



Application for a works approval

Division 3, Part V *Environmental Protection Act 1986*

Works approval number	W6620/2021/1
Applicant	Renergi Pty Ltd
ACN	160 694 388
File number	DWER2021/000557
Premises	Collie Pyrolysis Plant Gibbs Road COLLIE WA 6225
Date of report	18 March 2022
Status of report	Final

1. Purpose and scope of assessment

Renergi Pty Ltd (the applicant), proposes to construct a small-scale, trial pyrolysis plant. An application for works approval was submitted under Division 3 Part V of the *Environmental Protection Act 1986* (EP Act) on 20 September 2021.

This report sets out the delegated officer's assessment of potential risk events arising from emissions and discharges during construction and operation of infrastructure relating to the prescribed activity.

In completing the assessment documented in this decision report, the department has considered and given due regard to its regulatory framework and relevant policy documents which are available at <https://dwer.wa.gov.au/regulatory-documents>.

2. Application details

2.1 Background

The applicant proposes to construct a small-scale, trial pyrolysis plant at an existing landfill site on the outskirts of Collie (the premises). The landfill is currently operated by the Shire of Collie and is subject to licence L6831/1997/12. A licence amendment to exclude the portion of land for the pyrolysis plant from L6831/1997/12 is expected to be issued before works commence, and the applicant will be wholly responsible for this part of the premises and its operations within.

The technology underpinning the proposed pyrolysis plant has been successfully tested at a smaller demonstration scale of 100 kg per hour of waste throughput.

The proposal was referred to the Environmental Protection Authority (EPA) under section 38 of the EP Act in September 2021. The EPA determined the proposal was not a significant proposal, given its small scale (compared to other existing waste to energy plants), and only being a trial period of limited duration (2 years) with restricted throughput and feedstocks. An overview of the key elements of the proposal considered by the EPA in its decision is summarised in Table 1. Any decision made on this application must not be inconsistent with this determination.

The applicant advises that should the trials prove to be successful; it will re-refer a proposal under s38 of the EP Act to operate the plant on a commercial basis.

Table 1: Proposal content considered by EPA

Proposal element	Location/description	Maximum extent, capacity or range
Physical elements		
Location	Constructed within the boundary of the Collie waste facility operated by the Shire of Collie	N/A
Water supply	N/A	To be sourced from the town water supply
Operational elements		
Processing	N/A	<ul style="list-style-type: none">1.5 tonnes/hr dry MSW (3 tonnes/hr MSW with a moisture content of 50 wt%) or alternatively,2.8 tonnes/hr dry biomass (forestry waste) (4 tonnes/hr biomass with a moisture content of 30wt%). Production of biochar, bio-oil and wood vinegar to be sold as commercial products.
Process	As per Figure 1	Grinding pyrolysis technology

		No burning of solid particles
Stack dimensions	N/A	Up to 10 m
MSW storage	N/A	Within an enclosed space
Hot pyrolysis reactor	N/A	Within an enclosed heating jacket
Operating hours	N/A	24 hrs a day/ 7 days a week
Operation elements:		
GHG emissions	Scope 1 – below 100,000 tonnes co2-e/annum	
Other elements which affect extent of effects on the environment		
Proposal time	Maximum project life	Up to 2 years

2.2 Overview

The application comprises the construction of a new grinding pyrolysis plant, with the capacity to receive waste feedstock which will undergo pyrolysis at a temperature of between 300 and 600°C.

Key elements of the application include:

- construction and operation of a new grinding pyrolysis plant, with the capacity to process a maximum of 4 tonnes per hour of waste feedstock; and
- undertaking trials of feedstock composition (municipal solid wastes (MSW), forestry waste), temperature and the feeding rate.

Char, oil and wood vinegar produced in the pyrolysis process will be extracted through a series of cyclones, a wet scrubber and a wood vinegar collection system. The waste gases produced by the pyrolysis reactor will be directed to supply heat to the pyrolysis reactor, before exiting via a 10 m high stack.

Table 2 describes the prescribed premises categories that the application is subject, as defined in Schedule 1 of the Environmental Protection Regulations 1987.

Table 2: Prescribed premises category

Classification of premises	Assessed production capacity (as per application)
Category 37: Char manufacturing: premises on which wood, carbon material or coal is charred to produce a fuel or material of a carbonaceous nature or of enriched carbon content.	9,000 tonnes per year of char
Category 61A: Solid waste facility: premises (other than premises within category 67A) on which solid waste produced on other premises is stored, reprocessed, treated, or discharged onto land.	31,000 tonnes per year (4,000 tonnes of wet MSW and 27,000 tonnes of wet forestry waste)
Category 62: Solid waste depot: premises on which waste is stored or sorted, pending final disposal or re-use, other than in the course of operating — (a) a refund point (as defined in the Waste Avoidance and Resource Recovery Act 2007 section 47C(1)) (a refund point); or (b) a facility or other place (an aggregation point) for the aggregation of containers that have been returned to refund points until those containers are accepted for processing or disposal.	31,000 tonnes per year (4,000 tonnes of wet MSW and 27,000 tonnes of wet forestry waste)

