Public Environmental Review

Response to Submissions

Kwinana Waste to Energy Project

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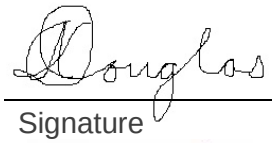
Authored by:	**Anthony Douglas** Project Engineer	 Signature	17 December 2014 Date
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Main Document

Kwinana WtE Project PER Response to Submissions Dec 2014 Rev2 FINAL

Part B – Appendices

Kwinana WtE Project PER Response to Submissions Dec 2014 Rev2 FINAL Part B

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Part B - Contents

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2 Introduction

2.1 The Kwinana Waste to Energy Project

Phoenix Energy Australia Pty Ltd (Phoenix Energy), as the Kwinana WtE Project Developer, has prepared this Public Environmental Review – Response to Submissions document on behalf of the Proponent, Kwinana WTE Project Co Pty Ltd (ACN 165 661 263).

The Kwinana WtE project will be a critical component of WA's long-term waste management infrastructure. The Proposal will utilise the tried and proven, market leading Martin GmbH reverse acting stoker grate combustion technology to process up to 400,000 t/yr of residual Municipal Solid Waste (MSW) into clean, base load renewable electricity. The process will recover energy in the form of electricity and employ Best Available Techniques to ensure that any emissions to the atmosphere are continually in compliance with world's best practice emission limits. In addition, solid residues from the combustion process will be further processed into bricks and pavers in an on-site Brick Plant and/or sold for use as a construction aggregate.

The Proposal area is defined by a specific geographical boundary or 'Development Envelope', and is located approximately 40 km south of Perth, in the Kwinana Industrial Area of Western Australia. The Development Envelope covers 3.479 ha and is comprised of four main elements or components; (i) the Main Process Area, which will comprise the Waste to Energy Plant, a control room, boiler make-up water treatment and laboratory, (ii) a Brick Plant, (iii) Car parks, roads and Services easements, and (iv) an Administration building.

The reader is referred to the Kwinana WtE Project Public Environmental Review document (June 2014) for a detailed description of the Proposal.

2.2 Assessment Process

The Proposal was referred to the WA Environmental Protection Authority (EPA) on 25 September 2012, under Section 38 of the WA Environmental Protection Act 1986 (EP Act). The EPA determined that the Proposal required assessment at the level of Public Environmental Review (PER) (with a six week public review period), whereby the Proponent must fulfil the requirements of the Environmental Impact Assessment (Part IV Division 1) Administrative Procedures 2012 for environmental assessment prescribed under the EP Act.

The EPA prepared the Environmental Scoping Document (ESD) for the Proposal, which was issued on 3 May 2013. The PER document was subsequently prepared which described the Proposal and its likely effects on the environment. The PER document was released for public comment on 9 June 2014 with the public submission period closing on 21 July 2014.

2.3 Purpose and Structure of this Document

Thirty-two (32) submissions were received by the Office of the Environmental Protection Authority (OEPA) during the formal public comment period for the PER.

This document provides responses from Phoenix Energy, on behalf of the Proponent, in relation to a summary of issues raised in the submissions made on the PER. The summary of issues was collated by the OEPA and provided to the Phoenix Energy in accordance with the requirements of Section 10.2.6 of the EPA's Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2012 (the Administrative Procedures 2012) under the EP Act.

The document also includes the Phoenix Energy's responses to a list of Important Matters to be Addressed, which were prepared by the OEPA in relation to the OEPA's review of the PER document.

This document is structured as follows:

- Introduction, The Kwinana Waste to Energy Project, the EPA assessment

process, purpose and structure of the document (this section)

- Responses to Important Matters to be Addressed (section **3**)
- Responses to Summary of Public Submissions (inclusive of both public and government agency submissions) (Section 4)

3 Responses to Important Matters to be Addressed

Question or Clarification Requested
Waste Acceptance A clear list and definition of the wastes proposed to be accepted is required (preferably in a table format). Please note that there are inconsistencies in the Public Environmental Review (PER) document on what wastes are proposed to be accepted (for example page 77 of the PER refers to a number of different waste streams).
Proponent Response
For this Part IV Public Environmental Review, the Kwinana WtE Project is proposing to accept all forms of residual Municipal Solid Waste (MSW) destined for landfill disposal, including: • Householder source separated residual MSW • Material Recovery Facility (MRF) residuals • Alternative Waste Treatment (AWT) 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. **PER section 10.1.1.6.3.1 (p77)** responds directly to the second part of the work requirement specified by the EPA in the Environmental Scoping Document (ESD) to "Provide detail on the composition of the proposed feedstock(s) identified by the proponent and any other potentially suitable feedstocks (see referenced documents)."
Question or Clarification Requested
Waste Hierarchy Recommendation 5 of the Report and recommendations of the Environmental Protection Authority (EPA) and the Waste Authority, Section 16(e) Report 1468 April 2013, states that *The waste hierarchy should be applied and only waste that does not have a viable recycling or reuse alternative should be used as feedstock. Conditions should be set to require monitoring and reporting of the waste material accepted over the life of a plant.* Please demonstrate how the proposal will meet this recommendation given that no on-site sorting is proposed. Information on any minimum source separation criteria that will be required of waste providers should also be provided.
Proponent Response
The *Waste Avoidance and Resource Recovery Act 2007* (WARR Act (2007)) contemplates resource management options as a hierarchy with 3 levels, from the most preferable 'avoidance', followed by resource recovery (which includes energy recovery), and the least preferable outcome being disposal. 5. Objects of this Act (1) The primary objects of this Act are to contribute to sustainability, and the protection of human health and the environment, in Western Australia and the move towards a waste-free society by — (a) promoting the most efficient use of resources, including resource recovery and waste avoidance; and (b) reducing environmental harm, including pollution through waste; and (c) the consideration of resource management options against the following hierarchy — (i) avoidance of unnecessary resource consumption; (ii) resource recovery (including reuse, reprocessing, recycling and energy recovery);

(iii) disposal.

(2) The principles set out in the EP Act section 4A apply in relation to the objects of this Act.

In its June 2013 Communication on the Waste Hierarchy, the Waste Authority made it clear that "The [waste] hierarchy is not intended as a standalone assessment tool, rather, it should be used alongside other assessment tools to analyse the full environmental, economic and social impacts of waste management options." This is consistent with, EU Directive 2008/98/EC (31) "The waste hierarchy generally lays down a priority order of what constitutes the best overall environmental option in waste legislation and policy, while departing from such hierarchy may be necessary for specific waste streams when justified for reasons of, inter alia, technical feasibility, economic viability and environmental protection." Furthermore, Article 10 (2) states "to facilitate or improve recovery, waste shall be collected separately if technically, environmentally and economically practicable and shall not be mixed with other waste or other material with different properties."

The Kwinana WtE Project is providing a resource recovery service to councils (by recovering energy and other resources), not a waste collection service, and seeks to prevent the disposal to landfill of 100% of the waste feedstock. The facility will accept MSW from municipalities that employ source separation through the provision of either a 2 or 3 bin collection service (i.e. to facilitate source separation by the householder). The facility will not accept source separated recyclables as feedstock.

It is noted that for a local government entity to accept the resource recovery service provided by the Kwinana WtE Project, the local government entity must ensure that the service is consistent with their Waste Plan, which implies consistency with the State government Waste Strategy, as required by the WARR Act (2007). The City of Kwinana has already entered into an agreement with the Project for the provision of a resource recovery service, and Rivers Regional Council has selected the Phoenix Energy led consortium developing the Kwinana WtE Project as the preferred tenderer for the provision of a resource recovery service. As such, those local governments have implicitly accepted that the Proposal is consistent with the requirements of the WARR Act (2007).

With regards to feedstock monitoring, the Proposal will be required to undertake 6 monthly waste audits in accordance with the Clean Energy Regulator *Guideline for Determining the Renewable Components in Waste for Electricity Generation*, to satisfy the requirements of the *Renewable Energy (Electricity) Act 2000,* in order to become a registered renewable electricity generator. This feedstock auditing is also expected to satisfy carbon reporting requirements, and along with vehicle recognition (to confirm the origin of waste loads) and random inspections of loads, will provide a basis for an on-going feedstock monitoring and reporting regime to be agreed with the DER during Part V Licensing.

Consistent with international best practice for the application of the selected WtE technology, the proposal does not include an up-front Materials Recovery Facility (MRF), but does include the recovery of ferrous and non-ferrous metals from the bottom ash. Some of the key reasons why it is best practice not to include a pre-sort are detailed in the PER (please refer to **PER section 5.1.2.1, p47**) and in the responses provided in section **6. Waste/Waste Characterisation** in **Attachment 3 Summary of Public Submissions**. Furthermore, international best practice, for those robust and flexible WtE technologies whose performance is not susceptible to changes in feedstock composition and moisture content, is to ensure effective source separation through:

- provision of collection services (by local governments) for source separated materials which are either undesirable to be processed through a WtE facility or for which a higher order recovery alternative exists, and
- effective education of the community.

As described in the PER documentation, once operational, the Facility will provide a regional focal point for waste management education through the provision of Facility open days and regular site tours. There will also be opportunities for local schools and universities to partner with the Facility for both educational and research purposes.

Our Plant Manager and Operations & Maintenance service provider, Covanta Energy Corporation, also brings a wealth of experience in community engagement and outreach programs, which create a tangible connection between the local WtE facility, the local community and the municipalities it serves. This connection will help drive further improvements in participation rates and positive source separation behaviour in the communities being served by the Facility.

Question or Clarification Requested

Cumulative Emissions

As previously advised, the response to submissions will need to update the air emission study to address cumulative emissions from both existing and proposed Kwinana industries (i.e. including the recently assessed East Rockingham Waste to Energy Facility).

Proponent Response

Please refer to **Appendix A** for a letter of advice from ENVIRON (the air quality consultant to the Proposal) dated 9 October 2014. Having assessed the potential for cumulative impacts associated with the proposed Kwinana WtE facility and the proposed East Rockingham WtE and MRF, ENVIRON concluded that:

a) the likelihood of cumulative impacts associated with the atmospheric emissions from the two facilities is considered to be very low give the location of each site in relation to one another. Note that this is also consistent with the findings presented in the response to submissions provided for the East Rockingham Proposal;
b) the infrequency with which meteorological conditions occur that could potentially result in an alignment of emissions between the two facilities;
c) the ground level concentrations (GLCs) predicted at distances of 3 km or more from each of the proposed facilities are many orders of magnitude below the concentration of emissions at the point of release; and
d) GLCs at a distance of 4.7 km (the estimated separation distance of the two emission sources) would be even lower, and as such, the potential for cumulative impacts to occur in association with the two proposals is considered negligible.

