Works Approval

Works Approval Number	W5911	
Year Issued	2015	
Version	1	
Works Approval Holder	Kwinana WTE Project Co Pty Ltd	
Works Approval Holder ACN number	165 661 263	
Registered Business Address	32 Kay Street, Traralgon VIC 3844	
Address for Notifications	Lot 9500 Leath Road, Kwinana Beach	
Duration 4 years	**Commencement date** 04-04-2016	**Expiry Date** 03-04-2020
Premises Location	Part of Lot 9500 on Plan 73740; within the coordinates 1:E384720.47, N6435668.39; 2:E384980.06, N6435668.44; 3:E384979.59, N6435538.32 and 4:E384704.40, N6435538.35	

Category number	Category description	Category production or design capacity	Approved premises production or design capacity
52	Electric Power Generation	20 MW or more in aggregate (using natural gas) 10 MW or more in aggregate (using a fuel other than natural gas)	36MW
60	Incineration	100 kg or more per hour	400,000 tpa (45.6tph)
61(A)	Solid Waste Facility	1000 tonnes or more per year	400,000 tpa
67	Fuel Burning	In aggregate 500 kg or more per hour (fuel with a sulphur content of 0.25% or more) or In aggregate 2 000 kg or more per hour (fuel with a sulphur content of less than 0.25%)	400,000 tpa (45.6tph)

This Works Approval is granted in respect of activities to be carried out on the Premises, subject to conditions, to the Works Approval Holder on	
31-03-2016	**by** Date signed: 31 March 2016
Name of delegate	**Ed Schuller**
Position of delegate	**A/Director, Licensing and Approvals**
an officer delegated under s20 of the *Environmental Protection Act 1986 (WA)* (EP Act)	

Premises Description

The Premises is located at part of Lot 9500 on Plan 73740 see Schedule 1. The Premises is situated within the Kwinana Industrial Area, with other industrial premises directly adjacent and the nearest residential area is approximately 2.9 km to the South East.

The Works Approval Holder is carrying out activities at the Premises which fall within Categories 52, 60 and 61(a), and as such the Premises is deemed a Prescribed Premises under the EP Act. The Works Approval Holder is proposing to construct a Municipal Solid Waste to Energy Plant.

General Conditions

1. The Works Approval Holder must comply with the EP Act and all regulations prescribed under the EP Act applicable to the Premises including:

(a) the duties of an occupier under s 61;

(b) the duty to notify the CEO of discharges of waste under s 72; and

(c) not causing, or doing anything that is likely to cause, an offence under the EP Act, except where the Works Approval Holder does something in accordance with a Condition which expressly states that a defence under s 74A of the EP Act may be available.

2. The Works Approval Holder must carry out the Works within the Premises in accordance with the requirements set out in Schedule 2.

3. This Works Approval applies to the Premises defined in the *Premises Description Table*, and as depicted in the Premises Map in Schedule 1.

Premises Description	
General Location	Legal land description, reserve or tenement (all or part)
Leath Road, Kwinana Beach WA	Part Lot 9500 on Plan 73740 within the coordinates 1:E384720.47, N6435668.39; 2:E384980.06, N6435668.44; 3:E384979.59, N6435538.32 and 4:E384704.40, N6435538.35 as outlined in Schedule 1.

Infrastructure Conditions

4. The Works Approval Holder must locate the Works generally in accordance with the Site Plan in Schedule 3.

5. Key items of infrastructure which are required to be built are listed in the *Infrastructure Requirements Table*. The Works Approval Holder must not depart from the requirements specified in column 2 of *the Infrastructure Requirements Table* except:

(a) where such departure does is minor in nature and does not materially change or affect the infrastructure; or

(b) where such departure improves the functionality of the infrastructure and does not increase risks to public health, public amenity or the environment;

and all other Conditions in this Works Approval are still satisfied.

Infrastructure Requirements Table	
Infrastructure	Requirements (Design and Construction)
Waste Acceptance Area: Weighbridge	- Weighbridge capable of measuring the weight of all incoming trucks to determine the amount of waste being processed by the plant; - Radiation detection equipment to determine the presence of radioactive material.
Waste Receiving Area: Tipping Hall	- Rapid opening and closing roller doors and louvres; - Air-curtain above roller entry and exit doors that prevent the exit of air from the Tipping Hall whenever doors are open; - Concrete flooring within the Tipping Hall to ensure that no waste or wastewater will be discharged to the environment from these areas; and - CCTV and large object detection system, designed to identify and facilitate removal of large objects which are unsuitable for incineration.
Waste Receiving Area: Waste Bunker	- The waste bunker to be equipped with automatic doors, designed to ensure the bunker remains sealed while no waste is being deposited; - Mixing cranes to mix the waste to ensure a suitably homogenous feedstock for incineration to meet all emission limits; - Air extraction system from the primary air fan to each incinerator, located above the waste bunker to ensure negative pressure within the waste bunker; and - Concrete flooring within the Waste Bunker to ensure that no waste or wastewater will be discharged to the environment from these areas.
Waste incineration	- Two combustion lines, each containing a furnace using Martin GmbH reverse acting (R-type) grate combustion technology, designed with a stoking action to move hot ash back up under incoming waste; - Startup burners, capable of firing as auxiliary burners to maintain incineration temperature in the incineration chamber such that minimum burning temperatures (850^{o}C) and residence times (2 seconds) are maintained at all times during operation; - Temperature sensors to be installed which are capable of the representative measurement across the entire incineration chamber and waste gases produced therein; - Oxygen sensors to be installed which facilitate the measurement of combustion efficiency; - Urea injection system capable of minimizing NOx emissions to below 400mg/m^{3}; and - Incineration Gas Recirculation Fan, capable of recirculating warm flue gases from the end of the grate to the overfire nozzles for the purpose of minimisation of NOx emissions.

Infrastructure Requirements Table	
Infrastructure	Requirements (Design and Construction)
Automated Combustion Control System (ACCS)	- Automated monitoring and control system capable of collecting CEMS (Continuous emission Monitoring System) output data and using this data to control the grate-boiler combustion and APCS parameters.
Boiler Economiser	- Boiler Economiser capable of reducing flue gas temperature to below 200^{o}C.
Air Pollution Control System	- Gas Cooling Tower capable of cooling flue gas rapidly to between 135 and 160^{o}C; - Hydrated Lime Injection System capable of injecting dry hydrated lime or sodium bicarbonate into the flue gas stream and reducing: • SO_2 emissions to below 200 mg/m^3; • HF emissions to below 4 mg/m^3; and • HCl emissions to below 60 mg/m^3. - Activated Carbon Injection System capable of injecting activated carbon into the flue gas and reducing: • VOC emissions to below 20 mg/m^3, • Dioxin and furan emissions to below 0.1 ng/m^3 as I-TEQ; • Mercury emissions to be below 0.05 mg/m^3. - Bag filter capable of: • minimising particulate matter emissions to be below 30mg/m^3; • capturing activated carbon, sodium bicarbonate and/or lime for the purposes of treating flue gas emissions; and • Quick detection and isolation of broken bags, without requiring a baghouse bypass situation to exchange or replace the broken bag.
CEMS	- CEMS capable of accurately measuring the following pollutants from the waste gas emissions: • Particulate matter; • NOx; • SO2; • HCl; • CO; and • VOCs.
Stack and associated ducting	- Multi-Flue stack of minimum stack height of 87.5m above ground level; and - Sampling ports for emissions monitoring that are compliant with AS4323.1
Solid Residues Storage Area	- Concrete flooring within the Bottom Ash Bunker to ensure that no waste or wastewater will be discharged to the environment; - Concrete flooring within the Metal Recovery Area to ensure that

Infrastructure Requirements Table	
Infrastructure	Requirements (Design and Construction)
	no waste or wastewater will be discharged to the environment; and - Enclosed conveyors to transport bottom ash, fly ash, and APC residues.

6. On completion of the Works, the Works Approval Holder must provide to the CEO an engineering certification from a qualified engineer confirming each item of infrastructure or component of infrastructure specified in column 1 of the *Infrastructure Requirements Table* has been constructed in accordance with the requirements specified in column 2, with no material defects.

7. If any departures to the specified Works have occurred, the Works Approval Holder must provide the CEO with a list of departures which are certified as complying with Condition 6 at the same time, and from the same engineer, as the certification under Condition 7.

Commissioning Conditions

8. During the Commissioning Period, the Works Approval Holder must monitor the emissions specified in the *Emissions Monitoring Table* from the locations specified therein. Emissions must be calculated as an average over the period specified, in accordance with the frequency and method specified in the *Emissions Monitoring Table*.

Emissions Monitoring Table

Location	Emission	Averaging period	Frequency	Method
Stack 1 and Stack 2	Particulates	30 minutes 24 hours	Continuous monitoring, once CEMS has been commissioned, verified and calibrated (to occur within 500 operational hours of initial waste input)	DER Guideline: Continuous Emission Monitoring System (CEMS) Code
	VOCs as Total Organic Carbon	30 minutes 24 hours		
	HCl	30 minutes 24 hours		
	SO_2	30 minutes 24 hours		
	NO_x	30 minutes 24 hours		
	CO	30 minutes 24 hours		
	HF	60 minutes per test	Three sampling events, conducted to represent stable operation conditions under full or near-full load. Each sampling event to be conducted in duplicate (non-concurrent).	USEPA Method 26A
	NH_3	60 minutes per test		USEPA Conditional Test Method 027
	Group I Metals - Cd and TI	120 minutes per test		USEPA Method 29 or 30B
	Group II Metals – Hg	30 minutes per M30B test		
	Speciated (Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V) and total metals	120 minutes per test		USEPA Method 29
	Dioxins and Furans	360 minutes per test		USEPA Method 23

Note: Concentration results to be provided on a dry basis, corrected to standard temperature (273.15oK) and pressure (101.3 kPa) at 11% oxygen.

9. The Works Approval Holder must not cause any emissions from the Premises during the Commissioning Period except for specified emissions which are of the types, and within the limits, specified in the *Specified Emissions Limit Table*.

Emission	Units	Periodic Test	Emission Limit – 30 minute averages at 100% compliance (figure in brackets is 30 minute average at 97% compliance over a year, unless otherwise specified)	Emission limits – Average of 30 minute averages over a 24 hour day (100% compliance unless otherwise specified)	Source (Location and Description)
CO	mg/m^3	-	100 (150 for 95% of all 10 minute average measurements)	110% of 50 (97% over a year)	Stack 1 and 2
Particulates	mg/m^3	-	30 (10)	10	Stack 1 and 2
VOCs as Total Organic Carbon	mg/m^3	-	20 (10)	10	Stack 1 and 2
HCl	mg/m^3	-	60 (10)	10	Stack 1 and 2
HF	mg/m^3	4	-	-	Stack 1 and 2
SO_2	mg/m^3	-	200 (50)	50	Stack 1 and 2
NO_x	mg/m^3	-	400 (200)	200	Stack 1 and 2
Cd and TI	mg/m^3	Total 0.05	-	-	Stack 1 and 2
Hg	mg/m^3	0.05	-	-	Stack 1 and 2
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V	mg/m^3	Total 0.5	-	-	Stack 1 and 2
Dioxins and Furans as I-TEQ	ng/m^3	0.1	-	-	Stack 1 and 2

Note1 : Concentration results to be provided on a dry basis, corrected to standard temperature (273.15oK) and pressure (101.3 kPa) at 11% oxygen.
Note 2: At the daily emission limit value level, the values of the 95 % confidence intervals of a single measured result shall not exceed the following percentages of the emission limit values:

Emission	Units
CO	10 %
SO2 / NOx	20 %
Particulate / Total organic carbon	30 %
HCl/HF	40 %

10. The Works Approval Holder must submit to the CEO a Commissioning Report which includes:

(a) details of the CEMS specifications and location, as determined prior to the initial operation of the incinerator (i.e. incinerator offline) in accordance with Phase I and II of the CEMS Code;

(b) the Quality Assurance plan, as required under Section 2 of the CEMS Code;

(c) details of the successful calibration and verification of the CEMS, as conducted within 500 operational hours of the incinerator initially processing waste feedstock, (i.e. incinerator online) in accordance with Phase III of the CEMS Code;

(d) details of the ongoing calibration and verification of the CEMS, as conducted in accordance with Phase IV of the CEMS Code;

(e) a summary of the techniques and method used to optimise NOx emissions; and

(f) emission monitoring data, in accordance with the *Emissions Monitoring Table*.