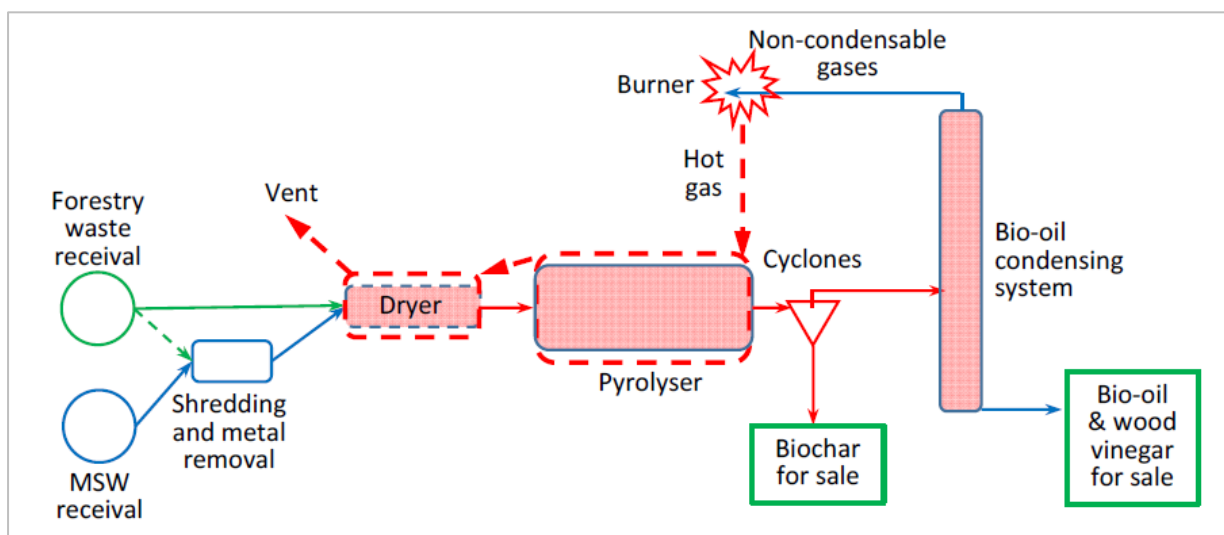
2.3 Proposal details

The grinding pyrolysis plant will process MSW and forestry waste on a trial basis for a two-year period. MSW and forestry waste will be received, shredded, metal objects removed via a magnetic separator, dried using re-circulated process gases and transported to the pyrolysis reactor. The feedstock will be ground and pyrolyzed to form char, oil vapour and waste gases.

On exiting the pyrolysis reactor, the oil vapour and waste gases will pass through a series of cyclones and char will be separated and removed. The oil vapour and waste gases will pass through a wet scrubber and wood vinegar collection system, and the oil and wood vinegar will condensate. The oil and wood vinegar will be recirculated in the wet scrubber and wood vinegar collection system respectively as a coolant and scrubbing agent before being separated and removed.

The waste gases exiting the wood vinegar collection system will be compressed, burned and mixed with the steam from the dryer to supply heat to the pyrolysis reactor from the heating jacket, and then be drawn into a stack and released into the atmosphere. A simplified process overview for the grinding pyrolysis plant is provided below as Figure 1.

The plant will be operated 24 hour per day, 365 days a year for a trial period of up to 2 years.



▲ *Figure 1: Simplified pyrolysis process flow*

2.3.1 Infrastructure and equipment

Table 3: Key systems and infrastructure

System / infrastructure	Description
Operational infrastructure	
Dryer	Indirectly heats the feedstock to remove moisture. The designed output temperature of dried solid and steam is over 100°C. Australian patent no: 2014366887, and Australian patent-application no: 2021903219.
Pyrolyser	The feedstock (MSW or forestry waste) will undergo grinding and pyrolysis simultaneously. Designed operating temperature is 300 to 600°C. Australian patent no: 2011269715.
Thermal oil heat exchanger	Heat will transfer from the hot flue gas to the thermal oil which is then used to heat the dryer. The maximum thermal oil temperature is <330°C.

System / infrastructure	Description
Cyclones	2 x cyclones will be used to separate char particles from the volatile particles.
Cyclone	1 x cyclone will be used to remove particles in the steam exiting the dryer. The cyclone is designed to operate at a temperature >100 °C to avoid steam condensation.
Scrubber	A wet scrubber will be used to condense oil vapour into oil liquid. The liquid oil is recirculated and sprayed into a vessel to cool down the oil vapour to form more oil liquid and a gas stream (containing wood vinegar vapour and waste gases).
Wood vinegar collection	In order to condense wood vinegar, liquid wood vinegar is circulated and sprayed to condense the light condensable organics to form more wood vinegar and waste gases.
Air-cooling heat exchanger	Ambient air is blown to a bank of tubes containing water (coolant), and the coolant is continuously circulated in the system to cool down the oil, wood vinegar and char.
Char cooling screw conveyor	The char from the cyclones is cooled down to between 40 to 60°C as it passes along the screw conveyor and exchanges heat with the water (coolant).
Char silo	Water is added to the cooled char to ensure that it does not spontaneously combust in storage.
Gas booster	The non-condensable gases are compressed slightly (<10kPa) to be fed into the burner.
Burner	The burner and the combustion chamber are designed to burn the waste gases at a high temperature with excess oxygen, long residence time and turbulence. The designed peak temperature is as high as 1,100-1,200°C or higher.
Root blower	Supplies a small amount of air to the pyrolyser.
ID fan	Draws the flue gas into the stack. The designed operating temperature is <500°C.
Stack	The waste gases will release to the atmosphere via the stack. Height: 10 metres Diameter: 0.4 metres
Air compressor and receiver	Compressed air pressure is <10 barg.
Control room	A commercial portable room will host the control system.
Biomass receiving area	Receival of biomass feedstock from trucks in a receiving pit.
MSW receiving area	Receival of MSW feedstock from trucks in a receiving pit.
Shredding area	Area for shredding MSW.
Conveyor	The sealed conveyor will transfer feedstock from the dryer to the pyrolyser. The operating temperature is ~100°C.
Liquid oil pump station	The liquid oil will be pumped to a tank for transport and sale. The pump station will be self-bunded.
Plate heat exchanger	The commercial plate heat exchanger will cool down the recirculating liquid oil with a coolant (water) via indirect heat transfer.

System / infrastructure	Description
Liquid oil recycle pump	The liquid oil will be pumped to circulate it around the wet scrubber.
Shredder	A magnetic metal separator will remove metals from the MSW and the shredder will shred the MSW into pieces. The output MSW pieces will be ~10 cm.
Containment infrastructure	
Thermal oil storage tanks	1 self-bunded tank will store thermal oil that is used as a heat transfer medium.
Feedstock storage containers	Feedstock (MSW and biomass) will be stored in two sets of modified sea containers to be built in two stages. The maximum storage capacity for the MSW and biomass container will be 80 tonnes and 200 tonnes respectively.
Char storage container	Char will be stored in modified sea containers (at least 200 m ³) for sale.
Liquid oil storage tanks	Liquid oil will be stored in 2 commercial self-bunded tanks for sale.
Wood vinegar storage	10 IBC containers will store wood vinegar product for sale.

2.4 Construction and commissioning

2.4.1 Construction schedule

The applicant proposes to commence construction activities in 2022, with commissioning expected to be undertaken over a period of about 10 weeks following construction.

2.4.2 Commissioning

Following completion of construction activities, commissioning will be undertaken. Initially the applicant will carry out cold commissioning, whereby the mechanical functions of each plant component are tested, including to ensure the noise emission levels meet the design specifications. Cold commissioning will be carried out during the day time only, to minimise the risk that if noise levels exceed the modelled levels this will exceed the Environmental Protection (Noise) Regulations 1997.