Question or Clarification Requested

By-products (Bricks and Pavers)

Recommendations 14 to 21 of the Report and recommendations of the EPA and the Waste Authority, Section 16(e) Report 1468 April 2013, relates to the reuse of ash. This is of particular concern to the EPA, and each of the recommendations needs to be addressed in detail. Please detail a proposed program that will address the following:

1. characterisation / testing of the ash to demonstrate compositional consistency (with variations in waste inputs, and over a suitable time period), to demonstrate that the ash is suitable for reuse to make by-products;
2. full details of the specific criteria that will be used to ensure that the by-products are fit for each identified use (e.g. leach testing);
3. batch testing (methods and frequency) of finished by-products to verify / certify that they meet the criteria identified in 2. above; and
4. identification of any by-product "end of life" uncertainties / risks for further reuse or disposal.

Proponent Response

Development of *Material Guideline Schedules for Waste Derived Products*

It is expected that new *Material Guidelines Schedules* will be developed in consultation with the DER for each of the waste-derived by-products produced by the WtE facility. This has been flagged to the DER by

way of a project specific submission during the recent industry consultation period for the DER's *Draft guidance statement: Regulating the use of waste-derived materials*.

The *Material Guideline Schedules* will as a minimum detail the applicable quality standards that the alternative construction products (e.g. bricks, pavers, aggregate) will need to achieve in order to be used as an alternative to an existing construction material. However, it is yet to be agreed with DER whether requirements for product testing (e.g. leaching tests) will be incorporated into the *Material Guideline Schedules* or whether these will be specified in the Part V License approval (or both).

Demonstration Phase

Phoenix Energy accepts that there is a need to develop a level of confidence regarding the proposed re-use of solid by-products of combustion (bottom ash and fly ash, including Air Pollution Control system reaction products) for the production of bricks and pavers, as a cost competitive and environmentally sustainable alternative to traditional quarried materials. We understand that it will be necessary to confirm the compositional consistency of the WtE plant residues, in order to establish the appropriate blend of WtE plant residues with other ingredients such as water, lime and pigment (for colour). During this demonstration period, it is anticipated that the WtE plant residues will, after characterisation, and depending on the outcome of the necessary compliance testing, it will be:

1. used for demonstration of the Brick Plant technology, or
2. dispatched by covered truck for use as a road aggregate, or
3. dispatched by covered truck for use as landfill daily cover, or, if found to be non-compliant,
4. dispatched by covered truck for disposal at an appropriate landfill.

Furthermore, during the demonstration phase, the brick products will, after characterisation and testing (including quality testing to confirm their suitability for proposed construction purposes in accordance with appropriate Australian or international standards), either be temporarily stockpiled on-site in preparation for sale or used for landscaping etc., or dispatched for sale/distribution for approved end uses, in accordance with the *Material Guideline Schedule* to be developed in consultation with the DER.

Those bricks that are found to be non-compliant will either be:

1. crushed and recycled through the brick making process,
2. dispatched by covered truck to be used for approved purposes at an appropriate landfill, or
3. dispatched by covered truck for disposal at an appropriate landfill.

The Brick Plant demonstration period is expected to coincide with the hot commissioning phase of the WtE plant, and continue for up to 3 months after the commencement of normal operation of the WtE plant.

1. characterisation / testing of the ash to demonstrate compositional consistency (with variations in waste inputs, and over a suitable time period), to demonstrate that the ash is suitable for reuse to make by-products;

Response:

For brick making, the following types of testing will be undertaken for the bottom ash (after the recovery of ferrous and non-ferrous metals) and fly ash:

- Screen Size Analysis
- Quantitative X-Ray Diffraction for mineralogy

The above testing will be undertaken as regularly as necessary during the Brick Plant commissioning and demonstration phase. Once testing of the brick products confirms consistent quality and compliance with both Part V License conditions and product performance specifications defined in the *Material Guideline Schedule* for Bricks and Pavers, it is proposed that the frequency of the above testing will be fortnightly during the first 6 months of operation, and then reduced to monthly, or as recommended by the technology provider (PMET).

For the preparation of construction aggregate, the following types of testing will be undertaken for the bottom ash (after the recovery of ferrous and non-ferrous metals):

- Testing (including Leach Testing) to confirm that the material is non-hazardous and would not be classed as a controlled waste in WA
- Other tests depending on the end-use material standards as defined in the *Material Guideline* to be developed in consultation with the DER, participating councils and the construction industry

For the preparation of landfill daily cover, the following types of testing will be undertaken for the bottom ash (after the recovery of ferrous and non-ferrous metals):

- Screen Size Analysis (To be confirmed)
- Testing (including Leach Testing) to confirm that the material is non-hazardous and would not be classed as a controlled waste in WA

The above testing requirements and frequency will be developed in consultation with the DER during Part V Licensing.

2. full details of the specific criteria that will be used to ensure that the by-products are fit for each identified use (e.g. leach testing);

Response:

Key criteria will be dependent on the proposed end-use (product quality and performance specifications as defined in the *Material Guideline Schedules*) and compliance with the Part V Licensing conditions to be agreed with the DER, for each of the potential by-products discussed above. As such, the key criteria will be developed in collaboration with the technology providers (MHIEC and PMET) and the plant operator (Covanta Energy Corporation), in consultation with the DER and industry. As such, the specific criteria to be developed for each by-product are expected to include leach testing performance criteria and product performance standards. For bricks and pavers, such criteria will likely include the compressive strength requirements of ASTM standard C902 and also the Severe Weather Requirements of ASTM standard C73, regarding compressive strength and water absorption.

3. batch testing (methods and frequency) of finished by-products to verify / certify that they meet the criteria identified in 2. above; and

Response:

The following testing will be undertaken for the brick products:

- Preparation of nominal 1.25 inch (~32mm) diameter test Brixx™ samples
- Compression test of test Brixx™
- Water Absorption testing of test Brixx™ samples
- Leach testing (using an approved Australian or international procedure and associated standard to confirm compliance)

The above testing will be undertaken in accordance with PMET requirements during Brick Plant commissioning, demonstration and during normal operation. It is expected that once proven, the testing regime will be governed by the Part V License requirements and the product performance specifications defined in the *Material Guideline Schedule* for Bricks and Pavers, to be developed in consultation with DER and PMET.

For the preparation of construction aggregate, the following types of tests are expected to be undertaken for the bottom ash (after the recovery of ferrous and non-ferrous metals):

- Screen Size Analysis
- Other tests depending on the end-use material standards as defined in the *Material Guideline*

Schedules to be developed in consultation with the DER, participating councils and the construction industry

Testing methods and frequency will be defined in the *Material Guideline Schedules* and/or Part V Licensing conditions.

For the preparation of landfill daily cover, testing of bottom ash is described above. Testing methods and frequency will be defined in the Part V Licensing conditions.

4. identification of any by-product "end of life" uncertainties / risks for further reuse or disposal.

Response:

Potential by-product "end of life" uncertainties or risks for further reuse or disposal shall be mitigated by definition of appropriate end uses of each by-product in the associated *Material Guideline Schedules*.

It will be important for the Project consortium to work with potential end users of the by-products (primarily alternative construction products), such as the contracted councils, to maximise appropriate re-use opportunities for public works, in order to minimise the risk of a market failure, which would prevent the project from achieving its stated objective of 100% diversion of waste feedstock away from landfill disposal.

In summary, the following program of characterisation, demonstration and testing is proposed in relation to all WtE Plant by-products:

Stage 1a – Pre-commissioning: Develop *Material Guideline Schedules* for Waste Derived Products in consultation with the DER for each by-product (bricks/pavers, construction aggregate, landfill daily cover), including:

- Environmental performance testing e.g. leach testing, compositional testing
- Construction product performance testing e.g. compressibility, water absorption, defects

Stage 1b – Pre-commissioning: Agree ash characterisation and testing requirements in consultation with the DER and the Brick Plant technology provider (PMET)

Stage 2 – Hot commissioning: Brick making technology demonstration

Stage 3 – Normal Operation:

- Bottom ash & fly ash characterisation/testing - Screen Size Analysis & Quantitative X-Ray Diffraction for mineralogy (monthly or as recommended by PMET)
- Compliance with Part V License requirements for characterisation and testing of ALL by-products (e.g. leach testing, confirmation of non-hazardous nature in relation to aggregate and landfill daily cover). Frequency to be agreed
- Compliance with Material Guideline Schedules for each by-product (e.g. compressive strength, water absorption, shape/size). Frequency to be agreed

4 Responses to Summary of Public Submissions

This section includes a summary of public submissions and advice regarding the Public Environmental Review (PER) for the Kwinana Waste to Energy Project proposed by Kwinana WtE Project Co. The Public Environmental Review (PER) was prepared by Phoenix Energy Pty Ltd and presented in the Kwinana Waste to Energy Project Public Environmental Review (June 2014).

The principle issues raised in the submissions and advice received included environmental and social issues as well as issues focussed on questions of fact and technical aspects of the proposal. Although not all of the issues raised in the submissions are environmental, the proponent is asked to address all issues, comments and questions, as they are relevant to the proposal.