11. The Commissioning Report must also provide details of the following key parameters during each monitoring/sampling event:

(a) Waste source at time of incineration;

(b) Incinerator waste feed rate (tonnes/hr);

(c) Incineration chamber temperature profile (^{o}C, one minute average);

(d) Incinerator gas residence time (sec);

(e) Urea injection rate and NOx emission concentration (kg/min and mg/m^3, one minute average, respectively);

(f) Boiler economiser flue gas exit temperature (^{o}C, one minute average);

(g) Gas Cooling Tower flue gas exit temperature (^{o}C, one minute average);

(h) Bag filter inlet flue gas exit temperature (^{o}C, one minute average);

(i) Activated carbon injection rate and VOC emission concentration (kg/min and mg/m^3, 1-minute average respectively); and

(j) Hydrated lime or sodium bicarbonate injection rate and acid gas emission concentration (kg/min and mg/m^3, 1-minute average respectively);

12. The Commissioning Report is to be received by the CEO within 90 calendar days of the completion of the Commissioning Period and, where applicable, in conjunction with an application for a licence if not already submitted.

Administrative Conditions

Records and Information

13. The Works Approval Holder must maintain accurate records including information, reports and data in relation to the Works.

14. All information and records required under this Works Approval must:

(a) be legible;

(b) if amended, be amended in such a way that the original and subsequent amendments remain legible or are capable of retrieval; and

(c) be retained for 6 years after the expiry of this Works Approval.

Reports

15. If requested by the CEO from time to time, the Works Approval Holder must provide the CEO with reports or information relating to the Works, the Premises or any condition in this Works Approval (including data from any monitoring conditions or environmental risk assessment studies).

16. Reports or information must be in such form as the CEO may require in a CEO Request.

Requests for Information

17. The Works Approval Holder must comply with a CEO Request, within 7 days from the date of the CEO Request or such other period specified in the CEO Request.

Definitions and Interpretation

Definitions

In this Works Approval, the following terms have the following meanings:

Authorised Activities means those activities within the relevant category of prescribed premises to be carried out by the Licensee at the premises, as specified at the front of this Licence. 'Category of prescribed premises' refers to the relevant category specified in Schedule 1 to the EP Regulations.

CEO Request means a request made by the CEO to the Works Approval Holder in writing, sent to the Works Approval Holder's address for notifications, as described at the front of this Works Approval, in relation to:

(a) information, records or reports in relation to specific matters in connection with this Works Approval including in relation to compliance with any conditions and the calculation of fees (whether or not a breach of condition or the EP Act is suspected); or

(b) reporting, records or administrative matters:

(i) which apply to all Works Approvals granted under the EP Act; or

(ii) which apply to specified categories of Works Approvals within which this Works Approval falls.

Commissioning Period means the period of operation where the plant is brought online and allows the proponent to operate whilst applying for an ongoing operating licence. The Commissioning period is defined as beginning at the date where the engineering certification is received by the CEO, for a period not totaling more than 12 months and occurring within the valid period of this works approval.

Condition means a condition to which this Works Approval is subject under s 62 of the EP Act.

discharge has the same meaning given to that term under the EP Act and, in relation to waste or other matter, includes deposit it or allow it to escape, or cause or permit it to be, or fail to prevent it from being, discharged, deposited or allowed to escape.

environmental harm has the same meaning given to that term under the EP Act and means direct or indirect —

(a) harm to the environment involving removal or destruction of, or damage to —

(i) native vegetation; or

(ii) the habitat of native vegetation or indigenous aquatic or terrestrial animals; or

(b) alteration of the environment to its detriment or degradation or potential detriment or degradation; or

(c) alteration of the environment to the detriment or potential detriment of an environmental value; or

(d) alteration of the environment of a prescribed kind.

environmental value has the same meaning given to that term under the EP Act and means —

(a) a beneficial use; or

(b) an ecosystem health condition.

EP Act means the *Environmental Protection Act 1986* (WA).

EP Regulations means the *Environmental Protection Regulations 1987* (WA).

Incinerator and Incineration as used within this document are synonymous with the terms “combustor” and “combustion”, as used within Ministerial Statement 1016.

material environmental harm has the same meaning given to that term under the EP Act and means environmental harm that —

(a) is neither trivial nor negligible; or

(b) results in actual or potential loss, property damage or damage costs of an amount, or amounts in aggregate, exceeding the threshold amount.

pollution has the same meaning given to that term under the EP Act and means direct or indirect alteration of the environment —

(a) to its detriment or degradation; or

(b) to the detriment of an environmental value; or

(c) of a prescribed kind, that involves an emission.

Premises refers to the premises to which this Works Approval applies, as specified at the front of this Works Approval and as shown on the map in Schedule 1 to this Works Approval.

serious environmental harm has the same meaning given to that term under the EP Act and means environmental harm that —

(a) is irreversible, of a high impact or on a wide scale; or

(b) is significant or in an area of high conservation value or special significance; or

(c) results in actual or potential loss, property damage or damage costs of an amount, or amounts in aggregate, exceeding 5 times the threshold amount.

Specified Emissions refers to emissions that comply with the emissions detailed in Schedule 4 of this Works approval.

Toxic Equivalent Quotient (I-TEQ) refers to toxic equivalency of Dioxin and Furan compounds when compared 2,3,7,8 tetrachlorodibenzodioxin, in accordance with Part 2 of Annex VI of the European Union Directive 2010/75/EU.

threshold amount has the same meaning given to that term under the EP Act and means $20 000, or if a greater amount is prescribed by regulation, that amount.

unreasonable emission has the same meaning given to that term under the EP Act and means an emission or transmission of noise, odour or electromagnetic radiation which unreasonably interferes with the health, welfare, convenience, comfort or amenity of any person.

Works Approval refers to this document, which evidences the grant of Works Approval by the CEO under s 57 of the EP Act, subject to the conditions.

Works Approval Holder refers to the occupier of the Premises being the person to whom this Works Approval has been granted, as specified at the front of this Works Approval.

Interpretation

In this Works Approval:

(a) the words 'including', 'includes' and 'include' will be read as if followed by the words 'without limitation';

(b) where any word or phrase is given a defined meaning, any other part of speech or other grammatical form of that word or phrase has a corresponding meaning;

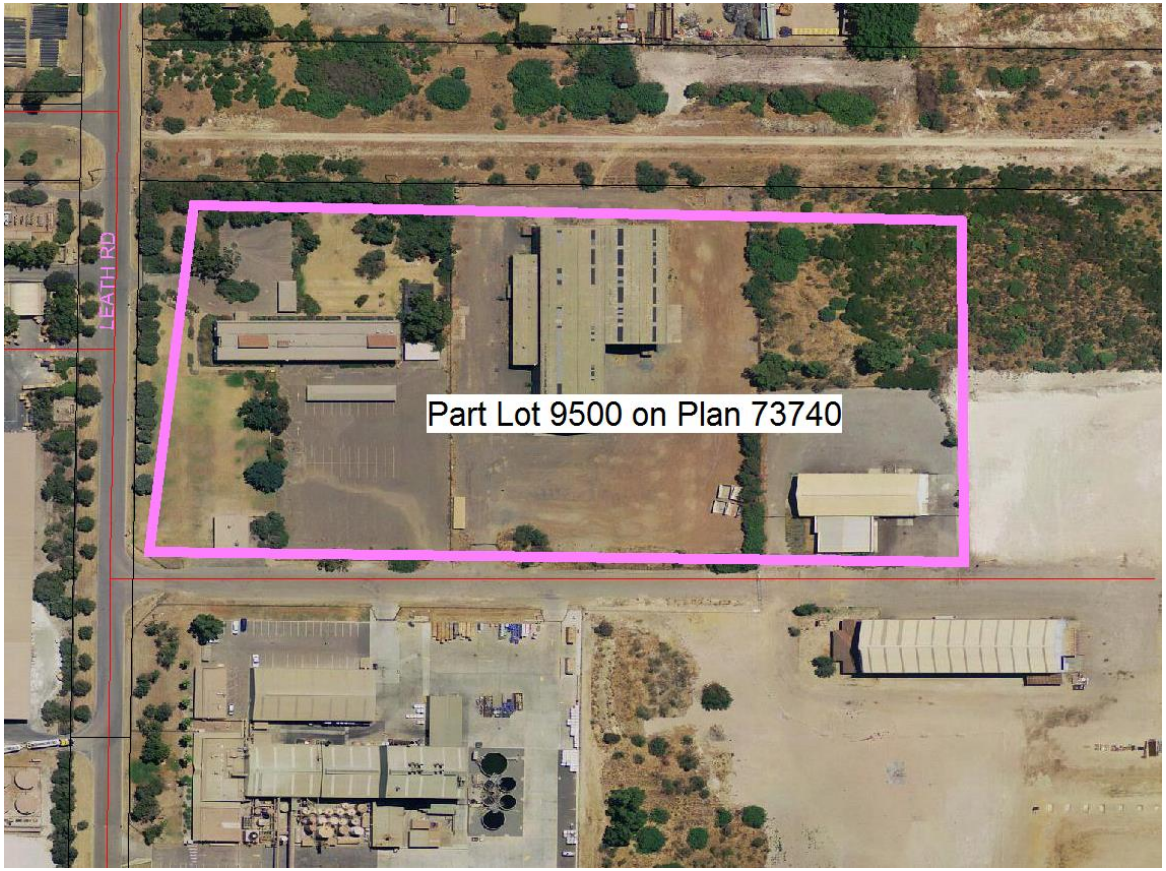
(c) where tables are used in a Condition, each row in a table constitutes a separate Condition; and

(d) any reference to an Australian or other standard, guideline or code of practice in this Works Approval means the version of the standard, guideline or code of practice in force at the time of granting of this Works Approval and includes any amendments to the standard, guideline or code of practice which may occur from time to time during the course of the Works Approval.

Schedule 1: Maps

1. Premises Map

The Premises is shown in the map(s) below. The pink line depicts the boundary to the Premises.