Commissioning activities will then include the following:

- pyrolysis of 'clean' feedstock (forestry waste) initially followed by MSW to optimise operating conditions with minimal propensity for air pollutants to form;
- gradually increase the feeding rate of the feedstock while monitoring the pollutant concentrations to find optimal operating conditions while complying with the limits specified in the works approval;
- trial multiple scenarios of pyrolysis temperatures (e.g., 400°C, 450°C, 500°C) and feed rates; and
- measure pollutant concentration once the plant has reached a steady state (may take upwards of 24 hours under each set of new conditions).

The applicant proposes to test feedstock types beyond MSW and forestry waste during commissioning, such as waste wood, agricultural waste, and food organics and garden organics, however the delegated officer notes these feedstocks were not included in the s38 referral or considered by the EPA in their determination of the proposal.

During commissioning, all environmental monitoring equipment will be tested and calibrated.

Emissions during commissioning

Emissions of concern to air and noise emissions from commissioning activities are expected to be similar to the emissions produced during operations (see below).

2.5 Operational aspects

Operation of the grinding pyrolysis plant will involve processing waste feedstocks to produce char, oil, wood vinegar and waste gases. The char, oil and wood vinegar are separated from the waste gases and stored for sale.

The following design controls are in place to mitigate the air emissions produced in the waste gases prior to emitting from the stack:

- the temperature of the dryer is controlled to minimise chemical reactions that would generate air pollutants;
- the low operating temperature of the pyrolysis reactor minimises the formation of pollutant precursors into the vapour phase, and the presence of char assists in the removal of particular acid gas pollutant precursors;
- cyclones will remove the solid char, and the pyrolyser is designed for maximised retention of key pollutant precursors such as metals and metalloids, nitrogen and sulfur in the char;
- the scrubber will condense oil, which will re-circulate in the scrubber to clean the waste gases by removing pollutant precursors, and the wood vinegar collection system is a second stage scrubber that collects remaining oil vapours from the waste gases; and
- the burner and combustion chamber are designed to ensure the remaining waste gases undergo combustion with a residence time of at least two seconds at > 850°C (in line with the EU Directive 2010/75/EU (Annex VI) (IED)) to ensure complete combustion and to minimise pollutant formation.

Expected air emissions

Emissions of concern in the waste gases include those listed in Annex VI of the IED: CO, NO₂, SO₂, particulate matter, Cd, Tl, Hg, Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, Dioxin and Furans, TOC, HCl and HF. The point source of air emissions will be from the stack.

The maximum expected emission rates during the pre-commercial operation of the plant have been calculated by applying the pollutant concentration upper limits from the IED (Annex VI). Table 4 shows the relevant pollutant concentration limit as per the IED, and the applicant's predicted upper emission rate. The pre-commercial operating conditions include a feedstock composition that is 85% forestry waste and 15% MSW.

Table 4: Air emission limits and calculated emission rates for the proposed trial pyrolysis plant

Pollutant	Average time	IED limit (mg/Nm ³ at 11% O ₂)	Adjusted IED limit (mg/Nm ³ @ 7.73% O ₂)	Upper emission rate (g/s)
Total dust (PM)	30 mins	30	40	0.030
TOC		20	26	0.020
HCl		60	80	0.060
HF		4	5.3	0.0039
SO ₂		200	265	0.20
NO _x		400	531	0.39
Cd and Tl	30 mins to 8 hrs	0.05	0.066	0.000049
Hg		0.05	0.066	0.000049
Sb, As, Pb, Cr, Co, Cu, Mn, Ni		0.5	0.66	0.00049

and V				
Dioxin and Furans	6 to 8 hrs	1.00x10 ⁻⁷	1.33x10 ⁻⁷	9.87x10 ⁻¹¹
CO	30 mins	100	133	0.099

2.6 Exclusions to this assessment

The activities undertaken at the Gibbs Road landfill operated by the Shire of Collie on Lot 500 on Deposited Plan 76826 are out of the scope of this assessment and have not been considered within the technical risk assessment detailed in this report.

The works approval is related to categories 37, 61A and 62 activities only and does not offer the defence to offence provisions in the EP Act (see s.74, 74A and 74B) relating to emissions or environmental impacts arising from non-prescribed activities, including those listed above.

3. Other approvals

3.1 Part IV of the EP Act

3.1.1 Background

A proposal for the trials of the grinding pyrolysis plant was referred to the EPA in September 2021 under section 38 of the EP Act. The EPA advertised the referral information for the proposal for public comment in September 2021 and received two submissions.

In October 2021, the EPA determined the proposal was not to be assessed under Part IV of the EP Act. The EPA in their decision stated that the likely environmental effects of the proposal are not so significant to warrant formal assessment because the proposal is for a trial plant and feedstock for the trial is limited to MSW currently generated in the Shire of Collie and forestry waste.

The EPA made their determination on the basis that the potential impacts of the proposal can be adequately managed through the implementation of the proposal in accordance with the referral documentation, the proponent's management and mitigation measures.

In exercising its duties, under section 54(4)(b) of the EP Act the department must ensure that the decisions and conditions for a works approval that is related to a proposal which has been referred to the EPA are consistent with decisions made under Part IV of the EP Act. The parameters that the applicant included in the referral to the EPA will therefore be considered binding to this assessment under Part V of the EP Act. The key parameters in the referral documentation, as they related to the application received under Part V of the EP Act, are:

- maximum project life of two years;
- processing MSW or alternatively biomass (forestry waste);
- MSW is to be stored in an enclosed space; and
- maximum throughput of 4,000 tonnes MSW and 27,000 tonnes forestry waste.

Key findings:

The delegated officer notes that:

- 1) it is the EPA's view the trial proposal can be adequately regulated through Part V of the EP Act; and
- 2) the assessment under Part V of the EP Act will be undertaken with deference to the information in the referral documentation received under Part IV.

3.2 Section 16 (e) advice of the EP Act

3.2.1 Industrial Emissions Directive

In April 2013 the Minister released the "Report and recommendation of the Environmental

Protection Authority and the Waste Authority” on the “Environmental and health performance of waste to energy technologies”. This was an Advice of the Environmental Protection Authority to the Minister for Environment under Section 16(e) of the *Environmental Protection Act 1986*.

Recommendation 8 of this report states:

In order to minimise the discharge of pollutants, and risks to human health and the environment, waste to energy plants should be required to use best practice technologies and processes. Best practice technologies should, as a minimum and under both steady state and non-steady state operating conditions, meet the equivalent of the emissions standards set in the European Union’s Waste Incineration Directive (2000/76/EC).