4.1 The proposal - General comments

Submitter	Submission and/or issue	Response to comment
DER	**Technology** The proponent should confirm the details of the flue gas cleaning air pollution control (APC) system.	Primary NOx abatement is achieved by the recirculation of flue gases from above the ash discharger to the Secondary Air injection nozzles. Flue gas exits the economizer section of the boiler at a temperature of ~230 ^{o}C after which it is promptly quenched with water and cooled to ~170 ^{o}C, well below temperatures at which de-novo formation of dioxins could potentially occur. MHIEC have recommended that the flue gas cleaning APC system utilise their Dry Scrubbing system (please refer to **Appendix B**), rather than the Semi-Dry Scrubbing system presented in **PER Figure 62 (p144)**. This change is due to the greater reliability associated with the use of a Dry Scrubbing system, consisting of a water quench chamber, followed by injection of dry reagents (such as lime and activated carbon) upstream of the fabric filter (Baghouse). It is important to note that this change does not affect the air quality modelling results, since the operational performance of both systems is very similar AND the air quality modelling assumed worse case WID limit values for acid gases such as HCl and SO_2. The fabric filter bags provide the necessary surface area for the removal of potential pollutant compounds, through both chemical reaction and physical adsorption of compounds in the flue gas. The proposed secondary NOx abatement is a Selective Catalytic Reactor (SCR). The SCR vessel is located downstream of the Baghouse and upstream of the ID Fan and the multi-flue stack.
Lynn MacLaren MLC, Kwinana Industries Council (KIA),	What is the status of the technology licence with Mitsubishi and the most up to date technology from Martin?	MHIEC has the exclusive right to sell and construct Martin GmbH reverse acting stoker grate (R-type) technology as the Martin GmbH cooperation partner (not licensee) in the Asian region and Australia and New Zealand. Of the 4 grate models offered by Martin GmbH, the R-type grate has the largest

Submitter	Submission and/or issue	Response to comment
Bel Air Homes, Alliance for a Clean Environment (ACE); and public submitters	Does the proposal include "world's best practice" and "best available techniques"? A comparison should be made between "hot" and "cool" combustion technologies.	installation base and its operation is proven, well studied and well understood. When Phoenix Energy approached Martin GmbH in 2009 in relation to utilising the Martin stoker grate technology on WtE projects in Western Australia, we were referred directly to MHIEC. Martin GmbH is now offering a modified version of the tried and proven R-type grate called the Vario grate. The modifications allow the speed of the separate zones of the standard grate to be controlled independently. However as there are only a very small number of Vario grates in operation (<5) to date, there is little operating data available to justify any operational, environmental or commercial benefits being derived. Therefore the tried and proven R-type grate is the preferred system of our technology provider, MHIEC, and is the system our O&M provider (Covanta Energy Corporation) is most familiar with. As such, we are confident that the Kwinana WtE Project will be a highly efficient and reliable energy recovery operation, as demonstrated by the hundreds of operating facilities using the R-type grate system (please refer to **PER Appendix D** for a listing of Martin reference sites using the R-type grate). Does the proposal include "world's best practice" and "best available techniques"? Yes it does, as described extensively throughout the PER document. The simple reason why there are more than 1000 WtE plants using (hot) combustion with energy recovery, processing MSW globally (as noted in the PER document) and why there are relatively few WtE plants utilising (cool) gasification technology, the majority of which are located in Japan, is because combustion with energy recovery is the most flexible and reliable commercially viable technology currently available for recovering energy from mixed wastes such as MSW. In 2009-10, when Phoenix Energy first began developing the Kwinana WtE Project, we conducted an extensive global search for tried and proven WtE technologies for processing MSW.

Submitter	Submission and/or issue	Response to comment
		That search, described in **PER section 4.2.2 (p42)**, involved site visits and consulting with global industry experts, also identified the Martin GmbH stoker grate as the dominant technology. When it comes to recovering energy and resources from MSW, alternatives such as gasification and pyrolysis are either unproven (with reference to the EPA definition for tried and proven WtE technology, please refer to EPA Report 1468, Recommendation 3) or have a poor track record for processing mixed waste streams such as MSW. One only has to look at the decade long boom in WtE project development in the UK to see that despite public finance initiatives and the discriminatory application of Renewable Obligation Certificates (ROCs) to technologies other than combustion, combustion with electricity generation and combustion with combined heat and power generation is still the preferred WtE technology for processing residual MSW, selected by risk-averse local councils (and the communities that elect them) and risk averse lenders. Another often overlooked aspect to the technology selection process is the availability of operational and maintenance expertise. The selection of the most appropriate underlying technology will not in itself guarantee that the facility will meet ALL of its environmental and commercial objectives in providing an effective and reliable resource recovery service to contracted councils. The prevalence of grate-combustion technology means that there is substantial domain knowledge regarding the operation and maintenance of the facilities employing that technology. As identified in the PER, Phoenix Energy has selected Covanta Energy Corporation as the Plant Manager and Operations & Maintenance service provider. Covanta currently owns and/or operates 46 grate-combustion type WtE facilities across North America, Europe and Asia. Covanta has an impressive record in environmental compliance, safety and reliability across its portfolio, due to its corporate led focus on Sustainability across its operations.
	The Eastern States have recently ruled out future	The Eastern States have not ‘ruled out’ future WtE, (EfW) projects based on

Submitter	Submission and/or issue	Response to comment
	incineration projects on emissions grounds – e.g. because (i) higher levels of dioxins from incineration which can be reduced by pre-sorting of the waste stream and (ii) temperature and management of the combustion process (e.g. difficult with incineration, but much more manageable with gasification).	technology such as the Martin Grate. In fact the opposite is true as the recent guidelines and recommendations favour those technologies that are tried and proven. As a consequence, whilst some gasification processes are gaining interest from a small number of Local Councils, the reality is that in the Eastern States, these emerging technologies need to demonstrate that they have reference plants operating at the same scale and processing the same type of feedstocks as proposed. As these reference plants do not exist globally, then it is likely that the proponents of such technologies will ultimately face an R&D or demonstration scale pathway through the Environmental licensing processes. In addition, with the failure of a number of AWT projects in both NSW and WA to deliver on their landfill diversion objectives, a very cautious approach is likely to be adopted at Local and State Government level. Dioxin control is readily achieved by combustion controls along with the design of the flue gas APC system, as evidenced by the reference plant data provided in the PER and the massive installation base of WtE plants using similar combustion technology world-wide. We see no basis or evidence to support statement (ii).
	Please provide details of the same sized plant using the same technology. Western Australia should not be used as an experiment with no proven technology.	The Kita-Tokyo reference facility has the same grate-boiler line size as the proposal. The Montgomery County WtE reference facility noted in the PER has a similar line size (544 tpd vs 606 tpd for the Proposal) and a larger overall capacity (1632 tpd) than the Proposal (1212 tpd). With reference to **PER Appendix D**, there are 117 Martin grate reference sites processing between 200,000 t/yr and 400,000t/yr of typically MSW and C&I wastes, and 36 sites processing more than 400,000t/yr, which have been operating for more than 12 months. The Kita-Tokyo and Montgomery County, USA Martin reference sites were selected because of their similar line size and modern flue gas APC systems.
	Incineration technology is inappropriate in nature in the context of readily available alternative waste management methods.	If 'incineration technology' refers to tried and proven WtE technology (i.e. combustion with energy recovery), then **PER Figure 5 (p38)** clearly demonstrates that those European countries which have minimised their reliance on landfill disposal and have maximised their resource recovery,

Submitter	Submission and/or issue	Response to comment
		have only done so by integrating WtE (typically combustion with energy recovery) into their waste management system, along-side recycling and composting of source separated organics.
	The amount of energy produced seems to be low compared to how much waste is going to be consumed. There is not enough plastic for recycling in Europe due to WtE. The dominance of WtE over recycling is not good enough.	A mixed waste such as MSW has roughly one third of the energy content of black coal and is relatively high in moisture. As such, MSW is not a particularly good fuel. However, WtE allows us to efficiently recover the embodied base load renewable energy immediately, thus avoiding fugitive landfill gas emissions and replacing base load energy, which would otherwise need to be generated from fossil fuels. Furthermore, single stage combustion with energy recovery is currently the most energy efficient proven approach to WtE. **PER Figure 5 (p38)** clearly demonstrates that those European countries which have the highest installed capacity of WtE also have some of the highest recycling rates.
	Mass combustion incinerators are the dirtiest form of energy generation both in toxics and climate change gases. Waste burning facilities produce far more carbon dioxide per unit of energy generated than coal, oil or gas fired power stations. The process produces more greenhouse gas (GHG) per energy unit than coal, destroys the 'resources' in waste that could be recovered. Incinerators rank as one of the dirtiest known forms of energy production.	If this statement were true, there would not be 300-400 mass combustion type WtE plants operating across Europe and the UK, mostly within major urban population centres such as London and Paris. There are also ~90 in the USA, mostly located on the more densely populated east coast. Whilst it is indeed true that a WtE plant processing residual MSW will emit more CO_2-e/MWh than a coal fired power station, a significant portion of the CO_2 emissions are from biomass components in the MSW. Therefore, according to current Australian and European climate change legislation those emissions generated from the combustion of biomass components in MSW are considered to be part of the natural carbon cycle and are not reportable for Greenhouse Gas accounting purposes. The same applies to the CO_2 in landfill gas emissions, hence only the methane in landfill gas emissions is accounted for and reported by the landfill operator. Of the large global install base of 1000 or so grate-combustion type WtE facilities (with integrated heat recovery and Air Pollution Control systems), each has gone through environmental permitting and each required a licence to operate - many under stringent EU, US EPA and Japanese environmental

Submitter	Submission and/or issue	Response to comment
		standards. This track record clearly demonstrates the proposed technology is tried and proven environmentally, but importantly, it also demonstrates that the proposed technology is commercially viable.
	Mass combustion incinerators require waste supply contracts that last for up to 30 years to ensure their fuel supply. Local governments will be locked up by incinerators for decades and alternative waste treatment technologies are stymied.	To be commercially viable, WtE must compete directly with landfill i.e. landfill gate fees. As such, it is essential that the Proposal also delivers value for money to the communities whose council's contract with the Facility for the provision of a high quality, reliable resource recovery service, rather than burying those resources in landfill. Typical waste supply agreements must have a contract length similar to the debt finance term, which is typically 15-20 years. While there is always a technology risk (as there is with any technology), local governments need to weigh the benefits of locking into a low cost, highly reliable resource recovery service using current tried and proven WtE technology, against the risk of continuing to rely on landfill disposal (and paying the increasing landfill levy) while waiting and hoping that some "better" AWT technology will appear on the market. Benefits to contracted councils include: • Long-term certainty on waste management rates • Limiting legacy issues associated with landfill, both before and after closure • A commitment to a higher order outcome for residual waste over the current landfill disposal alternative It is also noted that the procurement cycle for an AWT can be 3-5+ years from tender to first operation, which is a long time to continue paying the landfill levy (assuming the landfill airspace actually exists).
	Waste management systems based around recycling, re-use and 'cool technologies' have a high employment generation potential and flow-on effects throughout the community and economy.	WtE complements recycling, composting (of source separated organics) and reuse activities. These other key elements of an integrated waste management system will continue to operate alongside the Proposal and generate jobs, while new jobs will be created by the Proposal – initially for construction, but later for Plant Management, operation and maintenance, as well as contracted support service providers (caterers, cleaners, maintenance support staff, vermin management etc.).