The corners of the premises are located at the following coordinates:

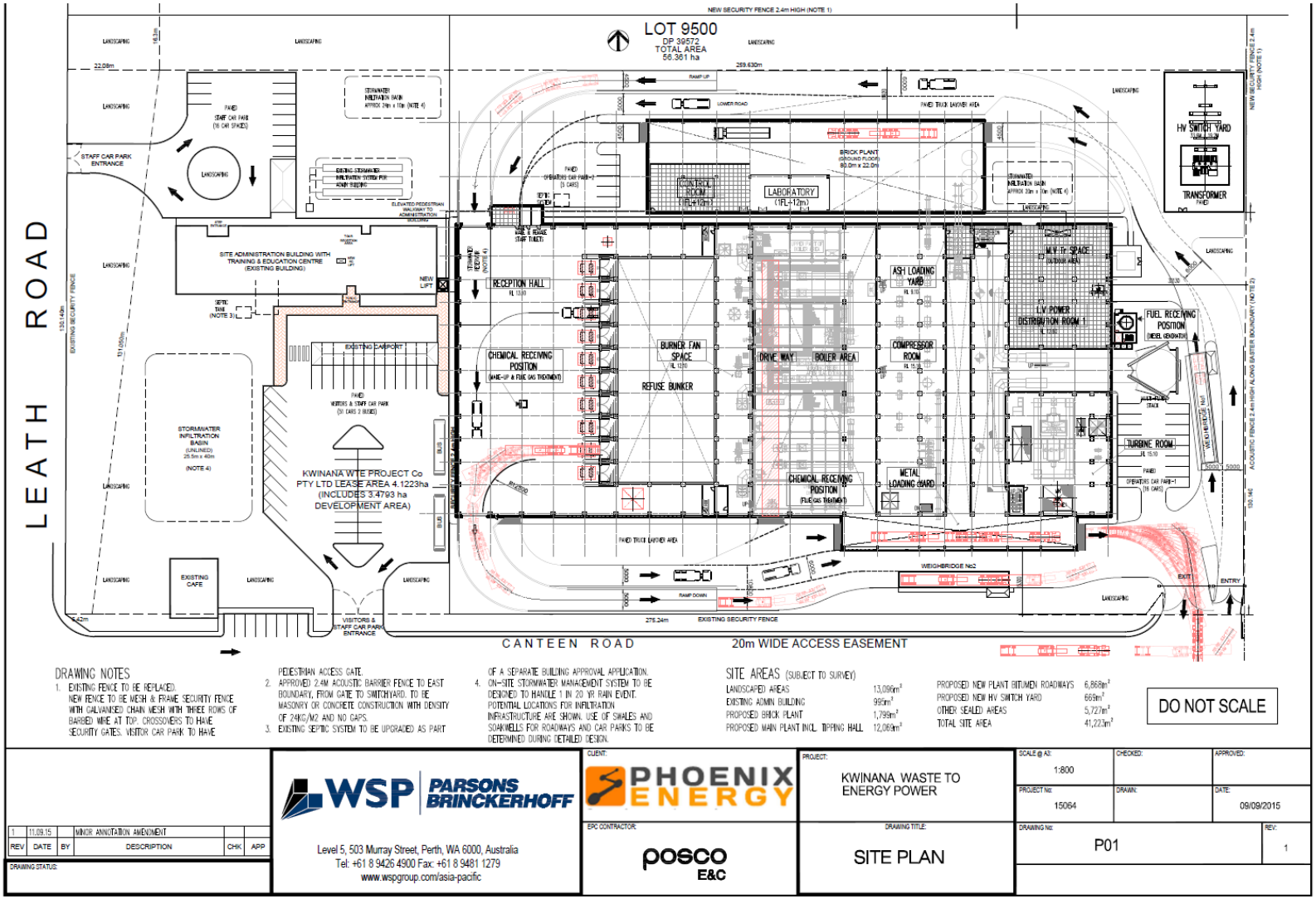
Coordinate No	Easting	Northing
1	384720.47	6435668.39
2	384980.06	6435668.44
3	384979.59	6435538.32
4	384704.40	6435538.35

Schedule 2: Works

The Works to be carried out on the Premises are specified in the table below:

Item	Works	Specifications/Drawings
1	Waste Acceptance Area: • Weighbridge • Office	Site Plan and Works Approval Application Support Document Kwinana Waste to Energy Project, Version: Final, Release Date: 15 September 2015
2	Waste Receivals Area: • Tipping Hall • Waste Bunker	
3	Waste Incinerator (2 lines): • Combustion Chamber • Steam Boiler	
4	Air Pollution Control System (2 lines): • Gas Cooling Tower • Hydrated Lime Injection System • Activated Carbon Injection System • Baghouse filter • NOx Selective Non-catalytic Reduction system	
5	Single Multi-flue stack: • 2 active flues	
6	Electrical generation system (steam system with electricity generation with gross capacity of 36MW)	
7	Solid Reside Storage Area	

Schedule 3: Site Plan



DRAWING NOTES

1. EXISTING FENCE TO BE REPLACED. NEW FENCE TO BE MESH & FRAME SECURITY FENCE WITH GALVANISED CHAIN MESH WITH THREE ROWS OF BARBED WIRE AT TOP. CROSSOVERS TO HAVE SECURITY GATES. VISITOR CAR PARK TO HAVE PEDESTRIAN ACCESS GATE.
2. APPROVED 2.4M ACOUSTIC BARRIER FENCE TO EAST BOUNDARY, FROM GATE TO SWITCHYARD. TO BE MASONRY OR CONCRETE CONSTRUCTION WITH DENSITY OF 24KG/M2 AND NO GAPS.
3. EXISTING SEPTIC SYSTEM TO BE UPGRADED AS PART OF A SEPARATE BUILDING APPROVAL APPLICATION.
4. ON-SITE STORMWATER MANAGEMENT SYSTEM TO BE DESIGNED TO HANDLE 1 IN 20 YR RAIN EVENT. POTENTIAL LOCATIONS FOR INFILTRATION INFRASTRUCTURE ARE SHOWN. USE OF SWALES AND SOAKWELLS FOR ROADWAYS AND CAR PARKS TO BE DETERMINED DURING DETAILED DESIGN.

SITE AREAS (SUBJECT TO SURVEY)

LANDSCAPED AREAS	13,096m²	PROPOSED NEW PLANT BITUMEN ROADWAYS	6,868m²
EXISTING ADMIN BUILDING	999m²	PROPOSED NEW HV SWITCH YARD	669m²
PROPOSED BRICK PLANT	1,799m²	OTHER SEALED AREAS	5,727m²
PROPOSED MAIN PLANT INCL. TIPPING HALL	12,069m²	TOTAL SITE AREA	41,223m²

DO NOT SCALE

REV	DATE	BY	DESCRIPTION	CHK	APP
1	11.09.15		MINOR ANNOTATION AMENDMENT		

DRAWING STATUS:

WSP PARSONS BRINCKERHOFF
Level 5, 503 Murray Street, Perth, WA 6000, Australia
Tel: +61 8 9426 4900 Fax: +61 8 9481 1279
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CLIENT: PHOENIX ENERGY

EPC CONTRACTOR: posco E&C

PROJECT: KWINANA WASTE TO ENERGY POWER

DRAWING TITLE: SITE PLAN

SCALE @ A3: 1:800	CHECKED:	APPROVED:
PROJECT No: 15064	DRAWN:	DATE: 09/09/2015
DRAWING No: P01		REV: 1

Works Approval

Division 3, Part V *Environmental Protection Act 1986*

Applicant:	**Kwinana WTE Project Co Pty Ltd**
ACN:	**165 661 263**
Works Approval Number:	**W5911/2015/1**
Final Number:	**DER2015/002147**
	Leath Road
	KWINANA BEACH WA 6167
Premises:	
	Part of Lot 9500 on Plan 73740
	Certificate of Title Volume 2843 Folio 996
Date of Report:	**31 March 2016**
Status:	**Final**

1 Description of Proposal

Kwinana WTE Project Co Pty Ltd (the 'Applicant') has applied for works approval for the construction of a Municipal Solid Waste to Energy Plant (MSW WTE plant) and associated brick making facility to be located on Leath Road, Kwinana.

The Applicant received Ministerial Approval for the proposed works on 3 September 2015 after going through the Public Environmental Review process (Ministerial Statement: 1016, EPA Report 1538).

The proposed WtE plant (the 'Facility') will receive up to 400,000 tonnes/year of MSW from local councils. The waste is combusted and the subsequent heat recovery is used to generate electricity. Solids generated from the combustion process are collected and it is the intention of the Applicant to use these residues to manufacture bricks, pavers and construction aggregate.

The technology proposed by the Applicant, moving grate combustion, is one of the more common WtE technologies used in the world. Specifically, the Facility will use Martin GmbH technology provided by MHIEC.[1] This technology has been used in approximately 400 operating and approved reference sites worldwide, mainly in Europe, USA and Japan. Of these, 153 have been in operation in excess of 12 months, processing between 200,000 tonnes/year to more than 400,000 tonnes/year of MSW. The MHIEC-Martin Tokyo-Kita reference plant has been used as the primary reference facility for benchmarking the proposal, as it has a similar Air Pollution Control System to the Facility and has been operational since 1998 (PER Report provided by Phoenix).

The Applicant proposes the following works :

- Waste receiving area;
- Waste incineration;
- Electricity generation;
- Air Pollution Control System;
- Solid waste material storage (fly ash, bottom ash and residual metals)
- Brick making plant (Proposed for future construction - not assessed within this works approval application)
- Control room;
- Laboratory; and
- Associated general infrastructure.

The proposed works are depicted on the site drawings set out in *Figure 1, Figure 2* and *Attachment 1*.

[1] MHIEC: Mitsubishi Heavy Industries Environmental & Chemical Engineering Co. Ltd

The Applicant has submitted the following documents in support of the works approval application:

1. Works Approval Application in the Industry Licensing System; submission date 15 September 2015; and
2. *"Works Approval Application Support Document Kwinana Waste to Energy Project"*, Phoenix Energy, Final, 15 September 2015, including the following draft management plans:
    - Waste Acceptance Monitoring and Management Plan;
    - Odour Mitigation and Management Plan
    - Dust Mitigation and Management Plan
    - Preliminary Commissioning Management Plan
    - Ash Characterisation Survey Plan
    - Ash Reuse Management Plan
    - Construction Environment Management Plan.

This Decision Report identifies the risks of the proposal and outlines proposed regulatory controls that will be implemented to mitigate risk where required. In summary:

- The main risk posed by the proposal is the potential health impact caused by emissions to air from the incinerator stack.
- It is recommended that the works approval be issued subject to the conditions set out in Section 8. The main controls relate to emission limits and emission monitoring.

2 Other Approvals

2.1 Planning Approval

Planning approval for this proposal was granted by the City of Kwinana on 7 December 2015. A total of 20 conditions involving a range of aspects (e.g. stormwater management, vehicle parking, areas to be sealed and drained) was attached to the approval. Of particular note is that a qualified acoustic consultant is required to assess compliance with the *Environmental Protection (Noise) Regulations 1997* during commissioning, and that the Applicant shall make near to real time emissions data publicly available by displaying this data either on the Applicant's website or at the site entrance.

2.2 Environmental Protection Authority Part IV Approval

The Proposal received Ministerial Approval on 3 September 2015 after going through the Public Environmental Review process (Ministerial Statement: 1016, EPA Report 1538).