It is noted that the European Union’s Waste Incineration Directive has been replaced by the European Union’s Industrial Emissions Directive (2010/75/EU) (IED), with emission limits and monitoring requirements placed in Annex VI.

Waste to energy is defined in this advice to include conversion of waste into synthetic gas and then into synthetic fuels (oils included).

The grinding pyrolysis plant is determined to meet the definition for a waste to energy plant, and therefore must comply with the Minister’s position statement and the IED.

4. Consultation

The application was referred to relevant public authorities and advertised for public comment on the department’s website 24 November 2021 and no comments were received.

4.1.1 Public authorities

The Shire of Collie has been referred the application but is yet to provide comment.

5. Environmental siting

5.1.1 Physiography

The premises is located in the Shire of Collie, a town situated in the South West region of Western Australia, approximately 210 km south of Perth and 60 km east of Bunbury. Collie town is located near the junction of the Collie and Harris Rivers and is surrounded by dense jarrah forest.

5.1.2 Land use and sensitive receptors

The premises is located within the Gibbs Road Putrescible Landfill site, which comprises a Class II unlined landfill and waste transfer station. Prior to operation as a landfill the site operated as a gravel and sand quarry, and an unmanned landfill for the unregulated disposal of waste into the depression left by the sand extraction quarry.

The main landfill area encompasses an inactive landfill, an active Class II putrescible landfill area and an asbestos disposal area. The active putrescible landfill cells are about 100 m from the proposed pyrolysis plant and are not accessible to the general public.

The transfer station is located immediately adjacent to the premises boundary to the north and comprises a putrescible waste drop off area, green waste drop off area, Drum Muster compound, waste oil recycling shed, reuse shop and the broader area surrounding this infrastructure. The transfer station is operated by shire employees and is open to the public every day to access the designated drop off areas. An average of 580 vehicles per week pass through the transfer station (Shire of Collie 2017).

The Collie River is about 550 m west and south west of the proposed pyrolysis plant. Wetlands occur in low-lying areas between the landfill and the Collie River to the west of the premises (about 100 m to the south west and 535 m to the north west). The wetland closest to the premises boundary (~100 m) receives stormwater from some operational areas of the landfill.

The surrounding land uses include residential to the north and north-west and state forest to the east. The closest residences are about 450 m to the north and 475 m to the north-west. Roche Park Recreation Centre is also located to the north of the premises, with the closest sporting oval about 250 m north of the proposed pyrolysis plant.

5.1.3 Climate

The climate of Collie is characterized by mild to warm summers and cold winters. The area is classed as a temperate climate (under the Koppen Climate Classification system) with distinctly dry (and hot summers).

The annual wind direction and speed from the Bureau of Meteorology’s weather station at Collie (Bureau of Meteorology ID 009994) is shown in Figure 1. Average annual prevailing wind directions vary seasonally. In summer months (November to April), wind direction is predominantly from east to southeast in the morning, and from the west to northwest in the afternoon. In the winter months (May to October) wind direction is predominantly from the northwest in the morning, and west to northwest in the afternoon. Average annual wind speed varies from 7 km/hr in the morning, to 11 km/hr in the afternoon.

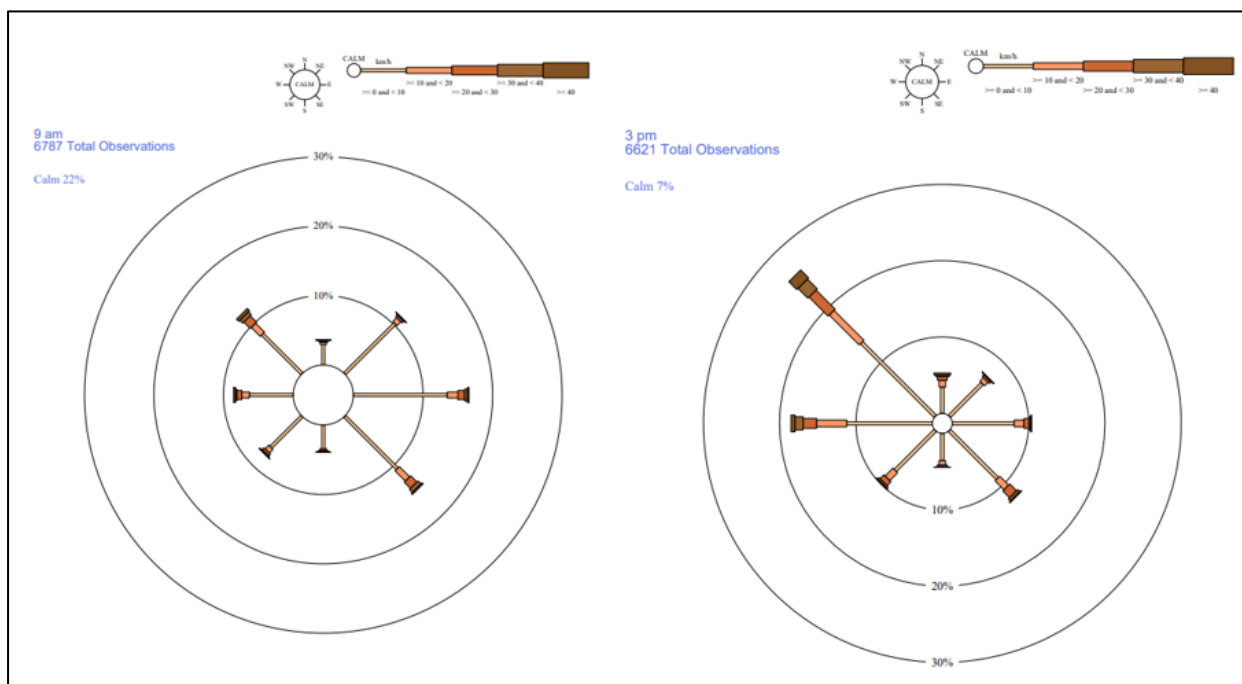


Image Source: BOM (2021); station ID 009628

Figure 1: Wind roses – Collie morning and afternoon

6. Modelling data

6.1 Air emissions assessment

6.1.1 Air dispersion model

The applicant undertook an air quality impact assessment for the project, which was updated to include modelling for all potential pollutants consistent with the IED.

The model used AERSCREEN, based on the USEPA regulatory dispersion model AERMOD, which is expected to be a conservative estimate of GLCs

6.1.2 Results

The screening results show that NO₂ and SO₂ concentrations are above the screening limits recommended in the draft DWER *Guideline: Air Emissions* and the adopted NO₂/NO_x ratio (0.10) is not very conservative.