Submitter	Submission and/or issue	Response to comment
ACE and Public submitters	**Scale** The volume of waste should be changed to 200,000 tonnes per annum (tpa) to enable a trial run and opportunities for other projects with newer and more advanced technologies.	It is typical to design the WtE plant to take into account growth in residual waste stream volumes over time, as a result of population growth. The primary waste catchment area for the Proposal is the Southern Perth metro area, encompassing some of Perth's fastest growing suburbs and population centres. While per capita waste generation is expected to decline over time, due to better education and higher participation rates for recycling, reuse and compositing of source separated organics, total residual waste volumes are still expected to grow over the more than 20 year life of the Proposal, since each new home built will have a residual waste bin requiring collection and either disposal (to landfill) or recovery.
	The plant at full capacity is designed to handle up to 400,000 tpa of MSW which is around 20% of Perth's MSW. This is too large and undermines current waste strategies and the waste hierarchy. What happens to the waste if the plant fails?	The plant capacity is being dictated by contracted waste quantities. Western Australia (like the rest of Australia) currently does not have any installed thermal WtE capacity as part of its waste management system. The Proposal is to divert up to 100% of the residual MSW feedstock away from landfill disposal. This will have a significant and positive impact toward achieving the targeted 65% recovery rate for MSW presented for collection, as defined in WA's current waste strategy ("Creating the Right Environment" (March 2012)). With over 1000 similar facilities operating world-wide, and most under stringent environmental regulations, we are confident that we have the right technology, the right team and the right Australian State to showcase WtE to Australia. If the entire plant is shutdown (e.g. for scheduled maintenance of the steam turbine generator system) waste will temporarily be diverted to an appropriate landfill site for disposal, as described in **PER section 10.1.2.9.1 (p92)**. **Waste Hierarchy** The waste hierarchy is, in its simplest form, a guide for identifying the highest order (most beneficial) actions and activities related to waste management, through to the lowest order (least beneficial). A detailed explanation of how the proposal meets the waste hierarchy of waste avoidance, recovery and safe disposal is provided in **PER Section 10.1.1.6.1 (p63-66)**. However,

Submitter	Submission and/or issue	Response to comment
		while the Waste Hierarchy is a useful tool, it should not be applied in isolation. In its June 2013 *Communication on the Waste Hierarchy*, the Waste Authority clearly states that: "The [waste] hierarchy is not intended as a standalone assessment tool, rather, it should be used alongside other assessment tools to analyse the full environmental, economic and social impacts of waste management options." (p4). In the absence of wholesale changes to product stewardship (manufacturing processes, packaging and whole of life design) and product marketing, consumers will continue to generate waste, some of which does not have a viable reuse or recycling outcome. This is where WtE steps into the void to offer a recovery outcome rather than a wasteful and undesirable disposal outcome.
Public submitters	**Lack of Evidence and shut downs** Based on the size of the plant a shut down poses a massive risk to the community. What is the contingency plan? Will monitoring of all containments on start-up and shut down be under taken?	With over 1000 similar facilities operating world-wide, many with a similar capacity or larger than the proposal (20 or more, which use the same Martin grate technology are operated by our O&M service provider, Covanta Energy Corporation), contingencies for managing a full plant shutdown are well understood. As described earlier, agreements will be in place for waste to temporarily be diverted to an appropriate landfill site for disposal, as described in **PER section 10.1.2.9.1 (p92)**. As described in the **PER section 10.2.1.6.4 (p158)**, the Proposal will include a Continuous Emissions Monitoring System (CEMS), which will be required to operate at all times when the facility is operational, including during start-up and shutdown. This will allow the regulatory authorities to confirm that the facility remains in compliance with its licensed emission limits at all times. As described in the **PER section 10.2.1.6.1.5 (p145)**, the Proposal will employ Best Available Techniques for flue gas Air Pollution Control, which will continue to operate during start-up and shut down, during which time natural gas fuelled auxiliary burners will be utilised to either warm-up the grate-boiler system (start-up), or maintain a minimum combustion temperature, while

Submitter	Submission and/or issue	Response to comment
		waste remains on the grate (shutdown).
Lynn MacLaren MLC, ACE and Public submitters	**EPA Best Practice/Alternatives** If WtE is unpredictable as far as non-compatible waste streams being incinerated, why is this proposal being considered? There needs to be justification of best practice and energy efficiency.	As discussed in **PER section 4.2.2 (p42)**, With over 1000 similar WtE facilities operating world-wide, their performance with respect to energy recovery and emissions from processing MSW has been well researched (e.g. Whiting et al (2013) and Lamers et al (2013), as referenced in the PER) and is both predictable and demonstrable, as indicated by the extensive reference lists presented in **PER Appendices D & E**. Please refer to **PER section 5.1.1 (p44)** where the energy efficiency advantages of single step combustion processes over two-stage processes (e.g. gasification followed by combustion), as reported by ISWA (Lamers et al, 2013) are discussed.
	The proponent's claims that this technology is the best available, and states on the website that it has been in use since 1959. Has the technology evolved/improved since then? Is it the latest most up to date available?	As discussed in **PER section 4.2.2 (p42)**, the Martin grate technology was invented in the 1920s and entered commercial operation in 1959. Its massive install base, which continues to grow annually, is a reflection of the fact that it is indeed the best available technology for recovering energy and other resources from MSW. **PER section 4.2.2** also notes that grate technology providers (of which Martin GmbH is a market leader) continue to innovate and improve the operational performance and control systems, to maximise energy recovery, longevity of components and reduce the production of oxides of nitrogen (NOx), a pollutant common to all combustion processes. In addition, numerous advances and innovations have been achieved over the years in relation to the flue gas cleaning Air Pollution Control technologies and process configuration. We are using the most tried and proven Martin grate technology available.
	Please discuss alternative technologies.	Please refer to **PER section 4.2.2 (p42)** for background to the selection of the Martin GmbH grate technology over alternative processing technologies – none of which are similarly tried and proven for processing MSW at the scale of the Proposal. The issue of why Phoenix Energy selected tried and proven grate (combustion) technology has been discussed extensively earlier in this

Submitter	Submission and/or issue	Response to comment
		response document.
	Other modern WtE technology may reduce or eliminate by products, not require gas energy to operate the incinerators, not require the storage of water on site prior to incineration and process more waste products than this proposed technology.	The Proposal relates to tried and proven WtE technology in accordance with EPA Report 1468 recommendation 3, which is proven both environmentally and commercially for processing residual MSW at the same scale as the Proposal. We are not aware of any other WtE technologies, which are similarly tried and proven, nor were any identified in the independent study, which formed the basis for EPA Report 1468, *Advice to the Minister for Environment on the Environmental and Health Performance of Waste to Energy Technologies*.
	Can you confirm and guarantee that the power you will generate can be deemed "renewable"?	We can confirm that under existing federal legislation (specifically the *Renewable Energy (Electricity) Act 2000*), the combustion of the biomass components of Municipal Solid Waste for the purpose of recovering energy and generating electricity is an eligible renewable energy (electricity) generation activity. The reader is referred to Nolan ITU & TBU Environmental Engineering. (2001) *Guideline for the Determining the Renewable Components in Waste for Electricity Generation*. Office of Renewable Energy Regulator, Australian Government, Canberra.
The Waste Authority	**Traffic** The Waste Authority notes that if one of the two facilities proposed for the area proceeds, that the other should be considered for a north or east of Perth location to reduce transport impacts.	Best practice for locating WtE facilities, as evidenced by European and Japanese experience, is to locate the facility as close to the source of waste generation. This minimises waste transportation costs and emissions, and reduces transmission losses associated with transmitting the electricity generated. Of the two proposed facilities for the Southern Perth metro region, only the Phoenix Energy proposal has secured a long-term waste supply agreement with a local municipality in the region. Furthermore, the proposed location of the Kwinana WtE Project, within the Kwinana Industrial Area, incorporates existing buffer zones and offers the potential for synergies with existing manufacturing operations within the KIA.

BGC, Bel Air Homes, ACE and public submitters	A full traffic management plan is required including a study on increased traffic emissions. What is the total contribution of the operation including transport NO_X to the Kwinana air-shed?	A traffic impact assessment will be undertaken as part of the Development Application for the proposal. Emissions from trucks were specifically excluded from the assessment because the proposal will be diverting trucks which would otherwise be travelling to landfills throughout the region, to the new facility.
	There is no clear plan for transport of MSW waste from most likely Southern Rivers Region to Kwinana. Suggested traffic numbers are only 90-100 vehicles per day. If transported directly by collection vehicles there would be >140 vehicles per day (vdp) when the 200,000 tpa plant is fully operational.	The expected average daily number of truck visits to the site once operating at full capacity is expected to be ~200. This number should be considered in the context of actual typical vehicle movement data for roads in the vicinity of the proposal. Our air quality consultant ENVIRON have commented that Main Roads Western Australia (MRWA) has produced a State-wide Traffic Digest that provides data on vehicle numbers for Western Australian Roads (MRWA, 2010. Statewide Traffic Digest 2003/04 – 2008/09). Although traffic counts are not available for Leath Rd, the average number of vehicles for a typical weekday is available for Beard St (400m north of the proposed WtE facility) and Rockingham Rd (500m east of the proposed WtE facility). The average daily number of vehicles passing through Beard St for the 2006/07 reporting period was 5,580. The average daily number of vehicles passing through Rockingham Rd south of Beard St, for the 2006/07 reporting period, was 31,470 and the average daily number of vehicles passing through Rockingham Rd south of Anketell Rd, for the 2007/08 reporting period, was 29,530. The expected number of trucks visiting the proposed WtE facility (on average, ~200 per day) represents a small percentage (<3.6%) of the average weekday vehicle counts for the surrounding roads. Note that this comparison is considered conservative as the vehicle counts presented in the MRWA report are since likely to have increased since the reported periods. The latest data will naturally be considered in preparing the Traffic Impact Assessment as part of the Development Application to the City of Kwinana.
	Given the truck and vehicle movements will be concentrated around shifts (p46); the proposed traffic management study (p43) should deliver a management framework that averts traffic	Indeed, this will be an important consideration during the Development Application planning approval process.