As required under Section 54 of the *Environmental Protection Act 1986 (*EP Act), the CEO of DER shall not grant or refuse a Works Approval "contrary to, or otherwise than in accordance with", a Ministerial Statement. As the environmental impacts of the Proposal have been assessed and deemed acceptable under the Ministerial Statement, DER's assessment of the application will focus on the control of emissions and discharges not covered by the Ministerial Statement.

Key aspects of the Ministerial Statement which have been considered in the preparation of DER's Decision Report are summarised below.

2.2.1 Waste Types and Acceptance

The types of waste which may and may not be accepted at the Facility are shown in Table 1.

Table 1: Waste types as presented in Ministerial Statement 1016, Schedule 1

Permitted Waste Types	Not Permitted Waste Types
• Householder source separated residual MSW • Material recovery facility residuals • Alternative waste treatment residuals • Residuals from processing of MSW • Refuse collected from small businesses (i.e. rateable businesses) where such a collection is carried out in conjunction with local government residual MSW collection	• Scheduled wastes, as defined by ANZECC for the National Strategy for the Management of Scheduled Waste (1992) • Medical waste • Radioactive waste • Asbestos • Liquid and oily wastes • Contaminated soils • Tyres • Animal carcasses • Waste with a halogen content greater than 1% • Highly corrosive or toxic liquids or gases such as strong acids or chlorine and fluorine • Commercial and industrial wastes • Construction and demolition wastes • Dewatered biosolids/sewage sludge and biomass

Given that the Facility accepts source-separated MSW from households, in some cases 'non-permitted' waste types may inadvertently enter the waste stream accepted at the Facility. This is most likely for medical waste and household chemicals. DER considers that the incinerator is designed and approved under Ministerial Statement 1016 to process minor residual amounts of these prohibited materials which may be present in the accepted waste.

Given that the type of substances generated by the combustion process is dependent on the type of waste incinerated and the combustion conditions, Section 6 of the Ministerial Statement requires the Applicant to prepare and submit a *Waste Acceptance Monitoring and Management Plan (WAMMP)* for EPA CEO approval. A key element of the WAMMP is record keeping to provide traceability for:

- Supplier of each waste load;
- Amount of waste accepted on site;
- Waste types/categories accepted (MSW, MRF residuals, alternative waste treatment residuals);
- Waste types fed into the combustion chamber; and
- Waste types disposed off site.

As part of this Works Approval application, DER has received a draft WAMMP. DER has based its decision making on the understanding that the final WAMMP will be effective in requiring the applicant to meet the conditions within the Ministerial Statement. DER considers the waste acceptance measures within Ministerial Statement 1016 are critical to eliminating bulk pollutants and hazardous materials that the incinerator is not approved or designed to process.

2.2.2 Ash Characterisation and Reuse

Three types of solid residue, bottom ash, fly ash and APC residues, are generated by the process. It is proposed by the Applicant that these residues be collected and used to manufacture bricks, pavers and construction aggregate in a Brick Plant on site.

Section 7 of the Ministerial Statement requires the Applicant to prepare and submit two plans pertaining to solid waste management:

1. An *Ash Characterisation Survey Plan (ACSP),* to outline the testing regime conducted to assess the suitability of the ash for the production of by-products;

2. An *Ash Reuse Management Plan*, to specify the testing procedure and criteria that will be used to ensure the by-products are fit for each identified use.

Correspondence received by DER confirms that the Brick Plant will be considered at a later date and that the *Ash Reuse Management Plan* will inform the emission profile of the Facility.

DER considers that Ministerial Statement Condition 7.8 addresses the disposal of solid waste and in the absence of the *Ash Reuse Management Plan*, that all waste will be sent to landfill until appropriate options can be assessed. Only ash storage onsite has been assessed and regulated under this approval.

2.2.3 Emissions

Table 2 of the Ministerial Statement addresses the emissions of the Facility, with the emissions output being instructed not to “exceed the emissions limits specified in Annex V of the European Union Waste Incineration Directive 2000/76 or its updates”. No other conditions regarding emissions or discharges are provided in the Ministerial Statement. Unlike the solid waste stream (i.e. ash and residues) which is the subject of a number of Ministerial conditions (Conditions 6-1 through to 7-11), no conditions have been placed on the monitoring requirements for gaseous or liquid emissions. Consequently, DER considers that gaseous and liquid emissions are intended to be regulated through Part V works approval and licence conditions.

The emission limits specified in Part V documentation will be consistent with Ministerial conditions. As part of the consultation process, the Office of Environmental Protection was provided a copy of the draft works approval and assessment report.

2.3 Department of Mines and Petroleum

The Facility includes a number of infrastructure items used for the storage of hydrocarbons and chemicals. The premises is not considered a Major Hazard Facility.[2]

The Applicant will liaise with the Department of Mines and Petroleum (DMP) for the potential need for a Dangerous Goods Licence for the storage of dangerous goods.

3 Site Characterisation, Pathways and Receptors

3.1 Indicative Separation Distances

The prescribed premises categories which apply to this Proposal and the applicable separation distances as presented in DER's draft *Guidance Statement: Separation distance* are shown in Table 2.

Table 2: Applicable prescribed premises categories and indicative separation distances

Category	Description	Emission	Distance (m)
52	Electric power generation	Gaseous, noise, dust	5,000
60	Incineration	Noise, dust, odour	1,000
61(A)	Solid waste facility	Noise, dust, odour	500
67	Fuel burning	Gaseous, noise, dust odour	500

Sensitive receptors have been identified and are presented in the following sections. The separation distance from each sensitive receptor has been estimated using 'Method 2' as described in the DER draft *Guidance Statement: Separation Distances*, August 2015.

3.2 Community Receptors

The closest community receptors are presented in Table 3.

Table 3: Closest sensitive community receptors

Sensitive Receptor	Distance from Prescribed Premises	Comment
Residential area	2.9km south-east	Suburb of Medina
Commercial/industrial area	Immediately adjacent	
Community	1.2km north-east	Naval Base Hotel
	4.8km	Calista Primary School
	4.9km south-east	Hillman Child Health Centre

3.3 Sensitive Ecosystems

Sensitive ecosystems are presented in Table 4.

Table 4: Closest sensitive ecosystems

Sensitive Ecosystem	Distance from Prescribed Premises	Comment
Cockburn Sound	750m	--
Resource enhancement dampland	800m north-east	--
Bush Forever	2.5km	--

The premises will not have any wastewater discharges to the environment (only rainwater) and as such there is no risk of any impact on these sensitive ecosystems from the premises.

3.4 Groundwater and Water Sources

Details regarding ground water and other water bodies in the area are provided in Table 5 .

Table 5: Groundwater and water sources

Sensitive Ecosystem	Distance from Prescribed Premises	Comment
Groundwater below the site	Approx. 4m bgl	--

There is neither groundwater abstraction for public drinking nor a discharge of wastewater to groundwater proposed; as such there is no risk of any impact to groundwater or water sources.

3.5 Kwinana Environmental Protection Policy Area

The premises will be located within Area A of the *Environmental Protection (Kwinana) Atmospheric Wastes Policy 1999.*

The SO_2 emission rate of 19 g/s from the Premises may need to be included in the table of maximum permissible quantities within the Kwinana EPP Redetermination 2009. The appropriateness of including these SO_2 emissions in a determination of maximum permissible quantities as per clause 7 of the *Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999 (EPP)* has been considered within this report and by DER's Air Quality Services (AQS).

DER will initiate the process to include the SO_2 emissions from the proposal within the relevant determination in 2016 and this will be finalised prior to commissioning of the works. Monitoring and reporting of SO_2 emissions will be included as conditions in the licence for the premises.

4 Process Description

4.1 Overview

There are three main types of thermal WTE plants used worldwide to treat MSW and recover energy from the waste. The key difference between these processes is the type of atmosphere in which the MSW is heated:

1. *Combustion* (also referred to as 'incineration') is a thermal process in which the MSW is heated in an atmosphere containing an excess of atmospheric oxygen.
2. *Gasification* (also referred to as 'indirect combustion' or 'staged combustion') is a thermal process in which MSW is heated in an atmosphere containing a limited amount of oxygen or other oxidising agent.
3. *Pyrolysis* is a thermal process in which MSW is heated in an atmosphere deficient in oxygen, resulting in the thermal decomposition of waste rather than its combustion.

The most common type of WTE plant in operation worldwide are combustion-based facilities. The Kwinana WTE plant uses combustion-based technology, specifically Martin GmbH reverse acting (R-type) grate combustion incinerators. This technology was invented in the 1920's and has been in commercial operation since 1959.[3]

The key areas of the Facility are:

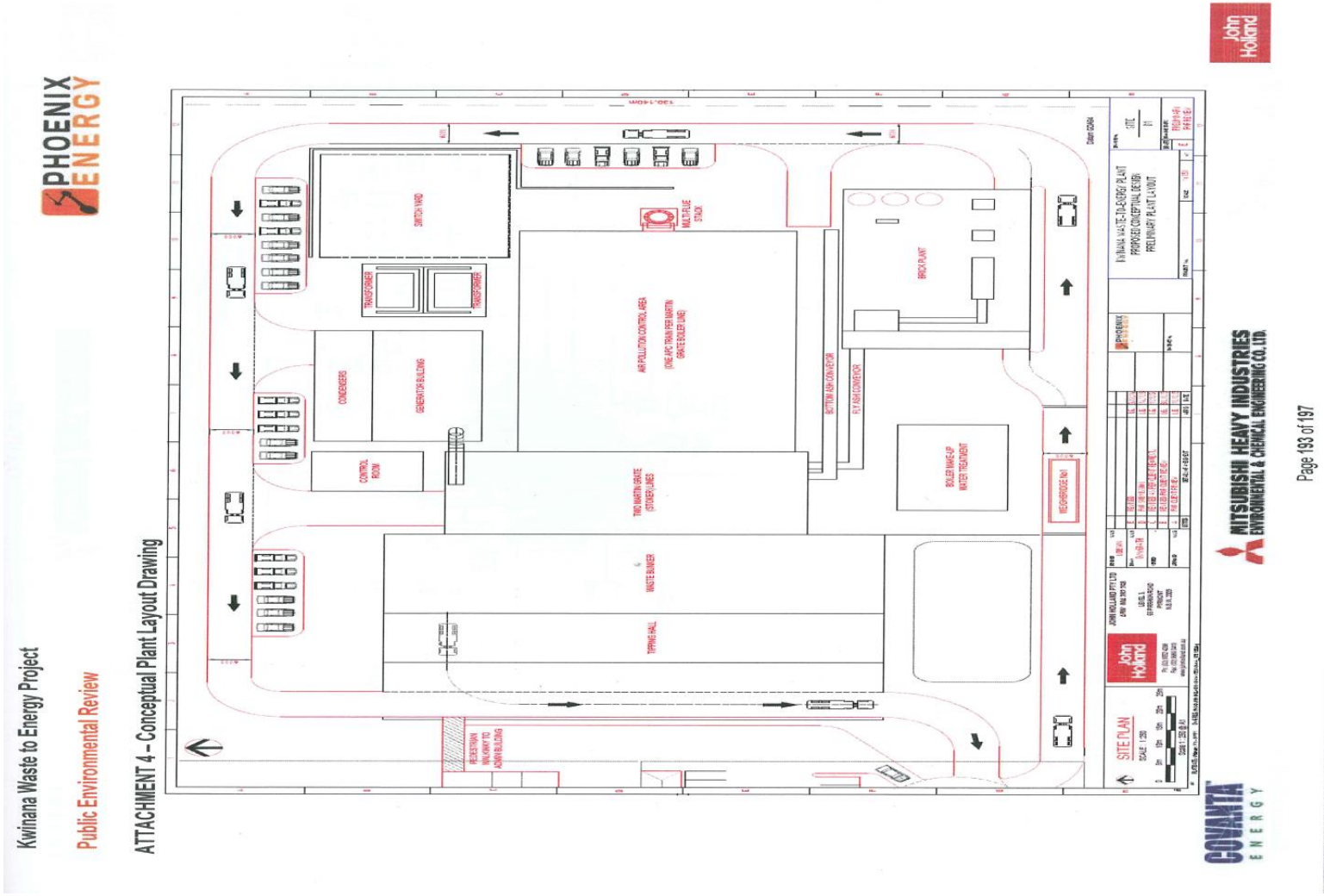
1. Waste Acceptance;
2. Waste Receivals Area;
3. Incinerator;
4. Air Pollution Control System;
5. Electricity Generation; and
6. Brick Plant

A simplified site layout showing these key areas, as presented in the June 2014 PER document, is presented in Figure 1. A more detailed and current site layout (dated September 2015) is presented in Figure 2.