The modelling indicates that predicted GLCs for all pollutants specified in the IED are less than 15% of the adopted air quality standards. It is noted that AERSCREEN cannot provide details of the spatial distribution of GLCs, and no site-specific meteorology or topography inputs were included.

6.1.3 DWER technical review

DWER's review of the air dispersion quality impact assessment identified that:

- the air quality assessment was conducted in accordance with the Air Quality Modelling Guidance Notes (DoE 2006);
- the ground level concentrations (GLCs) predicted in the screening assessment are less than relevant air quality standards, and noting there will be mitigation measures in place, the risk of impacts to the sensitive receptors appears to be low;
- the modelling is based on limited data and it is recommended that the GLCs are reviewed once emission data is obtained from source monitoring data during commissioning;
- the modelled emission source is only 10 m high which is more likely to be influenced by building wake effects;
- the pollutant levels rely heavily on the burner as an emission control system and the applicant has not proposed a contingency plan for any periods that the major emission controls are offline; and
- the emission estimates are based on 85% biomass and 15% MSW feedstock composition

6.2 Noise assessment

6.2.1 Noise model

The applicant undertook an environmental noise assessment. The noise modelling software dBMap.net was used to predict noise levels at nearby receptors from all noise sources on the premises under worst case conditions and a scenario with the applicant's proposed noise mitigation features.

6.2.2 Results

The model predicts that the proposed operation can be managed to comply with assigned levels under the Environmental Protection (Noise) Regulations 1997 (Noise Regulations). The upper limits of noise sound power level from the premises that would not exceed the assigned levels are predicted to be 109 dB(A), which corresponds to predicted sound pressure levels at the sensitive receptor of 39 dB(A). Including influencing factors, this falls within the assigned night time limit of 40-41 dB(A).

6.2.3 DWER technical review

The department has reviewed the applicant's noise assessment and is satisfied the assessment methodology and results present reliable conclusions on the predicted noise levels and compliance with the assigned levels at nearby sensitive receptors. The department is satisfied that the applicant's proposal to monitor noise levels during commissioning and the proposed additional noise mitigation measures are acceptable.

7. Risk assessment

7.1.1 Determination of emission, pathway and receptor

The department assesses the risk of emissions from prescribed premises and identifies the potential source, pathway and impact to receptors in accordance with the *Guideline: Risk Assessments* (DWER 2020a).

To establish a risk event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission.

7.1.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020a) for each identified emission source and takes into account identified potential source-pathway and receptor linkages. Where linkages are in-complete they have not been considered further in the risk assessment.

Where the applicant has proposed mitigation measures/controls, these have been considered when determining the final risk rating. Where the delegated officer considers the applicant's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the works approval as regulatory controls.

Additional regulatory controls may be imposed where the applicant's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in the below table.

7.2 Risk assessment table

The table below describes the risk events associated with the proposal consistent with the *Guideline: Risk Assessments* (DWER 2020). The table identifies whether the risk events are acceptable and tolerated, or unacceptable and not tolerated, and the appropriate treatment and degree of regulatory control, where required.

Risk Event				Consequence rating ¹	Likelihood rating ¹	Risk ¹	Reasoning	Regulatory controls
Source/ Activities	Potential emissions	Potential receptors, pathway and impact	Applicant controls					
Construction works								
Earthworks and construction activities during construction phase of the pyrolysis plant.	Noise and fugitive dust associated with earthworks, installation and construction works.	Unreasonable interference with the health, welfare, convenience, comfort or amenity of nearby sensitive receptors (residences 450m; sporting facilities 250m; industrial receptors immediately adjacent)	<ul style="list-style-type: none"> Construction work predominantly limited to day light hours. 	Minimal impacts to amenity on local scale Slight	Not likely to occur in most circumstances Unlikely	Low Acceptable, not subject to controls	The applicant proposes to undertake construction work during day light hours. The delegated officer considers this control in addition to there being sufficient separation in place (450m from residential receptors), and therefore does not reasonably foresee that noise and dust from construction works will impact on the amenity or health of off-site human receptors.	<u>Works approval controls:</u> None specified
Commissioning and time limited operations								
Commissioning and operation of the grinding pyrolysis plant	Noise, odour and fugitive dust during normal operations from: <ul style="list-style-type: none"> Trucks on the premises transporting feedstock for the plant Handling of MSW for the plant feedstock 	Unreasonable interference with the health, welfare, convenience, comfort or amenity of nearby sensitive receptors (residences 450m; sporting facilities 250m; industrial receptors immediately adjacent)	<ul style="list-style-type: none"> MSW stored on the premises will be 100m away from a waterbody MSW and forestry waste will be received in the MSW receiving area and the forestry waste receiving area respectively Covered belt conveyor will transfer MSW into the shredder Covered belt conveyor will transfer forestry waste to a storage container MSW will be stored in enclosed containers prior to processing Flexible covers will enclose the space between delivery vehicles and inlets of the belt conveyor during feedstock delivery Feedstock delivery of MSW and forestry waste will occur during day light hours 	Specific consequence criteria (for public health) likely to be met, low-level off-site impacts to amenity Minor	May occur only in exceptional circumstances Rare	Low Acceptable, not subject to controls	The applicant has proposed controls to minimize the noise, odour and fugitive dust impacts of feedstock receipt and handling on sensitive receptors. These controls include storing the feedstock in enclosed containers and receiving the feedstock in designated covered areas. The delegated officer considers these controls will ensure the risk of dust, noise and odour from the feedstock is acceptable. The applicant's proposed controls are critical for ensuring the MSW is stored in such a way as to not have a negative impact on the health and amenity of nearby sensitive receptors. As such they will be imposed on the works approval and are required to be maintained on the licence as minimum infrastructure requirements. The requirement for MSW to be stored within an enclosed space is also to be included as it was in the proposal content considered by EPAS.	<u>Works approval controls:</u> <ul style="list-style-type: none"> As per the applicant's proposed controls: Infrastructure design criteria specified for the containment infrastructure; <u>Licence controls:</u> <ul style="list-style-type: none"> As per the applicant's proposed controls: Infrastructure design and operational requirements specified in infrastructure table;
	Noise associated with operation of the grinding pyrolysis reactor		<ul style="list-style-type: none"> The grinding pyrolysis reactor will be enclosed in a structure with heating and sealing jackets A metal cover sheet will cover the insulation material All connections to the enclosure will be gas-tightly sealed Noise levels will be monitored during commissioning 	Specific consequence criteria (for public health) likely to be met, low-level off-site impacts to amenity Minor	Could occur at some time Possible		Medium Acceptable, generally subject to regulatory controls	Noise modelling indicates that the proposed operations can be managed to comply with the noise regulations at the residential receptors (450 m from the premises boundary). The highest sound pressure level at the sensitive residential receptors is likely to occur when there are south-easterly winds, however the software used does not allow for specific meteorological conditions. The applicant has proposed that if during commissioning noise levels exceed the predicted levels from the noise modelling, additional mitigation measures will be carried out, such as building sound barriers to the north of the premises to reduce the sound pressure level at the residences; and insulation to cover the ID fan to reduce the sound power level. To ensure an acceptable level of risk is maintained during operations, the applicant's proposed noise monitoring will