	congestion along the Canteen Rd easement, such as a slip road. Beard St will not be able to handle the traffic queuing at the Rockingham Rd lights.	
	The proposed vehicle entry and exit point has changed from the original concept plan (p191) to avert traffic build up on Leath Rd. The Proponent has indicated its support to include Canteen Rd in a traffic management plan.	Indeed, Canteen Road will be an important consideration during the Development Application planning approval process.
	How many trucks would be required with all truck movements including deliveries, chemical deliveries, the removal of bricks etc.?	Up to ~220, but typically averaging ~200 truck visits (and departures) are anticipated each weekday (80-100 trucks in two shifts and a further 10-20 trucks for consumables and brick dispatch) when operating at full capacity.
	A traffic management plan should be commissioned by the proponent for the site, Leath Rd, and other affected corridors in Kwinana, for the 170-220 trucks and service vehicles movements daily. When will this be done and who will review and approve it.	Traffic management will be a key consideration of the Development Application (planning) approval process being undertaken in parallel for the Proposal.
	Discussions in the PER refer to proposed improvements in roads within the area, and the PER states that “the redirection of waste trucks to the KIA is not expected to significantly impact existing waste transportation distances or truck movements on major roads…”	
	The PER outlines the receiving of waste of 2 by 2 hour shifts per day, 80-100 truck movements per shift. This would cause a major traffic burden along Rockingham Rd via the Beard St intersection and pollution, inconvenience, cost and danger to the community that traffic congestion entails.	It has been noted earlier that many of the trucks bringing waste feedstock to the WtE plant will already be carrying waste to landfill on surrounding roads. The 80-100 truck movements per shift should be considered in the context of overall traffic movements on the surrounding roads, as discussed above. This will be an important consideration of the Traffic Impact Assessment for the Development Application (planning) approval process being undertaken in

		parallel for the Proposal.
Lynn MacLaren MLC and public submitters	**Phoenix/Covanta** PE has stated Covanta will manage the plant. Covanta has a record of 100s, even 1000s of complaints against them for the way that they run plants. How will PE ensure that the plant is running to the law? PE has no record in building or running incinerators.	Covanta Energy Corporation has been selected as the O&M service provider because of their excellent track record in reliable service delivery (with boiler availability in excess of 90% across its portfolio) and an excellent environmental track record. For a company such as Covanta Energy Corporation, whose reputation and future growth prospects (for their shareholders) hinges on the high quality of resource recovery service delivery, high boiler availability, and ensuring compliance with its operational licence conditions, a compliance failure is a very big deal. The following programs have been implemented by Covanta to ensure its compliance (Covanta Corporate Sustainability Report 2010/11 (released 2012)): • A full-scale research program to evaluate alternative methods of managing air emissions • A targeted program (root cause analysis) in the event of any potential failure or exceedance • A policy linking compensation for all employees (facility and corporate) to 100 percent compliance with permit conditions. Noncompliance events have a direct negative effect on individual compensation The Kwinana WtE project and contracted councils stand to benefit from Covanta's worldwide knowledge base of lessons learnt and asset management over the 20+ year operating life of these facilities, leading to high levels of boiler availability and an ongoing effort to ensure 100% compliance with operating licence conditions, throughout the life of the facility. Phoenix Energy has 35 years' experience in large scale power station, construction, commissioning and operation, and waste management (including Alternative Waste Treatment). As such, we are uniquely placed to develop Waste to Energy projects. In developing WtE projects, our role is to identify the most appropriate WtE technology, provided by a reputable technology provider, and then partner with local and international professional

		services firms with expertise in engineering, construction, operation and maintenance of WtE facilities.
	PE does not explain the WA environmental laws compared to Japanese environmental laws.	The Kwinana WtE Project will be designed to comply with WA environmental law and regulations, and the recommendations of the WA EPA (e.g. report 1468 recommendation 8, which relates to adopting European best practice emission standards).
	Will there be insurance from PE regarding law suits from contamination or disasters at the plant?	The Kwinana WtE Project will have insurance policies typical of those required by overseas WtE plant operators.
	Is it true that there are limited company financial resources to cover any law suits?	This is not a relevant concern in relation to the Proposal, however appropriate parent company guarantees will be provided by the shareholders to the project.
	Who will buy the electricity if there is an oversupply in WA?	Kwinana WTE Project Co Pty Ltd will enter into a long term Power Purchase Agreement (PPA) in relation to the electricity generated by the Proposal.
	What is the break-even tonnage gate fee in the Phoenix financial model and what are the anticipated fees?	This is confidential information.

Kwinana Industry Association (KIA) and public submitters	**Other** The WtE proposal is supported by the KIA.	The support of the Kwinana Industries Council is gratefully accepted and appreciated. The KIC is well aware of the potential benefits and synergies that the proposal will bring to its members in the Kwinana Industrial Area.
	There needs to be a visual impact study. Will one be conducted and who will approve it?	The Development Application and future Building Approval process will provide an opportunity for assessment of the visual impact of the proposal by the City of Kwinana. That said, **PER Figure 2 (p35)** shows that the proposal will be a striking architectural building, much more in keeping with a major urban area than a heavy industrial area. This is deliberate, since the Proposal will be a showcase of WtE to the rest of Australia, and something all Western Australians can be proud of.
	There needs to be an impact study on the marine environment of Cockburn Sound including from contaminants from the plant.	The potential impacts of the proposal on Cockburn Sound are described in **PER section 10.2.1.6.3 (p155)**. The air quality consultant concluded that "The contribution of emissions from the proposed WtE facility to the total dioxin and furan emissions released within the Kwinana airshed is therefore expected to be negligible. The predicted deposition rate associated with such emissions would also be expected to be negligible, particularly in comparison to other significant regional sources including bushfires, motor vehicles and domestic fuel burning."
	Significant "fatal-flaws" exist that have not been addressed, and additional studies are highly recommended for traffic impact and management plan, flora and fauna impact, waste characterisation forecast, waste tonnages forecast, process water studies, rainwater and groundwater studies.	**Additional studies:** • A traffic impact assessment will be undertaken as part of the Development Application for the Proposal. • A flora and fauna impact assessment is not required to be undertaken since there is less than 5 ha of land to be cleared and because the proposal is consistent with the principles of native vegetation cleaning. Please refer to **Section 2 Flora and Vegetation/fauna** for further details. • An updated waste characterisation forecast will inform the upcoming detailed design, and therefore the Part V Works Approval and Licensing stages for the Proposal • Confidential waste tonnage forecasts have been developed by

		participating councils under Waste Services Agreements • Water management (including process water re-use and rainwater reuse) will be an important aspect of the detailed design, and therefore the Part V Works Approval and Licensing stages • The stormwater management philosophy is addressed in **PER sections 10.1.1.6.6 (p81) and 10.1.1.6.8.8.2 (p86-87)**, with the latter also dealing with how sewage will be managed on-site. These management plans will be assessed during the assessment of the Development Application and during the Part V Works Approval and Licensing • A groundwater monitoring study was undertaken on the site by Golder Associates in 2003/4 for the land owner, LandCorp. That study, which is documented in a report by Golder Associates entitled *Report On Petroleum Hydrocarbon Contamination Monitoring Feature E4-1, HIsmelt Project Office Risely and Leath Roads Site Kwinana WA* (2005) involved a 12 month groundwater sampling and testing program in the vicinity of an underground heating oil tank, which was excavated during a 2003 site decontamination and remediation project. The 2005 Golder report on the groundwater monitoring study notes that "The chemical and physical parameters measured during the groundwater monitoring rounds consisted of total petroleum hydrocarbons, monocyclic aromatic hydrocarbons, pH, redox potential, dissolved oxygen, nitrate, ferric iron, carbon dioxide, methane and alkalinity, which were considered the most appropriate to monitor petroleum hydrocarbon contamination and the associated natural attenuation processes for this type of contamination." Golders (2005) concludes: "The results of the monitoring program indicate that no groundwater contamination has resulted from the impacted soils remaining beneath the HIsmelt Project Office Building. In addition, there is no evidence that the concentrations of the contaminants remaining beneath the Building are sufficient to cause further groundwater contamination in the event of a change in either the groundwater flow direction or in a change in the geochemical conditions in the aquifer." Consequently, the monitoring program was

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<td>The alternatives of NRG plasma gasification system to make pavers and the AlgaeTech to reduce the carbon dioxide emissions have not been discussed.</td>
<td>stopped. The Proposal will have zero process waste water discharge, and, as described in the PER, surface water and groundwater will be protected through both design and management approaches.

The use of plasma gasification technology and Algae.Tec technology are not part of the Proposal and therefore, are not relevant to the PER.</td>
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<td>The proponent has failed to address the following:
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<tr><th>EPA requirement</th><th>EMRC compliance level.</th></tr>
<tr><td>1. Given the likely community perception and concern about waste to energy plants, a highly precautionary approach to the introduction of waste to energy plants is recommended.</td><td>The South Metro regional community has long suffered its trial of new waste management processes. To consider several new and in the case of a high temperature incinerator (HTI) locally untried technology in the disposal of municipal waste is neither precautionary nor in alignment with the community's wishes. More so in an area already environmentally stressed with waste disposal and high emission industries, downwind of a new industrial estate.</td></tr>
<tr><td>2. As part of the environmental assessment and approval, proposals must address the full waste to energy cycle -</td><td>"waste to energy technologies should not replace management options higher up the waste hierarchy".
This proposal only</td></tr>
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<td>Phoenix Energy and our project partners stand by our response to EPA recommendation 1 (PER Table 3 (p19)). Our proposed tried and proven WtE technology is well supported by the independent study which informed EPA Report 1468, Advice to the Minister for Environment on the Environmental and Health Performance of Waste to Energy Technologies.