A summary of the processes taking place in each of these areas is described in the following sections.

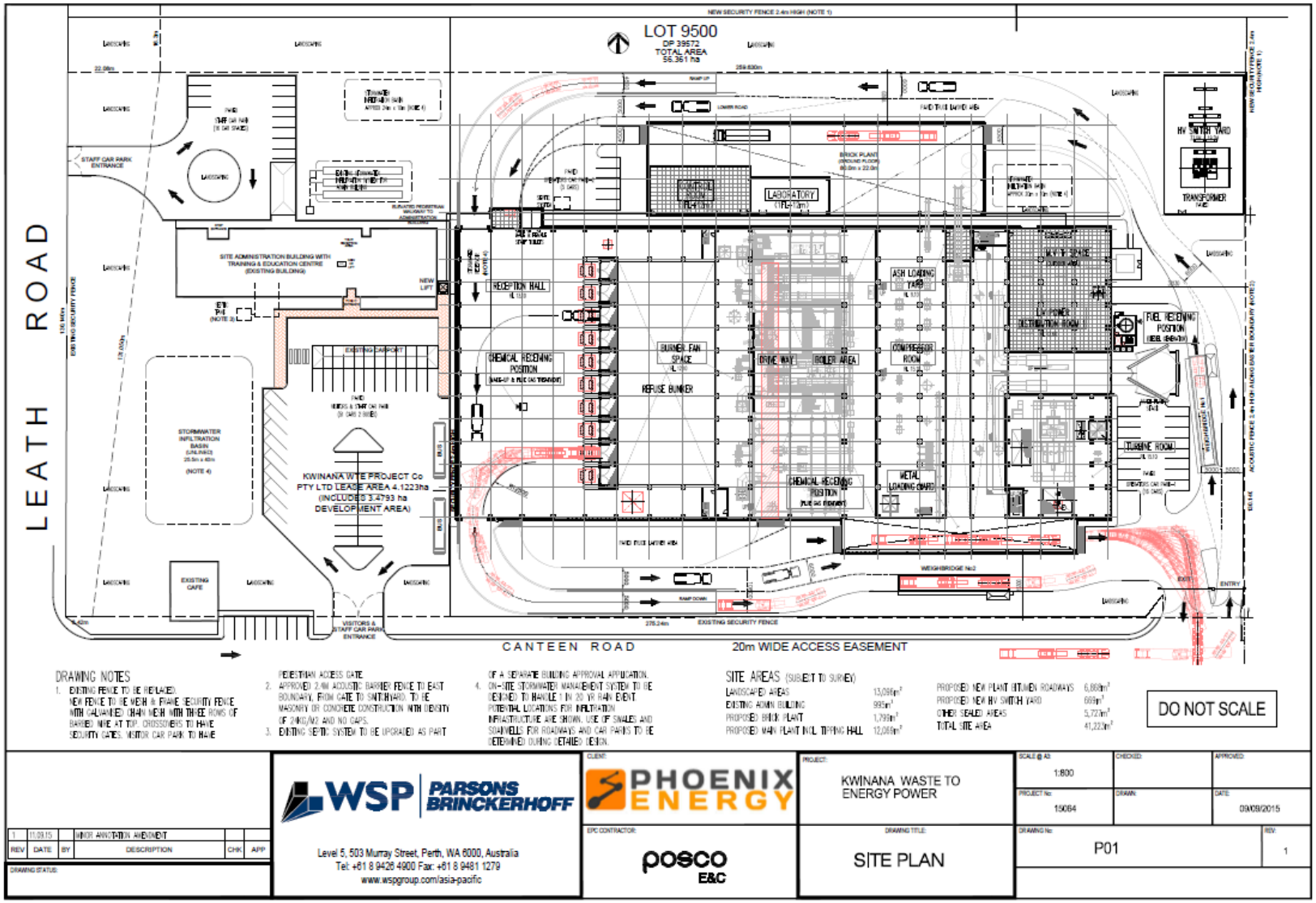
[3] As stated in Section 5.1 of Public Environmental Review.

Figure 1: Simplified site layout (June 2014)



Source: Attachment 4, Public Environmental Review

Figure 2: Detailed site layout (September 2015)



4.2 Waste Acceptance Area

The Waste Acceptance area consists of the weighbridge and associated office.

The management of this area is controlled by the *Waste Acceptance Monitoring and Management Plan (WAMMP)* which is a requirement of the Ministerial Statement (refer to Section 2.2.1).

Waste is received at the Facility in authorised and registered trucks, which are allowed entry via an automated vehicle recognition system. Radiation detection is employed at the weighbridge to enable scanning for radioactive materials.

All truck waste will be enclosed and the WAMMP is designed to minimise standing time for trucks waiting to enter the Facility.

4.3 Waste Receivals Area

The Waste Receivals Area consists of:

1. Tipping Hall; and
2. Waste Bunkers.

Trucks enter the Tipping Hall and unload the waste into 1 of 10 large storage bunkers. The Tipping Hall entry and exit points are equipped with high speed automated roller doors and air curtains, both of which are active during vehicle movements. Air curtains form a “wall” and prevent air from inside the Tipping Hall leaving the building.

The waste being discharged into the waste bunker is recorded via CCTV, and any large items identified via metal detectors are removed. On a routine periodic basis, trucks are directed to empty their load on the Tipping Hall floor for visual inspection. No waste will be tipped or stored outside the Tipping Hall.

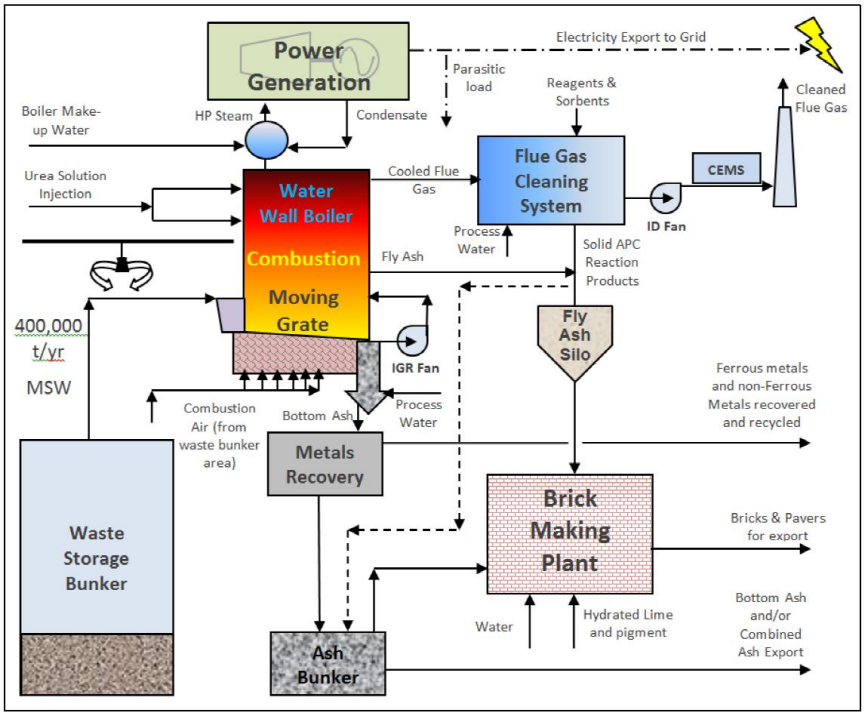
Waste is mixed by a grab crane in the Waste Bunker to ensure that the waste is semi-homogenous prior to being incinerated.

Combustion air is drawn from the Waste Bunker by two primary combustion air fans to ensure that air preferentially flows into the enclosed Tipping Hall and Waste Bunker. Automated louvers allow air for combustion to continue to enter the building when all doors are closed.

4.4 Waste Incineration Area

The generic process used in a moving grate combustion WTE plant is presented in Figure 3. Details specific to the proposed Facility are outlined below.

Figure 3: Overview of general process used in a combustion WTE plant



Source: "*Works Approval Application Support Document – Kwinana Waste to Energy Project",* Phoenix Energy, Final, 15 September 2015.

The Waste Incineration Area consists of 2 Martin grate lines, each consisting of a combustion grate, boiler, flue gas cleaning APC system, ID fan, CEMS and flue.

Mixed waste from the Waste Bunker is fed onto the moving grate where it is dried by hot flue gases. Carbon-based (i.e. 'organic') material in the waste is gasified, and these gaseous compounds are then fully combusted in the space above the grate.

An Automated Combustion Control System (ACCS) is used to ensure sufficient oxygen is provided to the combustion grate to maximise combustion efficiency, thus maintaining NO_x and carbon monoxide generation at low levels. The recirculation of hot flue gases from the end of the grate back into the combustion zone also aids in the reduction of NO_x formation.

Three main products are generated in the furnace:

1. High temperature '**flue gases'** (mainly carbon dioxide and water, but also gaseous metals, acid gases, dioxins and furans, NO_x and SO_x);
2. Fine particulate matter that is entrained in the flue gases is known as '**fly ash'**; and
3. Incombustible inorganics (e.g. metals) and any uncombusted organic matter is collected as **'bottom ash'**.

The flue gases and fly ash are treated by the Air Pollution Control System (APCS) as described in Section 4.5.

