advise the regulator (i.e. DER). An appropriate action plan would be developed with DER involvement to identify risks of environmental harm. In the event that material risks were identified then then the plant would be shut down while the process and operations review was carried out, and improvements identified to reduce emissions of the relevant parameters to comply with air quality standards.

As indicated, the implementation of the contingency plan in the event of higher than predicted emissions are observed would be the subject of discussions with the DER and approval of the actions necessary to acceptable emissions outcomes at all times. A report on the investigations, assessments, proposed process modifications to reduce emission rates of relevant parameters and any other relevant information to emissions performance, would be provided to DER at an agreed time.

3.4.3 Predicted environmental outcome

Having regard to the following outcomes in relation to air quality, the Proposal is not expected to represent a significant impact to the air quality of the area and achieves the EPA's objectives for this factor:

1. A mass balance has been developed from consideration of measured compositional data for the shredded tyre feed materials and key process design parameters that influence the formation and fate of air emissions within the process. The emissions data obtained from the emissions inventory have been used in the dispersion modelling.
2. Dispersion modelling for normal operations shows no exceedances of the air quality criteria for the maximum predicted GLCs at sensitive receptors. The most significant emission was SO_2, with a maximum predicted 10-minute average GLC of 1.7% of the air quality criterion for direct impacts.
3. With the exception of $PM_{2.5}$, no exceedances of the respective air quality criteria are predicted where the emissions from the proposed TRRF plant are combined with background concentrations.
4. Exceedances of the annual average PM2.5 NEPM are predicted but those exceedances are a consequence of background PM2.5 concentration used for the cumulative assessment. The worst case $PM_{2.5}$ emissions from the Proposal are predicted to contribute an additional 2% to the background $PM_{2.5}$ concentration, and as a consequence are insignificant.
5. Application of pollution control, monitoring and contingency planning to manage and control air emissions is proposed.
6. The model predictions suggest that the EPA recommended separation distance of 1000 m is not required for the Proposal, and that the actual separation distance of 600 m to residential area is more than adequate.

In considering the outcome as described, the Proposal is expected to meet the EPA objective for air quality - that is to maintain air quality for the protection of the environment and human health and amenity.

3.5 Other environmental factors

Other factors relevant to the Proposal include:

- amenity (noise, odour)
- air quality (non-point source - dust)
- wastewater
- solid waste

These are discussed briefly below.

Table 15: Other factors

Environmental factor	Assessment of impact / management	Predicted outcome
Amenity (noise)	Noise emissions from the plant will be required to achieve the *Environmental Protection (Noise) Regulations 1997.* The Plant will be located within existing enclosed buildings which are expected to provide significant attenuation of noise emissions from plant and equipment.	The Proposal is not expected to result in amenity impacts. Noise monitoring will be carried out to confirm acceptable noise outcomes.
Amenity (odour)	The primary source of odour from thermal treatment of tyres is the presence of sulfides (e.g. H_2S, thiols and organosulfides) in process gases. These gases are not released to atmosphere and as such odour is not anticipated to be an issue for the Proposal.	The Proposal is not expected to result in amenity impacts.
Amenity (dust)	Dust emissions will be minimised by processing end-of-life tyres within the enclosed buildings, with dust extraction systems and filtration units installed on the tyre feedstock processing equipment and the solid product (carbon black) recovery system. The site is fully hardstand and therefore fugitive dust emissions from vehicle movements are expected to be insignificant.	The Proposal is not expected to result in amenity impacts.
Waste water	Waste water will be produced from the char upgrading circuit. The waste water, which will contain soluble salts including Zn, Ca and Fe chlorides, will recycled as far as possible within the process with a bleed stream neutralised and removed from the site via a licenced liquid waste contractor for disposal in an approved liquid waste facility.	Wastewater can be readily managed and regulated through other regulatory mechanisms.
Solid waste	Insoluble mineral salts and grit from the char upgrading circuit will be removed from the site via licenced waste contractor for disposal in an approved solid waste facility.	Solid wastes can be readily managed and regulated through other regulatory mechanisms.

4. Overview of environmental impact and management

Table 16: Assessment of air quality

EPA objective	Existing Environment	Assessment of potential impacts	Management	Predicted outcome and regulatory control
To maintain air quality for the protection of the environment and human health and amenity.	The proposed site is located approximately 12 km of Perth CBD within the Welshpool industrial area. The site is zoned 'General Industry', under The City of Canning Town Planning Scheme 40. The site was previously utilised for a storage and wholesaling business and contains paved and hard panned lots. An existing warehouse occupies approximately half of the site. The nearest sensitive receptors are in the residential area 600 m to the east of the Proposal premises. Emissions characteristics have been derived from a mass balance (i.e. accounting for material entering and leaving the process) and emissions testing from a trial plant. The emissions data obtained from the mass balance and test plant trials have been used in dispersion modelling to assess the potential impacts at sensitive receptors..	The key air emissions parameters of interest to the Proposal are NOx, $SO_2$and CO. Dispersion modelling of emissions from the single stack was carried out using the AERMOD atmospheric dispersion model. The residential area to the east of the Proposal site has been identified as containing sensitive receptors, with industrial premises surrounding the remainder of the Proposal site. Modelling was undertaken based on a worst-case scenario and accounts for cumulative impacts with emissions from existing sources to ensure that the assessment of emissions is highly conservative. Ambient air quality guidelines and standards are derived from the Ambient Air Quality NEPM, DER (Toxikos), WHO and the Department of Health. These are the same standards as used for other projects recently assessed by EPA Direct impacts of NOx at the Proposal boundary are predicted to be 12% of the hourly average NEPM and 4% of the annual NEPM, SO_2 impacts are 20%, 12%, 20% and 10 of the 10-minute, 1-hour 24–hour and annual standards, respectively; and CO impacts are 0.09% of the 8 hour standard. The cumulative impacts of air emissions from the Proposal are insignificant. For example, the predicted NOx GLCs from the Proposal combined with background concentrations are 48% of the NEPM, with the background accounting for 37% of NEPM. The cumulative hourly average SO_2 GLC is 40% of the NEPM with the background accounting for 28% of the NEPM.	The Tyre Resource Recycling Plant will utilise 'state-of-art' technology, designed for processing used tyres to recover valuable materials. The proposed process is fully contained and the only emissions to the environment will be from a single stack of sufficient height to maximise dispersion and dilution, and minimise ground level concentrations. Dispersion model predictions show Ground Level Concentrations of air emissions are well below the air quality standards under worst-case meteorological conditions for both direct impacts and cumulative impacts where background concentrations are included. The following emissions management will be undertaken: • low NOx burners will be installed on the TCU combustion chamber and the thermal oxidiser. • the process gas condenser will remove the majority of sulfides thereby reducing the SO_2 emissions from the thermal oxidiser • the thermal oxidiser design provides for a minimum 2 second residence time at high temperature to ensure highly efficient combustion efficiencies • a 15 m tall stack will be installed to ensure efficient dispersion of emissions • stack emissions will be discharged at high temperature, providing good plume buoyancy for efficient dispersion of emissions	Taking into consideration: • dispersion modelling using the results of a mass balance emissions assessment and test plant trials • worst case dispersion modelling has indicated acceptable air emissions outcomes • application of pollution control and monitoring, the Proposal is not expected to represent a significant impact to the air quality of the area and meets the EPA objective for air quality. Furthermore, air emissions from the Proposal can be adequately regulated and managed under Part V of the EP Act. Relevant limits, targets, monitoring and management actions can be applied through conditions on a works approval and operating licence.

5. References

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Appendix 1

Electronic copies of attachments on CD