Phoenix Energy and our project partners stand by our response to EPA recommendation 2 (PER Table 3 (p19)). The proposal deals with a wide range of activities beyond the combustion of waste for the purpose of generating base load renewable energy from waste otherwise destined for landfill disposal, including:</td>
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	from accepting and handling waste to disposing of by-products, not just the processing of waste into energy.	discusses the burning of waste.	• Accepting residual MSW for energy recovery • The recovery of recyclable ferrous and non-ferrous metals • The recovery of solid residuals to create value added alternative construction materials such as bricks, pavers and aggregate • The important role the Proposal will play in enhancing awareness and education about waste management, to drive better outcomes in relation to source separation and participation rates in waste diversion programs, with the on-site Education & Training Centre and plans to conduct plant tours and Open Days.
	4. Waste to energy proposals must characterise the expected waste feedstock and consideration made to its likely variability over the life of the proposal.	Given the continuous delivery/tipping of waste into the 'bunker', there is unlikely to be sufficient time for the waste to be assessed and characterised, particularly from the perspective of hazardous wastes.	**PER section 10.1.1.6.3** provides details on the composition of the proposed feedstock and discusses potential variability of the feedstock composition. It is not necessary to characterise each load of waste delivered to the facility, nor is it feasible to do so. Indeed the reason for selecting the Martin grate stoker technology is because of its inherent robustness and flexibility, to be able to efficiently recover the embodied energy in the feedstock, even as the feedstock composition varies season to season and over time. This is clearly evidenced by the technology reference list in **PER Appendix D**, which lists numerous reference sites processing MSW for decades.
	5. The waste hierarchy should be applied and only waste that does not have a viable recycling or reuse alternative should be used as feedstock. Conditions should be set to require monitoring and reporting of the waste	As the waste is burnt rather than composted or treated for re-use there is very little incentive for them to sort the waste. There would be no attempt to recover recyclables from the MSW before directly burning it. This contradicts the Waste Hierarchy and Recommendation 5. Only	Phoenix Energy and our project partners stand by our response to EPA recommendation 5 (**PER Table 3 (p20)**). The proposal will accept residual waste subjected to source separation by the householder and otherwise destined for landfill disposal (not compositing). The reasons for not including expensive and energy intensive upfront pre-treatment or pre-sorting of the waste feedstock are detailed in **PER section 5.1.2.1 (p47)**. The bottom line is that international best practice is to empower the householder rather than to force rate payers to pay for something which is unnecessary and, if education campaigns are successful, will ultimately become redundant. This is consistent with the WA Waste Authority's *Communication on the Waste*

	material accepted over the life of a plant.	waste that has been recycled first should be put through as feedstock. There is no pre-separation, relying entirely on the householder to pre-sort at the kerbside.	*Hierarchy* (June 2013), which states: "The waste hierarchy is intended to be used alongside other tools (including economic, social and environmental assessment tools) to inform decision making." (p2)."
	8. 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 (EU) Waste Incineration Directive (WID) (2000/76/EC) 1.	A number of HTI's in Europe and America have been closed or shut down because they have exceeded emission standards. Phoenix Energy's (PE) proposal is to develop this part of their Operation Manual during 'detailed design phase'.	Phoenix Energy and our project partners stand by our response to EPA recommendation 8 (**PER Table 3 (p20)**). While it may indeed be the case that some older WtE facilities have been retired because it was too expensive to upgrade their APC systems to meet modern emission standards, with more than 1000 (and growing) WtE plants operating around the world (mostly in Europe, the UK, the USA and Japan), it is quite clear that the community can be confident that modern WtE facilities do operate safely and meet their regulatory emissions obligations. It is noted that the Part V Works Approval process will review the proposed APC system design in more detail than is feasible under this Part IV PER process.
	9. Pollution control equipment must be capable of meeting emissions standards during non-standard operations.	This technology relies heavily on the air quality system. There is no modelling for system or boiler failure.	Phoenix Energy and our project partners stand by our response to EPA recommendation 9 (**PER Table 3 (p21)**). PER section 10.2.1.6.5.1 (p159) details the typical operating procedure and response to a failure of a component of the Air Pollution Control system. The Air Quality modelling considered a conservative case of the entire plant operating at full capacity with all emissions at their WID/IED limit values. It is important to note that

			each grate-boiler line has its own dedicated APC system and operate independently of each other.
	10. Continuous Emissions Monitoring must be applied where the technology is feasible to do so (e.g. particulates, TOC, HCl, HF, SO2, NOx, CO). Non-continuous air emission monitoring shall occur for other pollutants (e.g. heavy metals, dioxins and furans) and should be more frequent during the initial operation of the plant (minimum of two years after receipt of Certificate of Practical Completion). This monitoring should capture seasonal variability in waste feedstock and characteristics. Monitoring frequency of non-continuously monitored parameters may be reduced once there is evidence that emissions standards are being consistently met.	The PER assumes that there will be no significant seasonal (such as Christmas) or long term viability in MSW streams from mobile bins. The proponent should justify these assumptions.	Phoenix Energy and our project partners stand by our response to EPA recommendation 10 (**PER Table 3 (p21)**). That said, the PER contemplates significant variability in MSW composition e.g. the impact of introducing a 3rd bin for source separation of green organic waste. Please refer to **PER section 10.1.1.6.3 (p74)** where the inherent flexibility and robustness of the Martin grate stoker technology is discussed. Furthermore, there is no reason to believe that a technology which is deployed in 33 different countries will be unable to cope with waste generated by households in WA. Experience at the 21 WtE plants in Tokyo have shown that over 25years of operation the technology has been able to quite readily process waste streams that have changed within that period. This outcome is consistent with European and US experience.

	11. Background levels of pollutants at sensitive receptors should be determined for the Environmental Impact Assessment process and used in air dispersion modelling. This modelling should include an assessment of the worst, best and most likely case air emissions using *appropriate air dispersion modelling* techniques to enable comparison of the predicted air quality against the appropriate air quality standards. Background monitoring should continue periodically after commencement of operation.	The air modelling should be independently reviewed as air emissions are very important for a facility of this size.	Air quality modelling experts from the Department of Environment Regulation Air Quality Branch have reviewed and commented on both the model inputs and the model results.
	12. To address community concerns, proponents should document in detail how dioxin and furan emissions will be minimised through process controls, air pollution control equipment and during non-standard operating	The following are unanswered: Control during non-standard operating conditions is not responded to by the proponent here.	Phoenix Energy is confident that the selection, design and operation (control) of the Air Pollution Control system will be capable of meeting emission standards during both standard and non-standard operations. Our confidence is based on the following project fundamentals: • APC equipment design and selection will be carried out by MHIEC. MHIEC has designed and built almost 100 Mitsubishi-Martin WtE plants (see **PER Appendix E**). • Critical equipment items will include duty/standby arrangements and/or secure power supplies, all of which will be reviewed during the Hazard and Operability (HAZOP) studies, which will be undertaken as

	conditions.	While pre-mixing may well reduce the concentrations of chlorinated wastes being burnt, it does not mitigate the accumulating amount of toxic products over periods of time. Given the size of this operation it may be that the time that the contents of the waste bunker take to be consumed may well be	a matter of course during the detailed engineering design, to be undertaken by MHIEC • The facility will generate its own electricity, even if one line is off-line for maintenance or due to equipment failure, thus providing a high level of security for the electrical power supply for parasitic loads • With two grate-boiler lines operating independently and in parallel, both the steam system and the electricity generation system will have an inherently high level of availability and reliability to service the parasitic steam and electricity needs of the facility, and especially the APC system • Unlike other WtE technologies, the Mitsubishi-Martin designed WtE facility does NOT have a bypass around the APC system, thus all flue gases generated in the boiler must pass through the APC system under all operating scenarios. This is different to the configuration of some WtE technologies, which use gasification to generate a flammable syngas and are therefore required to employ an emergency bypass flare system. • The Continuous Emissions Monitoring System (CEMS) will continue to monitor the flue gas composition during all operating conditions • The minimum combustion temperature requirement of 850^{o}C for 2 seconds will be an operating requirement whenever there is waste on the grate. In relation to the first part of this comment, this is indeed reason why the Air Pollution Controls for potentially toxic pollutants are designed such that pollutants are removed to the maximum extent achievable and why the regulatory limit value for compounds such as dioxins are set so low. Premixing of the waste is but one mitigating factor in managing the formation or generation of potentially toxic compounds in the combustion process. The next mitigating factor is the careful control of the combustion conditions, by managing the feed rate of fresh waste to the grate, as well as primary air injection. Once combustion occurs, the secondary combustion air and recirculating flue gas helps to maintain combustion conditions well above the

		quite short, say a few days, and so the level of pollutants from even well mixed MSW may well exceed limits.	temperature at which dioxins can exist. If there is insufficient waste to maintain the combustion temperature without assistance, the auxiliary burners provide a back-up to ensure that flue gas temperatures do not drop below 850 ^{o}C for the required 2 second residence time in the combustion zone (discussed further below). De-novo dioxin formation is mitigated through the use of a rapid quench, to rapidly cool the flue gas exiting the boiler, while final scrubbing of organics and heavy metals is carried out through the injection of activated carbon upstream of the fabric filter baghouse. This final stage is referred to as Maximum Achievable Control technology. It is this combination of mitigation and control actions, which will ensure that the Kwinana WtE project achieved best practice emission control when processing locally generated residual MSW.
		How easy is it to maintain flue gas temperatures at 850 degrees Celsius (deg C) (minimum) even for only two seconds? This suggests that the European Union (EU) Waste Incineration Directive (WID)/Industrial Emissions Directive (IED) will not be met by anything less than 850 deg C and that below that temperature would produce exceedances. This all argues that the safe operating limit is critical, more critical than the proponent is willing to admit. It is also clear that even at this temperature there are emissions of these carcinogens.	The minimum allowable combustion temperature of 850^{o}C is approximately 200^{o}C below normal operating temperature for the boiler. The combustion chamber temperature is readily controlled by the automated combustion management system, which adjusts the introduction of new feedstock to the grate, the injection of primary combustion air (under the grate) and secondary air (above the grate). Temperature measurement instruments, in the critical combustion zone above the grate, provide input to the combustion management system. This in turn can call upon the natural gas fired auxiliary burners, if there is insufficient fuel on the grate or insufficient heat from combustion of the fuel on the grate, in order to maintain the combustion temperature at or above 850 ^{o}C. The control of combustion conditions is the first stage in the mitigation and management of dioxins. Downstream, the flue gas quench (to quickly reduce the flue gas temperature leaving the economiser section of the boiler) provides a second stage, while the injection of activated carbon upstream of the baghouse completes the task and is the international benchmark for best practice maximum achievable control (through adsorption) of residual chlorinated and fluorinated organic compounds, prior to flue gas dispersion from the stack.