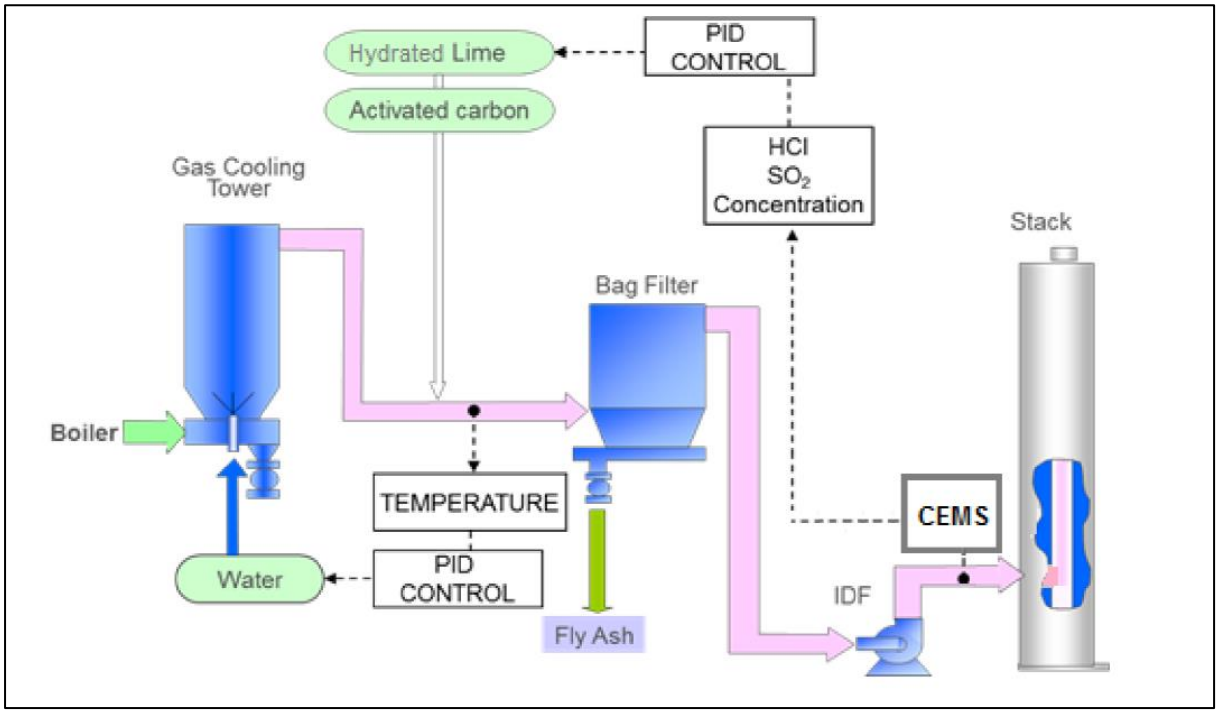
The bottom ash is collected as described in Section 4.6.

Further details regarding the emissions from the Facility are presented in Section 5.

4.5 Air Pollution Control System

The purpose of the Air Pollution Control System (APCS) is to clean the waste gases prior to the electrical generation system and to remove pollutants prior to emission via the stack. A simplified schematic of the APC to be used at the Facility is shown in Figure 4.

Figure 4: Simplified schematic of the MHIEC dry scrubbing control system



Source: *"Works Approval Application Support Document – Kwinana Waste to Energy Project",* Phoenix Energy, Final, 15 September 2015.

Hot flue gases leaving the furnace are passed through a boiler where steam is raised at a pressure of 40bar(g) and superheated to a temperature of 420^{o}C.

The waste gases from the economiser section of the boiler enter the APCS, which consists of:

1. Gas cooling tower;
2. Hydrated lime injection system;
3. Activated carbon injection system;
4. Bag filter;
5. Continuous Emissions Monitoring System (CEMS).

4.5.1 Gas Cooling Tower

The Gas Cooling Tower cools the waste gases to 135-160^{o}C to ensure the performance of the bag filter and that overheating or ignition does not occur. It also ensures that dosing chemicals can be injected safely into the flue gas.

4.5.2 Hydrated Lime Injection

Dry hydrated lime will be injected into the waste gas stream after the Gas Cooling Tower to remove SO_2, HF and HCl from the flue gas stream.

4.5.3 Activated Carbon Injection System

Activated carbon will be injected into the waste gas stream after the Gas Cooling Tower and before the Bag Filter. The purpose of the activated carbon is to absorb VOCs, heavy metals (including mercury), and dioxins and furans from the waste gas stream. This will occur in two ways: firstly within the waste gas stream and secondly within the bag filter.

4.5.4 Bag Filter

The APCS includes a bag filter consisting of multiple individual filter chambers with each chamber having a separate inlet and outlet so that it can be isolated for maintenance or repairs of the bags, without taking the whole APCS offline.

The main purposes of the bag filter is the removal of particulates, but due to the hydrated lime and activated carbon systems downstream, APC residues will also be captured on the surface of the Bag Filter, allowing the removal of acid gases, VOCs, mercury and dioxins and furans.

The bag filter uses the reverse pulse technique to clean the bags, causing the APC residues to drop down into a hopper.

4.5.5 CEMS

A Continuous Emissions Monitoring System (CEMS) will be installed to monitor stack emissions for NO_x, SO_x, CO, particulates, HF, HCl and VOCs. The emission data will be used by the Automatic Combustion Control System (refer to Section 4.4) to control both the Waste Incineration and the APC process settings.

4.6 Solid Residues Area

A number of solid residue waste streams are generated by the WTE plant. Each of these is briefly summarised below.

4.6.1 Bottom Ash

Although the waste in the incinerator will be largely combusted, some incombustible or poorly combusted residual waste will remain in solid form on the moving grate.

This ‘bottom ash’ is removed from the grate and passes through a water-filled Ash Discharger. The resultant bottom ash slurry is pushed onto a series of vibrating sieves and

conveyors, where ferrous metals and non-metals are recovered for recycling in the Metals Recovery Area.

The ferrous and non-ferrous metals will be stored separately in a storage bunker prior to being moved (sold) off site.

The bottom ash slurry is deposited in the Bottom Ash Bunker for temporary storage (up to approximately 11 days at full production capacity of 400,000 tonnes per annum). When the Kwinana WTE plant first comes into operation, the bottom ash slurry will be disposed offsite. It is intended that, pending OEPA and DER approval of the Brick Plant, bottom ash will be conveyed directly to the Brick Plant.

Ministerial Statement 1016 has conditions included regarding Ash Characterisation and Reuse.

4.6.2 Fly Ash and APC Residues

Fly ash collected on the boiler and APC residues collected on the bag filter will also be collected and either disposed of, or used in the Brick Plant.

Ministerial Statement 1016 has conditions included regarding Ash Characterisation and Reuse.

4.7 Brick Plant

The Applicant provided information in the Works Approval Application for a Brick Plant which proposes to use the bottom ash and fly ash combined with water, lime and pigment to produce bricks. Following discussions with the Applicant, the Applicant has informed DER that this Brick Plant would no longer form part of the current Works Approval Application, and will be applied for at a later date pending the results of the ash characterisation program.

4.8 Water Management

4.8.1 Stormwater

Storm water will be collected in an on-site stormwater reservoir incorporated into the WTE plant floor (below the Tipping Hall). This will be used as process make-up water and wash down activities.

Excess stormwater will be collected in one or more unlined infiltration basins, situated outside the WTE plant, and inside the premises site boundary. Stormwater in excess of basin capacity will be directed offsite to existing stormwater management systems associated with existing roadways.

4.8.2 Process Wastewater

The Facility is designed as a zero process wastewater facility. Process wastewater is generated by the activities shown in Table 6.

Table 6: Summary of process wastewater generated by the proposed Facility

Area	Activity	Storage/Disposal
Waste Receivals Area	• Washdown water for Tipping Hall floor and Waste Bunkers	Refuse Drainage Reservoir
Waste Incineration Area	• Washdown water for furnace area floor	Reuse Water Reservoir
Solid Residues Area	• Washdown water in metals recovery area	Ash Bunker, followed by Refuse Drainage Reservoir
Air Pollution Control System	• Boiler blowdown water • Equipment cooling water blowdown • Any other process waste water	Reuse Water Reservoir
Brick Plant	• Washdown water for Brick Plant floor	Reuse Water Reservoir

5 Key Emissions

The primary pollutants of interest from a WTE plant are oxides of Nitrogen (NOx), Carbon Monoxide (CO), Sulfur Dioxide (SO_2), Particulates (PM), Hydrogen Fluoride (HF), Hydrogen Chloride (HCl), Volatile organic compounds (VOCs), heavy metals, and dioxins and furans.

Optimal conditions of incineration are assured by the plant's control system which monitors and detects temperature and oxygen levels and facilitate waste gases being exposed to a temperature of higher than 850 °C for a minimum of 2 seconds to ensure that VOCs are being destroyed.

Auxiliary burners will be used for start-up, shut-down and in case of low loads (stability), burning natural gas. Auxiliary burners are installed at rear and side of combustion chamber to maintain the temperature profile in the chamber. If furnace temperature control mode is selected at the DCS, output of burner is automatically adjusted and temperature of the furnace is kept at 850 °C or higher.

NOx is primarily formed in the incinerator at high temperatures where nitrogen and oxygen react. NOx formation is commonly associated with all combustion activities and is an expected pollutant to be formed in the process where high temperatures are required to achieve complete combustion.

SO_2 is primarily formed from residual sulphurous compounds in the waste feedstock. Once incinerated, sulfurous compounds are oxidised to form gaseous SO_2 within the upper area of the incineration chamber. This reaction should form almost completely in an oxidising environment, with the possible formation of sulfur trioxide in minor quantities. SO_2 will be transported in the flue gas for treatment at the APCS.

HCl and HF are residual gaseous pollutants formed from the thermal breakdown of halogenated compounds in the waste feedstock. Once formed, HCl and HF are not combustible and pass through to the APCS for treatment.

The Hydrated Lime Injection System has the flexibility to use both dry hydrated lime and dry sodium bicarbonate. Acid gases react with the dry reagents, which are injected into the waste gas duct upstream of the Bag Filter.

5.1 Discharge Points

5.1.1 Air

The only point source for air emissions is a single, multi-flue stack. This stack is planned to consist of at least two flues, one from each of the combustion lines.

Fugitive air emissions (dust and odour) may be generated from the Waste Receivals Area (refer to Section 4.2).

5.1.2 Land

No discharges to land are expected.

5.1.3 Water

The Facility is designed as a zero process wastewater facility. Only clean stormwater will be discharged via unlined infiltration basins.

5.2 Emissions Monitoring

As the monitoring requirements of gaseous and liquid emissions have not been included in the Ministerial Statement, the Works Approval and Licence will include conditions to regulate these emissions.

Emission limits will be applied in accordance with Ministerial Statement 1016 and the direction provided by the OEPA. The emissions and discharges from the premises shall not exceed the limits specified in Annex V of the European Union Waste Incineration Directive 2000/76.[4]

[4] More formally known as Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste.

6 Commissioning

As part of the Works Approval Application process, a *Preliminary Commissioning Management Plan* has been submitted by the Applicant. In this Plan, a commitment was made to provide a Detailed Commissioning Plan prior to the commencement of commissioning of the Facility.[5] However, DER considers the detail provided in the preliminary plan, together with the reporting and other requirements specified in the Works Approval, will be sufficient to regulate the emissions during the Commissioning Period.