Risk Event				Consequence rating ¹	Likelihood rating ¹	Risk ¹	Reasoning	Regulatory controls
Source/ Activities	Potential emissions	Potential receptors, pathway and impact	Applicant controls					
	Air emissions associated with the combustion of waste gases (pollutants in IED Annex VI)		<ul style="list-style-type: none"> The stack parameters are 10m high with an inner diameter of 0.4m Magnetic metal separator is installed to remove metals from MSW feedstock Cyclone will operate at >100°C to prevent steam condensation Waste gases will pass through a wet scrubber and a wood vinegar collection system Continuous emission monitoring system (CEMS) for TOC, SO₂, NO_x, CO and O₂. Manual emissions testing for particulate matter, HCl, HF, Cd and Tl, Hg, Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, Dioxins and Furans 	Specific consequence criteria (for public health) are likely to be met, low level on site impacts and minimal offsite impacts at a local scale Minor	Could occur at some time Possible	Medium Acceptable, generally subject to regulatory controls	<p>be imposed on the works approval to require validation of the noise modelling.</p> <p>Air screening modelling assessment indicates predicted GLCs for all potential air emissions are below the relevant air quality standards and noting there will be mitigation measures in place the risk of impacts to sensitive receptors appears to be minimal.</p> <p>The air screening modelling results show that NO₂ and SO₂ concentrations were above the draft DWER Guideline: Air Emissions, however as noted above they were below the relevant air quality standards.</p> <p>The potential emissions considered are consistent with Annex VI of the IED and commissioning may demonstrate that not all potential pollutants are present, and the modelling was based on a worst case scenario. The assessment presented is based on limited data (particularly with respect to the composition of MSW feedstock), and verification of emission rates is necessary to ensure the risk of impacts to the sensitive receptors is low.</p> <p>As noted above, under s16(e) of the EP Act in Advice of the Environmental Protection Authority to the Minister for Environment, it was determined that the IED sets out the minimum requirements for all waste to energy plants in order to minimise the discharge of pollutants, and risks to human health and the environment.</p> <p>The applicant will be required to validate pollutant levels during commissioning (in line with the applicant's proposed controls and the IED monitoring requirements in Annex VI). The verification of the IED requirement under Article 50 for waste gases exposure to 850°C for a minimum of two seconds will be conditioned in the works approval to ensure most pollutants are destroyed as the applicant has predicted.</p> <p>The pollutant levels that emit from the stack (posing a risk to sensitive receptors) are heavily reliant on the infrastructure controls proposed by the applicant. To ensure an acceptable level of risk is maintained during operations, controls will be imposed on the works approval to require the specified infrastructure design criteria.</p> <p>The control on air emissions is dependent on the operation of the burner, as most pollutants (such as non-condensable VOCs, HCl, HF and dioxins) are expected to be destroyed at the high burner temperature (>1,000°C). To ensure an acceptable level of risk is maintained during operations, controls will be imposed to require a plant shutdown if the main pollutant control (the burner) is offline.</p> <p>The emission estimates for the proposed plant are subject to variability, and the modelling estimates were made based on 85% forestry waste and 15% MSW feedstocks. To ensure emission rates do not exceed the levels predicted, controls will be imposed to require the applicant to log feedstock composition during commissioning.</p> <p>A limit on feedstock of 4,000 tonnes of MSW on the works approval is based on the documentation provided to EPAS in the applicant's referral is also a limit on the size of the plant and corresponding pollutants.</p>	<p><u>Works approval controls:</u></p> <ul style="list-style-type: none"> As per the applicant's proposed controls: Infrastructure design criteria specified and pollution control infrastructure (cyclones, scrubber, wood vinegar collection system, burner); Submission of a commissioning report, including validation of air emissions, compliance with IED requirements, and log feedstock composition; Plant shut down in the event the burner is offline <p><u>Licence controls:</u></p> <ul style="list-style-type: none"> Infrastructure design and operational requirements specified in infrastructure table; CEMS and manual stack emissions testing and emission limit values

Risk Event				Consequence rating ¹	Likelihood rating ¹	Risk ¹	Reasoning	Regulatory controls
Source/ Activities	Potential emissions	Potential receptors, pathway and impact	Applicant controls					
	Odour emissions associated with the combustion of waste gases (VOCs)			Minimal off-site impacts on a local scale Minor	May occur only in exceptional circumstances Rare	Low Acceptable, not subject to controls	The non-condensable VOCs are expected to be destroyed at the high burner temperature (>1,000°C). As noted above in the reasoning for air emissions, to comply with the IED (Article 50) the waste gases must be exposed to 850°C for a minimum of two seconds. As the residence time in the burner is crucial to eliminating the risk of odour from VOCs to the adjacent industrial receptors and residences, during commissioning the applicant will be required to verify that the plant meets the IED operating conditions under Article 50. If waste gases are verified to comply with the IED operating conditions under Article 50, the delegated officer does not reasonably foresee odour emissions (associated with waste gases emitting from the stack) impacting on the amenity of sensitive receptors.	<u>Works approval controls:</u> <ul style="list-style-type: none"> Verification with IED requirement for waste gas to be raised to a temperature of at least 850°C for at least two seconds. <u>Licence controls:</u> <ul style="list-style-type: none"> None specified
	Spills and leaks of product (oil, vinegar) associated with the storage and handling	Direct discharge causing contamination of land or stormwater	<ul style="list-style-type: none"> The stormwater from the premises will be treated with char prior to being discharged, and the char will then go through the pyrolysis process again Oil product for sale will be stored in self-bunded commercial tanks 	Minimal on-site impact Slight	May occur only in exceptional circumstances Rare	Low Acceptable, not subject to controls	The applicant has proposed to store liquid products from the pyrolysis process in self bunded commercial tanks, and to treat stormwater from the site with char prior to release into the environment. The delegated officer therefore does not reasonably foresee contamination of the adjacent land or stormwater from oil or vinegar products.	<u>Works approval controls:</u> <ul style="list-style-type: none"> As per the applicant's proposed controls: Infrastructure design criteria specified <u>Licence controls:</u> <ul style="list-style-type: none"> As per the applicant's proposed controls: Infrastructure design and operational requirements specified in infrastructure table

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the Guideline: Risk Assessments (DWER 2020).