		The proponent blithely states that "the sizing of the multi-flue stack will ensure that the minute amounts of dioxins and furans which may be present in the flue gas after scrubbing and cleaning are fully dispersed…" This sounds like magical thinking. Making the stack higher sends the toxins away!	The above processes work together to ensure that emissions of dioxins and furans are well below regulatory limit values at all times, while the flue gas stack is sized such that dispersion of the flue gas (with any trace pollutants) ensures that ground level concentrations will remain well within environmental standards, as demonstrated by best practice air dispersion modelling techniques.
	13. Proposals must demonstrate that odour emissions can be effectively managed during both operation and shut-down of the plant.	The response to Recommendation 13 is not adequate.	Phoenix Energy and our project partners stand by our response to EPA recommendation 13 (**PER Table 3 (p22)**). Our project partners have a great deal of operating experience in both designing and running these facilities to ensure odours are readily managed. It is noted that there are no buffer zones around any of the 21 WtE plants operating in Tokyo city, as is also the case for many such facilities throughout Europe. As such, each of these facilities must be able to (and DO) manage air quality, odour, dust and noise effectively in order to remain in compliance with environmental regulations, to remain operational.
	14. All air pollution control residues must be characterised and disposed of to an appropriate waste facility according to that characterisation.	There is concern with the proposal to use fly ash in brick making. There is no thorough analysis of the health and safety impacts.	*Material Guideline Schedules* for waste derived products will be developed in consultation with the DER for all alternative construction products (bricks, pavers, aggregate etc.), which are proposed to be manufactured by the Proposal. The testing regime associated with those *Material Guidelines* along with the Part V Licensing approval process, will ensure that the proposed use of fly ash in brick making is safe with respect to health and safety impacts, as well as environmental impacts and that the products are fit for purpose with respect to applicable construction codes.
	15. Bottom ash must be disposed of at an appropriate landfill	It's not clear what "market failure" for by products means. If it means that the	A 'market failure', in this context, occurs when there is no market for either the sale or use of a product i.e. there are no known customer(s) or user(s) with an available and regular need for the product. If a product does not meet

	unless approval has been granted to reuse this product.	market rejects the product for some non-chemical reason; the use of landfill would increase markedly and claims of this benefit for the plant would have to be reassessed. If those words mean that the product fails the leaching tests and the product is declared to be a risk to the community health at some point following marketing and use in projects, what will be done with the bricks already laid for houses or as pavers? Who will be responsible for the clean-up?	its regulatory testing requirements it will either be re-processed, or, subject to regulatory testing requirements, sent to an appropriately licensed landfill for disposal. Naturally the use of any alternative construction materials will be carefully regulated by the DER, and it is expected that a new *Material Guideline* will be developed in consultation with the DER for each of the waste-derived by-products produced by the WtE facility. This has been flagged to the DER during the recent industry consultation period for the DER's *Draft guidance statement: Regulating the use of waste-derived materials*. In any case, WtE is the most effective large-scale landfill diversion option, typically achieving a reduction in volume (relative to the incoming feedstock) of 90%. In Europe, where bottom ash is reused for construction purposes and in Japan, where both bottom ash and fly ash are converted to construction products, landfill diversion rates can reach 100%. The inference that PMET experience is limited to 'industrial waste' (**PER p97**) is an oversight on our part. The letter from PMET provided in **PER Appendix J** clearly states "Our experience with MSW ash in the US has not indicated a need to change mixes over calendar time." Further details on residue testing and by-product testing requirements are provided in **Section 3 Responses to Important Matters to be Addressed**.
	16. Any proposed use of process bottom ash must demonstrate the health and environmental safety and integrity of a proposed use, through characterisation of the ash and leachate testing of the by-product. This should include consideration of manufactured nanoparticles.	The response is inadequate. The Pittsburgh Mineral Environmental Technology, Inc's (PMET's) letter does not contain "testing requirements", only suggestions. The EPA/DER should increase this to requirements for both bottom and fly ash. Also PMET's letter refers only to residues from industrial waste, not to residues from burning MSW (PER page 97).	

	17. Long term use and disposal of any by-product must be considered in determining the acceptability of the proposed use.	The plan is to crush the non-confirming bricks and transport waste to a secure landfill. This action would seriously reduce the plants energy and financial efficiency.	Indeed, any reliance on landfill disposal will have a negative impact on the financial performance of the facility. As such, every effort will be made to establish markets for by-products and to ensure that those by-products are appropriately tested and demonstrated to meet their DER approved *Material Guidelines* for the use of waste derived materials.
	18. Standards should be set which specify the permitted composition of ash for further use.	What standards are applied for leaching tests of heavy metals or other hazardous chemicals?	Standards for by-products (mechanical or civil/construction performance) and for testing (including leach testing) will be agreed with the DER as part of an approved *Material Guideline Schedule* for each by-product.
	19. Regular composition testing of the by-products must occur to ensure that the waste is treated appropriately. Waste by-products must be tested whenever a new waste input is introduced.	PE's documented test plans suggest that there will be regular (monthly) testing during the first year of operation. Following that the frequency is not specified. This is not adequate.	Standards for by-product testing (including leach testing) will be agreed with the DER as part of an approved *Material Guideline Schedule* for each by-product.
	20. Waste to energy plants must be sited in appropriate current or future industrial zoned areas with adequate buffer distances to sensitive receptors. Buffer integrity should be maintained over the life of the plant.	LandCorp's new Industrial Park (Flinders Precinct) on Armstrong Rd is directly in line with the prevailing wind and within 2 km of this facility. Further it is elevated some 50-60 m above the incinerator.	Phoenix Energy and our project partners stand by our response to EPA recommendation 20 (**PER Table 3 (p24)**). The results of the Air Quality assessment clearly demonstrate that, as proposed, the Proposal will comfortably comply with all current ground level standards, which are set to protect the environment and human health.
	21. For a waste to energy plant to be considered an energy	The PER states that the same best practice design techniques used in	Phoenix Energy and our project partners stand by our response to EPA recommendation 21 (**PER Table 3 (p24)**). Phoenix Energy will be guided by

	recovery facility (i.e. not a disposal facility) , a proposal must demonstrate that it can meet the R1 Efficiency Indicator as defined in WID.	European municipal solid waste (MSW) incinerators will be employed to achieve the relevant R1 efficiency factor. What parts of the incineration and energy recovery process would be included as measurement points for energy efficiency, in order to ensure a correct calculation of the R1 formula. Please provide independent calculations. If there is no long term viable (subsided) market for the supply of power and heat, this could lead to PE taking other commercial/industrial waste products to make their operation viable.	our project partner experience and the EC *Guidelines on the interpretation of the R1 energy efficiency formula for incineration facilities dedicated to the processing of municipal solid waste according to the processing of municipal solid waste according to Annex II of Directive 2008/98/EC on waste* (please refer to **Appendix F**) when establishing what parts of the process would be included as measurement points for energy efficiency, in order to ensure correct application of the R1 formula. **From ANNEX 5:** 1.1 amount of incinerated waste **1 E_w: energy input to the system by waste (MWh)** 2.1 $E_{f\,1}$: amount of natural gas for start-up and keeping incineration temperature Nm^3 **2 S E_f: energy input by imported energy with steam production (MWh)** 3.2 Ei 2: e.g. natural gas for heating up of flue gas temperature for SCR and start-up/shut down Nm^3 3.3 $E_{i\,3}$: imported electricity (multiplied with the equivalence factor 2.6) 3.4 $E_{i\,4}$: imported heat (multiplied with the equivalence factor 1.1) **3 S E_i: energy input by imported energy without steam production (MWh)** 4.1 $Ep_{el\ internal\ used}$: electricity produced and internally used for the incineration process (MWh) 4.2 $Ep_{el\ exported}$: electricity delivered to a third party (MWh) **4 S $Ep_{el\ produced}$ = $Ep_{el\ internal\ used}$ + $Ep_{el\ exported}$ (MWh)** 5.1 $Ep_{heat\ exp.1}$: steam delivered to a third party without backflow as condensate 5.2 $Ep_{heat\ exp.2}$: district heat delivered to a third party with backflow as condensate (hot water) **5 S $Ep_{heat\ exported}$ = $Ep_{heat\ exp.1}$ + $Ep_{heat\ exp.2}$ (MWh)** 6.1 $Ep_{heat\ int.used1}$: for steam driven turbo pumps for boiler water, backflow as steam 6.2 $Ep_{heat\ int.used2}$: for heating up of flue gas with steam, backflow as condensate 6.4 $Ep_{heat\ int.used5}$: for soot blowing without backflow as steam or condensate 6.5 $Ep_{heat\ int.used7}$: for heating purposes of buildings/instruments/silos, backflow as condensate 6.6 $Ep_{heat\ int.used8}$: for deaeration- demineralization with condensate as boiler water input 6.7 $Ep_{heat\ int.used9}$: for NH_4OH (water) injection without backflow as steam or condensate (if applicable) **6 S $Ep_{heat\ int.used}$ = S $Ep_{heat\ int.used1-9}$ (MWh)** R1 = (Ep - (Ef + Ei)) / (0.97 * (Ew + Ef)) ***Where Ep = 2.6*(S $Ep_{el\ int.used}$+S $Ep_{el\ exported}$) + 1.1*(S $Ep_{heat\ int.used}$+S $Ep_{heat\ exported}$)* (MWh)**

		Can you confirm and guarantee that the power you will generate can be deemed "renewable"? How do you substantiate your claims of the amount of power you will generate at this facility? Can this be guaranteed? Does the energy efficiency meet the EPA Guidelines?	Calculation of the R1 efficiency factor will be undertaken once location specific process design information is available. Otherwise, too many assumptions would be required and the results would not be meaningful. It is proposed that the calculation of the R1 efficiency factor will occur at Part V Works Approval stage. This question has been asked and addressed earlier in this response document. The amount of power generation presented in the PER is an estimate based on the typical performance of a modern WtE facility. Power generation will be determined in more detail during the engineering design. Phoenix Energy and our project partners stand by our response to EPA recommendation 21 (**PER Table 3 (p24)**).
Public submitters	**Greenhouse Gases** Claims that the project (PER p 177) includes "a large reduction in potential greenhouse gas emissions…, potential to provide a renewable energy source (as high pressure stream) for neighbouring facilities currently utilising fossil fuel fired boilers…renewable alternative to existing base load fossil generation while supplementing existing intermittent renewable electricity generation from wind and solar."		While an assessment of GHG emissions was not part of the Environmental Scoping Document work requirements for the proposal, a high level assessment has been included to demonstrate how the facility is expected to be a net GHG sink, once all abatements are taken into consideration. The assessment, contained in **PER section 10.1.1.6.2 (p73)**, shows that the abatement of baseload fossil fuel based electricity generation alone outweighs the reportable CO2-e emissions from the facility, even before accounting for avoided landfill gas emissions.