The Applicant has delineated the following commissioning activities as shown in Table 7:

Table 7: Summary of key characteristics of commissioning stages

Stage	Phase	Key Details
PRE-COMMISSIONING [6]	--	Expected duration of 10-15 weeks. No waste is charged; no heat is applied. No emissions. Main activities include: • Test and turnover of electrical systems, process utility systems, boiler fans and draft controls, boiler and APC systems. : • Pre-commissioning of turbine systems • Install steam blow piping • Prepare for refuse fire • Complete turbine pre-roll checks • Plan full load run and tuning period
COMMISSIONING [7]	**Phase 1: Curing of refractory**	Expected duration of 1-2 months. No waste is combusted in the furnaces. Emission profile resembles combustion of natural gas only. Main activities include: • Firing of auxiliary burners with natural gas • Start-up and tuning of auxilliary burners • Steam blowing of boilers • Preliminary calibration of CEMS with test gases
	Phase 2: First firing of waste	Expected duration of 3- 6 months. MSW is charged and furnaces convert MSW to steam and/or electricity. MSW load is progressively increased to allow for adjustment and optimization of control systems. SNCR, lime & carbon injection, bag filter and CEMS will be online at all times. Emission profile will consist of all WID gases.

[5] "*Preliminary Commissioning Management Plan",* Phoenix Energy, Draft, 15 September 2015
[6] Also known as 'cold commissioning'.
[7] Also known as 'hot commissioning'.

Stage	Phase	Key Details
		Main activities include: • Waste deliveries • Operation of APC system • Start-up and shutdown using natural gas • Troubleshooting of equipment
	Phase 3: Acceptance and reliability testing	Expected duration of 1 month. Occurs once both units are able to sustain continuous steady state operation. SNCR, lime & carbon injection, bag filter and CEMS will be online at all times. Emission profile will consist of all WID gases. Main activities are: • Certification of CEMS • Air emissions testing using manual methods • Sampling for characterization of ash

Prior to commissioning[7] beginning, DER will require an engineering certification to ensure that the plant has been built to meet the appropriate infrastructure requirements. The report should be provided prior to firing the incinerator, in order to automatically trigger the commissioning period.

DER has conditioned a commissioning period of twelve months to allow the facility to reach operational status and apply for an operating licence.

7 Risks to Amenity, Public Health or Environment

	Source of emission and discharge		Pathway	Receptor	Proponent controls	Potential Impact	Consequence on Receptor	Likelihood of Consequence	Level of Risk	Regulatory Controls
	Emission (type and quantity)	**Emission event (normal/upset)**								
1	Odour emissions from the Waste Receivals Area	Normal operation	Air	Neighbouring industrial premises	Rapid roller doors to be installed at entry and exit points to the Tipping Hall and remain closed when trucks are not passing through the door; Air curtain to be installed on the entry and exit points to the Tipping Hall and function whenever the doors are open; Negative pressure will be maintained in the Tipping Hall and Waste Bunkers at all times by the extraction of primary air from the Waste Bunkers for the incinerator;	Amenity impacts on local receptors.	Insignificant	Possible	Low	Proponent proposed controls are satisfactory and have been adopted to ensure infrastructure is built to purpose.
2	Fugitive dust emissions from the Waste Receivals Area	Normal operation	Air	Neighbouring industrial premises	Rapid roller doors to be installed at entry and exit points to the Tipping Hall and remain closed when trucks are not passing through the door; Air curtain to be installed on the entry and exit points to the Tipping Hall and function whenever the doors are open; Negative pressure will be maintained in the Tipping Hall and Waste Bunkers at all times by the extraction of primary air from the Waste Bunkers for the incinerator; Mechanical and manual cleanup of spilled material from trafficable roads and the Waste Receivals Hall will occur whenever waste material is present on the grounds	Amenity impacts on local receptors.	Insignificant	Possible	Low	Proponent proposed controls are satisfactory and have been adopted to ensure infrastructure is built to purpose.
3	Oxides of Nitrogen from the main stack	Normal operation	Air	Neighbouring industrial premises	NOx emissions will be limited by: 1. Combustion controls; 2. APC System. **Combustion Controls:** • Use of Automatic Combustion Control System	Potential health impact when exposed to pollutants	Minor	Possible	Moderate	Proponent proposed controls have been adopted to ensure infrastructure is built to purpose. **Additional CEO requirements will be included in Works Approval.**

	Source of emission and discharge		Pathway	Receptor	Proponent controls	Potential Impact	Consequence on Receptor	Likelihood of Consequence	Level of Risk	Regulatory Controls
	Emission (type and quantity)	**Emission event (normal/upset)**								
					(ACCS) • Low excess air rate • Internal Gas Recirculation (IGR) **IGR fan** to be installed, functional and optimized for NOx reduction during operational periods; **APC System Controls:** Urea injection System to be installed, functional and optimized for NOx reduction during operational periods; CEMS to be installed, calibrated and functional during operational periods, feeding back into ACCS and APCS					
4	Ammonia from the main stack due to ammonia slippage	Normal operation	Air	Neighbouring industrial premises	CEMS monitoring for NOx will inform optimisation. Monitoring to be conducted during commissioning period for NH_3, facilitating an understanding of peak urea dosing rates and associated slippage	Potential health impact when exposed to pollutants	Insignificant	Possible	Low	Proponent proposed controls have been adopted to ensure infrastructure is built to purpose. **Additional CEO requirements will be included in Works Approval.**
5	Carbon Monoxide from the main stack	Normal operation	Air	Neighbouring industrial premises	Waste bunker will have two mixing cranes which facilitate waste mixing to form a semi-homogenous feedstock to be fed into the incinerator; The incinerator will have the appropriate infrastructure to measure temperature, pressure and oxygen levels in the main incineration chamber to ensure that a residence time of 2 seconds at 850°C can be representatively measure in the waste gas stream; The incinerator will be fitted and operate auxiliary burners which enable supplementary firing to maintain temperatures of 850°C in the incineration chamber;	Potential health impact when exposed to pollutants	Insignificant	Possible	Low	Proponent proposed controls have been adopted to ensure infrastructure is built to purpose. **Additional CEO requirements will be included in Works Approval.**
6	VOCs from the main stack	Normal operation	Air	Neighbouring industrial	Waste bunker will have two mixing cranes which facilitate waste	Potential health impact when exposed to	Moderate VOCs are a broad	Possible	Moderate	Proponent proposed controls have been adopted to ensure infrastructure is built to

	Source of emission and discharge		Pathway	Receptor	Proponent controls	Potential Impact	Consequence on Receptor	Likelihood of Consequence	Level of Risk	Regulatory Controls
	Emission (type and quantity)	**Emission event (normal/upset)**								
				premises	mixing to form a semi-homogenous feedstock to be fed into the incinerator; The incinerator will have the appropriate infrastructure to measure temperature, pressure and oxygen levels in the main incineration chamber to ensure that a residence time of 2 seconds at 850°C can be representatively measure in the waste gas stream; The incinerator will be fitted and operate auxiliary burners which enable supplementary firing to maintain temperatures of 850°C in the incineration chamber; Activated Carbon Injection System to be installed, functional and optimised for VOC reduction during operational periods; Bag filter to be installed which facilitates: a) the capture and coating of activated carbon on the bag filter surface; b) the capture and residual incineration products such as flyash; c) the detection and identification of specific broken bags; and d) the ability to change broken bags by bypassing bags within the bag filter CEMS to be installed, calibrated and functional during operational periods, feeding back into control room optimisation of activated carbon injection	pollutants	category of compounds with varying levels of toxicity. A conservative approach has been adopted in regard to consequence to reflect this position.			purpose. **Additional CEO requirements will be included in Works Approval.**
7	Acid Gases (SO_2, HCl and HF) from the main stack	Normal operation	Air	Neighbouring industrial premises	Waste bunker will have two mixing cranes which facilitate waste mixing to form a semi-homogenous feedstock to be fed into the incinerator; Hydrated Lime Injection System to be installed, functional and optimized for Acid gas reduction during operational periods;	Potential health impact when exposed to pollutants	Minor	Possible	Moderate	Proponent proposed controls have been adopted to ensure infrastructure is built to purpose. **Additional CEO requirements will be included in Works Approval.**

	Source of emission and discharge		Pathway	Receptor	Proponent controls	Potential Impact	Consequence on Receptor	Likelihood of Consequence	Level of Risk	Regulatory Controls
	Emission (type and quantity)	**Emission event (normal/upset)**								
					Bag filter to be installed which facilitates: a) the capture and coating of hydrated lime on the bag filter surface; b) the capture and residual incineration products such as flyash; c) the detection and identification of specific broken bags; and d) the ability to change broken bags by bypassing bags within the bag filter CEMS to be installed, calibrated and functional during operational periods, feeding back into control room optimization of hydrated lime injection					
8	Heavy metals from the main stack	Normal operation	Air	Neighbouring industrial premises	Waste bunker will have two mixing cranes which facilitate waste mixing to form a semi-homogenous feedstock to be fed into the incinerator; Wet gas cooling tower is to be installed and operated to reduce flue gas temperatures to a level that protect the bag filter from heat damage; Activated Carbon Injection System to be installed, functional and optimized for VOC reduction during operational periods; Bag filter to be installed which facilitates: a) the capture and coating of activated carbon on the bag filter surface; b) the capture and residual incineration products such as flyash; c) the detection and identification of specific broken bags; and d) the ability to change broken bags by bypassing bags within	Potential health impact when exposed to pollutants	Minor	Possible	Moderate	Proponent proposed controls have been adopted to ensure infrastructure is built to purpose. **Additional CEO requirements will be included in Works Approval.**

	Source of emission and discharge		Pathway	Receptor	Proponent controls	Potential Impact	Consequence on Receptor	Likelihood of Consequence	Level of Risk	Regulatory Controls
	Emission (type and quantity)	**Emission event (normal/upset)**								
					the bag filter CEMS to be installed, calibrated and functional during operational periods					
9	Dioxins and Furans from the main stack	Normal operation	Air	Neighbouring industrial premises	Waste bunker will have two mixing cranes which facilitate waste mixing to form a semi-homogenous feedstock to be fed into the incinerator; The incinerator will have the appropriate infrastructure to measure temperature, pressure and oxygen levels in the main incineration chamber to ensure that a residence time of 2 seconds at 850°C can be representatively measure in the waste gas stream; The incinerator will be fitted and operate auxiliary burners which enable supplementary firing to maintain temperatures of 850°C in the incineration chamber; Wet gas cooling tower is to be installed and operated to reduce flue gas temperatures to a level that protect the bag filter from heat damage and avoid the de novo synthesis of Dioxins and Furans; Activated Carbon Injection System to be installed, functional and optimised for VOC reduction during operational periods; Bag filter to be installed which facilitates: a) the capture and coating of activated carbon on the bag filter surface; b) the capture and residual incineration products such as flyash; c) the detection and identification of specific broken bags; and d) the ability to change broken bags by bypassing bags within the bag filter	Potential health impact when exposed to pollutants	Minor	Possible	Moderate	Proponent proposed controls have been adopted to ensure infrastructure is built to purpose. **Additional CEO requirements will be included in Works Approval.**

	Source of emission and discharge		Pathway	Receptor	Proponent controls	Potential Impact	Consequence on Receptor	Likelihood of Consequence	Level of Risk	Regulatory Controls
	Emission (type and quantity)	**Emission event (normal/upset)**								
					CEMS to be installed, calibrated and functional during operational periods, feeding back into control room optimisation of activated carbon injection					
10	Particulates, including PM10 from the main stack	Normal operation	Air	Neighbouring industrial premises	Waste bunker will have two mixing cranes which facilitate waste mixing to form a semi-homogenous feedstock to be fed into the incinerator; Wet gas cooling tower is to be installed and operated to reduce flue gas temperatures to a level that protect the bag filter from heat damage; Bag filter to be installed which facilitates a) :the capture and coating of hydrated lime on the bag filter surface; b) the capture and residual incineration products such as flyash; c) the detection and identification of specific broken bags; and d) the ability to change broken bags by bypassing bags within the bag filter CEMS to be installed, calibrated and functional during operational periods,	Potential health impact when exposed to pollutants	Minor	Possible	Moderate	Proponent proposed controls have been adopted to ensure infrastructure is built to purpose. Additional CEO requirements will be included in Works Approval.
11	Noise, assessed from the plant as a whole.	Normal	Air	Neighbouring Industry Residents	Design of the plant and equipment	Nuisance and health impacts	Insignificant	Unlikely	Moderate	No additional controls required as *Environmental Protection (Noise) Regulations 1997* regulates this sufficiently
12	Light, assessed from the plant as a whole.	Normal	Air	Neighbouring Industry	Design of the light infrastructure	Nuisance and health impacts	Insignificant	Unlikely	Low	No additional controls required as premises is located in heavy industrial area that operates 24/7
13	Radiation	Normal	Air	Neighbouring Industry	Waste Acceptance Management Radiation Monitoring at the Weighbridge with alarm	Health impacts	Moderate	Rare	Moderate	No controls imposed, Ministerial Statement 1016 imposes conditions
14	Stormwater	Normal	Land/Water	Groundwater or surface	All process areas are enclosed and stormwater is separated from	Groundwater or surface water contamination	Insignificant	Possible	Low	No controls imposed, proponent controls are satisfactory.