8. Decision

The delegated officer has determined the proposal to construct and operate a small-scale, trial pyrolysis plant at the premises, with a proposed production capacity of 31,000 tonnes per year of waste feedstock, does not pose an unacceptable risk of impacts to on- and off-site receptors. This determination is based on the following:

- the limitation on the duration of the plant to operate over two years on a trial basis;
- the restriction on throughput and feedstock type;
- predicted GLCs for all air emissions of concern (those indicated in the IED) being below the corresponding air quality standards; and
- noise levels at the nearest sensitive receptor predicted to comply with the Noise Regulations when considering all noise sources under worst case conditions.

In order to minimise the potential for environmental impacts, the applicant has proposed the following controls, which will be imposed on the works approval as they are considered critical to maintaining an acceptable level of risk:

- specified containment infrastructure criteria to store waste feedstock;
- specified pollution control equipment such as cyclones, a scrubber, burner and wood vinegar collection system;
- operational controls, including compliance with the IED article 50 waste gas treatment;
- continuous monitoring of air emissions, as per the IED; and
- verification of the noise modelling assessment and predicted air pollutant levels through monitoring.

The works approval will also be limited in scope by the proposal content considered by the EPA in their assessment of the referral. This will include controls on:

- throughput and feedstock material (4,000 tonnes of MSW and 27,000 tonnes of forestry waste); and
- the duration the plant will operate (two years).

The delegated officer is satisfied the above controls lower the overall risk profile of the proposal, and adequately assist the department in our ongoing assessment of the risk of the plant.

8.1.1 Consideration of Part IV of the EP Act

The delegated officer has considered the EPA's view that potential impacts of the proposal can be adequately regulated under Part V of the EP Act, and that the likely environmental effects of the proposal are not so significant as to warrant formal assessment.

The delegated officer has ensured the works approval is not inconsistent with the details in the original s.38 referral information in which the EPA based its determination the proposal not a significant proposal.

8.1.2 Works approval and licence

Works Approval W6620/2021/1 that accompanies this report authorises construction, commissioning and time-limited operations only. The conditions in the issued works approval, as outlined in the above risk table have been determined in accordance with the *Guideline: Setting Conditions* (DWER 2020b).

A licence is required to authorise emissions associated with the ongoing operation of the premises, i.e. the char manufacturing, solid waste facility, and solid waste depot. A risk assessment for the operational phase has been included in this report, however licence conditions will not be finalised until the department assesses the licence. Conditions will be imposed to ensure day-day operations do not pose an unacceptable risk of impacts to on- and off-site receptors, and a new s.38 referral for the ongoing operation of the plant submitted.

8.1.3 Applicant comments on draft decision

The applicant was provided with drafts of the works approval and this report on 28 February 2022 and, in addition to providing minor comments and clarifications, requested changes to be made as per Appendix 1.

9. Conclusion

Based on this assessment, it has been determined the issued works approval will be granted subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

Daniel Hartnup
A/MANAGER, PROCESS INDUSTRIES
REGULATORY SERVICES

Delegated officer
under section 20 of the Environmental Protection Act 1986

10. References

1. Department of Environment (DoE) 2006, *Air Quality Modelling Guidance Notes*, Perth, Western Australia.
2. Department of Water and Environmental Regulation (DWER) 2020a, *Guideline: Risk Assessments*, Perth, Western Australia.
3. DWER 2020b, *Guideline: Setting Conditions*, Perth, Western Australia.
4. Bureau of Meteorology (BOM), 2021. *Climate Data Online*. Accessed 24 November 2021. www.bom.gov.au
5. European Union Industrial Emissions Directive (IED) 2010/75/EU.
6. Shire of Collie 2017, *Gibbs Road Waste Management Facility*. Accessed 24 November 2021. <https://www.collie.wa.gov.au/wp-content/uploads/2017/09/APP15-DTS-Gibbs-Road-Waste-Management-Facility-Review-P.pdf>.

Appendix 1: Summary of applicant's comments on draft works approval and decision report

Works Approval		
Condition	Summary of applicant's comment	Department's response
N/A	Change of registered business address	The registered business address has been updated with the new information.
N/A	Requested that the assessed production capacity for Category 37: Char manufacturing to be 9,000 tonnes per year.	The delegated officer considered the request to amend the char production capacity is appropriate as the previous figure was calculated based on outdated feedstock information and will not change the risk profile of the pyrolysis plant.
Condition 1, Table 1, Pyrolysis Plant infrastructure, Item 2	Requested that the bag filter system to remove particulates from the dryer be an optional requirement that the works approval holder can install if the cyclone proves insufficient during commissioning.	The delegated officer noted that the air emissions risk event was determined without the applicant control of a bag filter system. The process description that accompanied the air emissions modelling in the application did not describe the use of a bag filter. The delegated officer has removed the bag filter from Condition 1 and will consider including the requirement to install a bag filter if the air emissions monitoring during commissioning shows unacceptable levels of particulates.
Condition 1, Table 1, Pyrolysis Plant infrastructure, Item 4	Responded to the department's request for details on the feedstock receival area and processing.	The delegated officer noted the information provided and updated the works approval and decision report.
Condition 1 Table 1, By-product containment infrastructure, Items 1-4	Responded to the department's request for details on the by-product containment infrastructure.	The delegated officer noted the information provided and updated the works approval and decision report. Where the applicant stated ambiguous terminology, i.e. 'mostly' this is not suitable for the works approval as the requirements for the applicant to comply with the works approval must be clear.
Condition 2	Understood condition 2 to mean that the applicant would be required to submit an Environmental Compliance Report for each piece of infrastructure (eight Environmental Compliance Reports).	The delegated officer noted the ambiguity in the language in condition 2 and updated the works approval to make it clear that once the items of infrastructure in Table 1 have been constructed the works approval holder is required to submit one Environmental Compliance Report.
Condition 5	Requested to submit the Environmental Commissioning Plan prior to completion of the	The delegated officer considered the request to reduce the period in which the works approval holder must provide the Environmental Commissioning Plan

	Construction Phase, and to shorten the period to less than three months in order to commence environmental commissioning as soon as the plant is constructed.	prior to commencing commissioning is appropriate and will not change the risk profile. The delegated officer therefore amended the period to 1 month prior to commencement of environmental commissioning.
Condition 13	Requested to extend the period of time limited operations from 120 calendar days to 180 calendar days in order to operate for a period of 6 months, which is a requirement for the applicant's granting bodies.	The delegated officer considered the request to extend the period of time limited operations from 120 to 180 calendar days will not change the risk profile. The delegated officer therefore amended Condition 13, but it remains the intent for a licence to be issued before the completion of 120 days of time limited operations.
Condition 14, Table 2: Item 1.	Requested that the temperature range for the pyrolysis reactor be changed from 300°C - 600°C; instead of 400°C - 500°C.	The delegated officer considered the request to increase the temperature range for the pyrolysis reactor. As the works approval holder is undertaking commissioning to optimize the operating conditions of the pyrolysis plant the Delegated Officer has amended the temperature range to 300°C - 600°C and will review the temperature range if the resulting air emissions shown during commissioning are at unacceptable levels.
Condition 14, Table 2: Item 1.	Requested the cyclone temperature range specified in the infrastructure description be removed as it is dependent on the pyrolysis reactor temperature and cannot be controlled independently.	The delegated officer noted the applicant's comment that it was not possible to independently control the cyclone temperature as it was dependent on the pyrolysis reactor temperature. The Delegated Officer considered the request to remove the cyclone temperature range as appropriate, particularly as there is a temperature range stated in Condition 14 Table 2 for the pyrolysis reactor that will result in the temperature of the cyclone being a few degrees cooler (due to heat loss) than the pyrolysis reactor range.
Condition 14, Table 2: Item 1.	Requested the addition of water (or other liquid) as a possible scrubber in the scrubbing system and the wood vinegar collection system during the start up of the pyrolysis plant prior to there being sufficient oil or wood vinegar product to circulate.	The delegated officer reviewed the request and deemed it suitable to include an exception to the requirement for oil or wood vinegar to circulate in the scrubber and wood vinegar collection respectively during start up periods as practically the product would not be available. Table 2 has been updated to reflect this exception.
Condition 15, Table 3: Item 1	Requested that the acceptance specification for vegetative waste includes plantation biomass.	The delegated officer considered the request to include plantation biomass in the acceptance specification for the vegetative waste type is appropriate, particularly given the exclusions present to exclude any contaminated biomass or wood treated with chemical containing heavy metals, and therefore amended the acceptance specification for vegetative waste in Table 3 of the works approval.
Condition 15, Table	Requested that the acceptance specification	The delegated officer reviewed the request to include green waste in the

3: Item 2	for putrescible waste not exclude green waste as it is often collected in red bins.	acceptance specification for the putrescible waste type and deemed it appropriate to include an allowance for minor green waste contamination as may be present in MGB bins, as it does not alter the risk profile of the feedstock.
Condition 16, Table 4: Item 1	Requested the exclusion of the requirement for vegetative waste to be stored in containers, instead the applicant intends to initially only store MSW in an enclosed container and for biomass to be stored in a receival area.	The delegated officer noted the applicant's comment that the storage containers would be built in two stages to first accommodate MSW storage and deemed it appropriate, as the requirement to store MSW in enclosed storage containers remains. The Delegated Officer removed the requirement that vegetative waste is stored in enclosed containers.
Condition 18, Table 6, Parameter: Particulates	Requested that the limit for particulates be changed from 10 mg/m ³ to 30 mg/m ³ .	The delegated officer noted the particulates limit of 30 mg/m ³ is in line with the IED limit for a 30-minute averaging period and deemed it appropriate to update Table 6 in line with the applicant's request.
Condition 18, Table 6, Parameter: Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V	Requested that the limit for Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V be changed from Total 0.05 mg/m ³ to Total 0.5 mg/m ³ .	The delegated officer noted that the 0.05 mg/m ³ limit was included in error. Table 6 has been updated to reflect the correct 0.5 mg/m ³ limit.
Condition 23, Table 7	Requested that the Reporting Units for parameters be reviewed where listed as g/s.	The delegated officer noted the inclusion of g/s in addition to the mg/m ³ reporting unit in Table 7 was included in error. Table 7 has been updated to remove g/s.
Condition 27, Table 9	Requested clarification on the Monitoring Location Point listed for Validation noise monitoring requirements.	The delegated officer noted that the monitoring point location (N1) had not been specified on the map. The Delegated Officer updated Table 9 with a description of the monitoring point location so that the works approval holder is aware of where the monitoring point location must be.
Works Approval decision report		
Section	Summary of applicant's comment	Department's response
2.3.1, Table 3: Key systems and infrastructure, Cyclones	Requested the cyclone temperature range specified in the infrastructure description be removed as it is dependent on the pyrolysis reactor temperature and cannot be controlled independently.	As noted above in the response to the applicant's comment on the works approval, the request was accepted and the decision report has been updated.
2.3 Proposal Details	Noted that during commissioning the pyrolysis plant will process MSW and forestry waste together not consecutively.	The delegated officer considered the request to remove the word 'consecutively' appropriate as processing the two feedstock types together during commissioning will not change the risk profile. The delegated officer

		therefore updated the description in the section 2.3 of the decision report.
2.3.1 Table 3: Key systems and infrastructure, Feedstock storage containers.	Noted that the feedstock storage containers will be built in two stages.	As noted above in the response to the applicant's comment on the works approval, the delegated officer has noted that the feedstock storage containers will be built in two stages.
2.5 Table 4	Noted that in their calculations the applicant had provided Adjusted IED concentration limits and upper emission rates with multiple decimal places and that was included in the draft works approval decision report, and request that the figures are rounded up.	The delegated officer noted the applicant's comment and has rounded the adjusted IED concentration limits in Table 4 to two significant figures, and the upper emission rate to two significant figures. The delegated officer noted that the numbers in Table 4 are to illustrate the expected air emissions but are not the binding limits on the works approval holder, which are contained in the works approval itself.
5.1.2 Land use and sensitive receptors	Advised that the distance from the premises to the closest sporting oval at Roche Park Recreation Centre is 330 m not 250 m.	The delegated officer noted the proposed change, however the distance given by the applicant is to the Roche Park Recreation Centre building complex, rather than the closest oval which is ~250 m north of the premises boundary.