	Source of emission and discharge		Pathway	Receptor	Proponent controls	Potential Impact	Consequence on Receptor	Likelihood of Consequence	Level of Risk	Regulatory Controls
	Emission (type and quantity)	Emission event (normal/upset)								
				water	any contaminated water sources and discharged via sump. Contaminated process water is directed to the treatment plant and reused within the process. Liquid waste present in the waste receiving hall Is stored within the concrete bunker and absorbed into waste prior to incineration.					
15	Dust from solid waste residues (bottom ash, fly ash, APC residues)	Normal	Land/Water	Groundwater or surface water	All process areas are enclosed and stormwater is separated from any contaminated water sources	Groundwater or surface water contamination	Insignificant	Possible	Low	No controls imposed, proponent controls are satisfactory.

8 Regulatory Controls

The emission risks identified in Section 7 and the controls to be implemented have been summarised in the table below.

			Regulatory Controls					
			8.1 Waste Acceptance Area	*8.2 Waste Receivals Area*	*8.3 Waste Incineration Area*	*8.4 APC System*	*8.5 Stack and CEMS*	*8.6 Solid Residue Storage Area*
Risk Items (Section 7)	*1*	*Odour*	•	•				
	2	*Fugitive dust*	•					•
	3	*Oxides of nitrogen*			•	•	•	
	4	*Ammonia*			•	•	•	
	5	*Carbon monoxide*			•	•	•	
	6	*VOCs*			•	•	•	
	7	*Acid gases (SO_2, HCl and HF)*			•	•	•	
	8	*Heavy metals*			•	•	•	•
	9	*Dioxins and furans*			•	•	•	•
	10	*Particulates, including PM10*	•			•		
	11	*Noise*						
	12	*Light*						
	13	*Radiation*						
	14	*Stormwater*						•
	15	*Solid waste residues*					•	•

8.1 Waste Acceptance Area

8.1.1 Proposed Condition

- Weighbridge capable of measuring the weight of all incoming trucks to determine the amount of waste being processed by the plant; and
- Radiation detection equipment to determine the presence of radioactive material

8.1.2 Grounds for Condition

Waste acceptance at the Facility will be managed by Ministerial Statement 1016, hence DER has only included the infrastructure requirements for this area. DER considers the waste acceptance measures within Ministerial Statement 1016 are critical to eliminating bulk pollutants and hazardous materials that the incinerator is not approved or designed to process.

8.2 Waste Receivals Area

8.2.1 Proposed Condition

Infrastructure requirements for Tipping Hall:

- Rapid opening and closing roller doors and louvres, designed to ensure that the Tipping Hall remains under negative pressure at all times;
- Air-curtain above roller entry and exit doors that prevent the exit of air from the Tipping Hall whenever doors are open;
- Concrete flooring within the Tipping Hall to ensure that no waste or wastewater will be discharged to the environment from these areas; and
- CCTV and large object detection system, designed to identify and facilitate removal of large objects which are unsuitable for incineration.

Infrastructure requirements for Waste Bunker:

- Each waste bunker to be equipped with an automatic door, designed to ensure the bunker remains sealed while no waste is being deposited;
- Mixing cranes to mix the waste to ensure a suitably homogenous feedstock for incineration to meet all emission limits;
- Air extraction system from the primary air fan to each incinerator, located above the waste bunker to ensure negative pressure within the Waste Receiving Area; and
- Concrete flooring within the Waste Bunkers to ensure that no waste or wastewater will be discharged to the environment from these areas.

8.2.2 Grounds for Condition

The infrastructure design proposed by the Applicant will ensure that odours and dust are retained within the Waste Receivals area.

8.3 Waste Incineration Area

8.3.1 Proposed Condition

Infrastructure requirements for furnace:

- Two combustion lines, each containing a furnace using Martin GmbH reverse acting (R-type) grate combustion technology, designed with a stoking action to move hot ash back up under incoming waste;
- Startup burners, capable of firing as auxiliary burners to maintain incineration temperature in the incineration chamber such that minimum burning temperatures (850^{o}C) and residence times (2 seconds) are maintained at all times during operation;
- Temperature sensors to be installed which are capable of the representative measurement across the entire incineration chamber and waste gases produced therein;
- Oxygen sensors to be installed which facilitate the measurement of combustion efficiency;
- Urea injection system capable of minimizing NOx emissions to below 400mg/m^{3}and controlling ammonia slip to less than 10mg/m^{3} at all times; and
- Incineration Gas Recirculation Fan, capable of recirculating warm flue gases from the end of the grate to the overfire nozzles for the purpose of minimisation of NOx emissions.

Infrastructure requirements for Automated Combustion Control System (ACCS):

- Automated monitoring and control system capable of collecting CEMS output data and using this data to control the grate-boiler combustion and APCS parameters.

Infrastructure requirements for Boiler Economiser:

- Boiler Economiser capable of reducing flue gas temperature to below 200^{o}C.

8.3.2 Grounds for Condition

The infrastructure requirements for the furnace will help facilitate high combustion efficiency and low NOx emissions.

The ACCS, in conjuction with the CEMS, will enable the process conditions (feedrate, furnace and APC system) to be controlled in real time to ensure high combustion efficiencies.

8.4 Air Pollution Control System

8.4.1 Proposed Condition

- Gas Cooling Tower capable of cooling flue gas rapidly to below 135^{o}C;
- Hydrated Lime Injection System capable of injecting dry hydrated lime or sodium bicarbonate into the flue gas stream and reducing:
    - SO_2 emissions to below 200 mg/m^3;
    - HF emissions to below 4 mg/m^3; and
    - HCl emissions to below 60 mg/m^3.
- Activated Carbon Injection System capable of injecting activated carbon into the flue gas and reducing:
    - VOC emissions to below 20 mg/m^3,
    - Dioxin and furan emissions to below 0.1 ng/m^3 as TEQ;
    - Mercury emissions to be below 0.05 mg/m^3.
- Bag filter capable of:
    - minimising particulate matter emissions to be below 30mg/m^3;
    - capturing activated carbon, sodium bicarbonate and/or lime for the purposes of treating flue gas emissions; and

Quick detection and isolation of broken bags, without requiring a baghouse bypass situation to exchange or replace the broken bag.

8.4.2 Grounds for Condition

The combined elements of the APC System (i.e. Cooling Tower, Hydrated Lime Injection System, Activated Carbon Injection System and Bag Filter) are known to successfully reduce the concentrations of combustion gases and particulates in the gas stream from WTE plants.

8.5 Stack and CEMS

8.5.1 Proposed Condition

- A multi-flue stack of minimum height of 87.5m above ground level.

- CEMS being operated in accordance with the CEMS Code and capable of accurately measuring the following pollutants from the waste gas emissions:
    - Particulate matter;
    - NOx;
    - SO2;
    - HF;
    - HCl;
    - CO; and
    - VOCs.

  On a dry basis at standard temperature (273.15^{o}K), pressure (101.3kPa) and corrected to 11% Oxygen concentration.

8.5.2 Grounds for Condition

A CEMS will enable emissions of key combustion compounds to be monitored continuously against emission limits. The data collected will be fed back into the Automated Combustion Control System and be used for process optimisation.

8.6 Solid Residue Storage Area

8.6.1 Proposed Condition

- Concrete flooring within the Bottom Ash Bunker to ensure that no waste or wastewater will be discharged to the environment;
- Concrete flooring within the Metal Recovery Area to ensure that no waste or wastewater will be discharged to the environment; and
- Enclosed conveyors to transport bottom ash, fly ash, and APC residues.

8.6.2 Grounds for Condition

It is planned that the Brick Plant will use bottom ash, fly ash and APC residues generated at the Plant in the manufacture of bricks, pavers and construction aggregate. The characterisation and assessment of these residues is regulated under Part IV.

Prior to the Brick Plant being approved, built and operational, solid residues will be collected and stored on site. The proposed infrastructure should minimise any fugitive dust emissions, either into the air or the waterways.

9 Consultation

The DER publically advertised the application in the *West Australian* newspaper on 12 October 2015 for 21 days and did not receive any comments.

DER have consulted with the Office of Environmental Protection in regard to the conditions within Ministerial Statement 1015.

10 Conditions for the Works Approval

Most controls will be conditioned in the works approval instrument by:

- conditions regarding to infrastructure requirements; and
- conditions specifying that on completion of the works, the Applicant will be required to provide the CEO with engineered certification that the as built works comply with the relevant controls;
- conditions for the commissioning of the proposed works, including stack testing and CEMS calibration;
- a condition setting emission limits so that commissioning can occur under the works approval.

11 Conditions for the Licence

Most controls will be conditioned in the licence instrument by conditions specifying requirements which are consistent with the regulatory controls outlined in this Report.

The licence will include conditions regarding CEMS, stack testing, maintaining the APC, response to upset conditions and reporting requirements.

12 Conclusion

Based on the assessment of the proposed works, it has been demonstrated that the Facility will not cause pollution or environmental harm and as such, a Works Approval can be issued subject to the regulatory controls and conditions outlined in this decision report to mitigate identified environmental risks.

DER has taken in consideration the fact that a Ministerial Statement was in place for this Proposal and as such DER focussed on conditions regarding emissions and discharges instead of the acceptability of the Proposal, as this was already determined by the Minister. DER has attempted to avoid regulatory duplication and in particular, has accepted that Ministerial Statement 1016 will adequately manage waste acceptance at the site.

By issuing the Works Approval, DER has determined that the SO_2 emissions from this premises, as modelled at 19 g/s, are to be included in a new Determination (Clause 7) or in a new Redetermination as per Clause 12 of the *Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999*.

DER's CEO will formalise this prior to the issue of the licence.

Ed Schuller
Senior Manager Industry Regulation (Process Industries)
delegated Officer under section 20 of the *Environmental Protection Act 1986*

Attachment 1: Site Drawings