	The tables for comparison of greenhouse gas emissions are incomplete. They do not take into account construction on the plant, trucking and the opportunity cost of burning things like plastics and timber which could either be reconstituted or reused with little or no emissions. Also left out is the effectiveness of methane extraction from landfill, and the fact that burning carbonaceous materials releases all or most of the carbon while landfilling it ensures that much will remain sequestered for many years while that portion converted to methane can provide somewhat cleaner fuel than coal or oil. Other energies are not discussed such as solar thermal, wind and algae. More accounting of CO_2 emission comparison should be completed before the proponent could claim "clean energy". The greenhouse gas modelling needs to be specific to Perth and a study is recommended.	GHG emissions from trucks were specifically excluded from the assessment because the proposal will be diverting trucks which would otherwise be travelling to landfills throughout the region, to the new facility. It is noted however, that once the local landfills are full, the policy of no new landfills on the Swan Coastal Plain will mean that (in the absence of the proposal); trucks carrying waste will have to travel further distances to remote landfill sites. Such potential avoided emissions have not been considered. There is insufficient information to adequately assess GHG emissions associated with construction. However, it is noted that construction will occur over a relatively short period (~2 years), while the plant will operate for more than 20 years. The impact on cost, energy, materials and land associated with including an unnecessary upfront sorting process to recovery the small fraction of recyclable materials, which may end up in the residual MSW feedstock, is expected to far outweigh the benefits associated with any recoverable recyclate. **PER section 10.1.1.6.2 (p72)** clearly notes "net greenhouse gas emissions are estimated to be up to –584,350t CO2-e/yr (i.e. a net reduction), once all offsets are taken into consideration and *in the absence of any landfill gas capture for either flaring or electricity generation*." Data from the *Australian National Greenhouse Gas Inventory Report 2012* identifies that WA had an average capture rate for methane emissions form landfill of 30%. Using the State average as a guide, the overall net reduction in GHG emissions associated with the proposal is still estimated at 440,350t CO_2-e/yr.

4.2 Flora and Vegetation/fauna

Submitter	Submission and/or issue	Response to comment
South West Group (SWG) and Lynn MacLaren MLC and Public submitters.	There are no studies up front for flora and fauna involved in the vegetation clearing. The site proposed to be cleared is the only significant stand of healthy native vegetation within a 1 kilometre (km) radius of the proposed plant. Full surveys should be carried out. The SWG considers that the PER does not contain sufficient information to assess the impact on the loss of remnant vegetation. The proponent should conduct a flora survey of the site and prepare a species list. Is there any Declared Rare Flora or rare fauna? The wider location, and possibly the site, is known habitat for the Southern Brown Bandicoot, which is a rare fauna species protected under State legislation. It is common practice for proponents to offset loss of vegetation or habitat through the replanting of other areas nearby to ensure that there is no loss of biodiversity values.	It was unnecessary to undertake flora and fauna studies specifically for the PER, nor were any requested in the Environmental Scoping Document (ESD) issued by the EPA in relation to the PER for the proposal. Consideration has been given to the Ten Clearing Principles: **Principle 1**: Vegetation should not be cleared if it comprises a high level of biological diversity. **Principle 2**: Vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia. **Principle 3**: Vegetation should not be cleared if it includes, or is necessary for the continued existence of rare flora. **Principle 4**: Vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community. **Principle 5**: Vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared. **Principle 6**: Vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland. **Principle 7**: Vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation. **Principle 8**: Vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area. **Principle 9**: Vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water. **Principle 10**: Vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding. The nearest neighbour on the eastern boundary of the development envelope

Submitter	Submission and/or issue	Response to comment
		recently applied for and was granted a clearing permit (please refer to **Appendix D**, obtained from the public record) covering the clearing of not more than 6 ha of land in relation to an adjoining industrial development on the same Lot. With reference to the area hatched in yellow on the Plan 5251/1 in **Appendix D**, it can be seen that the vegetation subject to clearing also includes a portion of the same area of vegetation which will need to be cleared to make way for buildings, roadways and fences associated with the Kwinana WtE Project. The Clearing Permit Decision Report (CPDR), which accompanies the Clearing Permit in **Appendix D**, considered each of the 10 Clearing Principles noted above. The CPDR indicates that the DER conducted an inspection and a review of aerial imagery. In the DER's assessment, the proposed clearing is not likely to be at variance to with any of the 10 principles. The DER notes the degraded condition of the vegetation, the lack of large trees and native understorey, and concludes that "it is unlikely that the application area provides significant habitat for fauna". Furthermore, the DER notes that "There are 14 records of rare flora within the local area (10 kilometre radius). Only one record occurs on the same mapped soil and vegetation type as the application area. Given the condition of the vegetation under application and that it is not representative of the mapped vegetation type, it is unlikely that this species occurs within the application area." With reference to DER Native Vegetation Fact Sheet 9 (included as **Appendix E**), clearing for certain types of activities (as listed in the Fact Sheet) which do not involve an environmentally sensitive area and relates to less than 5 ha to be cleared within a financial year, will be exempt from obtaining a clearing permit. The 6 ha of clearing associated with the neighbouring development was completed during the past financial year, while the Kwinana WtE Project involves the clearing of less than 1 ha of vegetation, for the purposes of constructing buildings, roadways and fences. In our assessment, none of the above clearing principles will be compromised by the Proposal because:

Submitter	Submission and/or issue	Response to comment
		• The land is zoned Industrial and the majority has already been cleared due to past land use activities. • The State government (the current land owner i.e. LandCorp) has overseen extensive assessment and remediation (by the former land owner) of the parcel of land identified as Lot 9500 (formerly Lot 14), of which only a small portion is associated with the Kwinana WtE Project proposal. • The PER identifies that only a small section of native vegetation and/or regrowth (< 1 ha) will require clearing to make way for buildings, roads and fences. Furthermore, the vegetation "is generally in a degraded condition, surrounded by existing heavy industry and a services easement. As such, it is not considered to be significant habitat for indigenous fauna, nor is it important for biodiversity in the region." (**PER, section 9.4, p60**). "As such, clearing of this vegetation is assessed as being insignificant with respect to representation, diversity, viability and ecological function at the species population and community level for flora, vegetation and terrestrial fauna. This assessment is based on the following observations: a) the vegetation on the site is unlikely to be considered significant habitat for indigenous Western Australian fauna, b) the site is approximately 2.5 km from the nearest wetland and is hydrologically up-gradient, and c) the site is approximately 2.5 km from the nearest Bush Forever site." (**PER section 10.4.1.3.1, p169**) On this basis, it has been assessed that there is no requirement to undertake additional flora and fauna studies beyond those which have been undertaken in the past for the current Land Owner (LandCorp), and by the DER (please refer to **Appendix D**), and there should be no restrictions placed on the clearing of the small parcel of vegetation associated with the development of the Proposal.

4.3 Inland Waters Environmental Quality

Submitter	Submission and/or issue	Response to comment
Lynn MacLaren MLC, Bel Air Homes and public submitters.	There are no upfront studies to support claims that groundwater is not an issue. It is suggested that prior to approval attention is given to how it is kept clean and managed safely without contamination to the groundwater.	A groundwater monitoring study was undertaken on the site by Golder Associates in 2003/4 for the land owner, LandCorp. *That study, which is documented in a report by Golder Associates entitled Report On Petroleum Hydrocarbon Contamination Monitoring Feature E4-1, HIsmelt Project Office Risely and Leath Roads Site Kwinana WA* (2005) involved a 12 month groundwater sampling and testing program in the vicinity of an underground heating oil tank, which was excavated during a 2003 site decontamination and remediation project. The 2005 Golders report concludes: "The results of the monitoring program indicate that no groundwater contamination has resulted from the impacted soils remaining beneath the HIsmelt Project Office Building. In addition, there is no evidence that the concentrations of the contaminants remaining beneath the Building are sufficient to cause further groundwater contamination in the event of a change in either the groundwater flow direction or in a change in the geochemical conditions in the aquifer." Consequently, the monitoring program was stopped. **PER section 10.1.1.6.8.8.2 (p86)** describes in detail how surface water and groundwater quality will be protected during operation. The Proposal does not seek to extract and use any groundwater. There will be no wastewater discharge from the site. All wastes and chemicals will be handled and stored within buildings or in appropriately sealed and bunded areas and stormwater will be managed on-site in accordance with City of Kwinana specifications. As such, there is no further requirement to undertake a groundwater study as part of the Part IV PER process.
	Rising sea levels coupled with the proposed 6 metre deep waste bunker/ash pits would suggest that there will be construction and operational problems. If seepage gets into the stockpiled waste, the resultant 'leachate' will need to be	The site is approximately 800m from the sea and approximately 5m above sea level (as determined from contours from the online Landgate Map Service). There are other industrial operations between the sea shore and the site. Furthermore, it will be impossible for seepage into or leakage from the thick concrete lined waste storage bunker.

Submitter	Submission and/or issue	Response to comment
	managed. Given that there is no sewer connection available, this presents a significant challenge.	
	Stormwater runoff from the plant's substantial impervious area is unlikely to be managed by the usual soakage methods, so all rainwater that cannot be contained in tanks will require treatment/disposal.	The Stormwater Management system will be designed in accordance with City of Kwinana specifications for the Kwinana Industrial Area, and will be considered by the City of Kwinana during the assessment of the Development Application for the Proposal. That said, there is no basis to the statement that stormwater runoff is "unlikely to be managed by the usual soakage methods", given the large number of similar scale or larger operations in the Kwinana Industrial Area who are successfully utilising the prescribed soakage methods.
	The description of stormwater management is exceedingly brief. A full groundwater and stormwater management plan should be provided prior to approval.	
	There will be a small discharge to the trade waste sewer without any indication of the quantity and environmental impact and whether the waste is toxic.	There will be no wastewater discharge from the Proposal.

4.4 Air Quality/Human Health

Submitter	Submission and/or issue	Response to comment
DER	**Air Quality** Results of SO_2 modelling appear reliable and ambient impacts are considered acceptably small.	Noted
	The proponent should confirm the details of the flue gas cleaning APC system.	This is a repeat of a question which was responded to in section 1 entitled **The proposal - General comments**.
	This modelling directly followed the 2009 modelling for re-determination of Kwinana industry emissions limits. Phoenix WtE makes a small, acceptable addition to SO_2 concentrations. NOTE: a re-determination under the Environmental Protection (**Kwinana**) (Atmospheric Wastes) Policy 1999, will be required to provide an emission limit for this project. No changes are anticipated to be necessary to emission limits for other Kwinana area industries.	Noted. Despite the conservative approach of using the WID/IED limit value for potential modelling SO_2 emissions from the proposal, it is pleasing to have confirmation from the DER that the modelling results presented "appear reliable and ambient impacts are considered acceptably small". It is noted that it is expected that the SO_2 emissions during normal operation will be comfortable below the WID/IED emission limit values, therefore further reducing ambient impacts. Phoenix Energy acknowledges that as a new emission source with a potential emission rate above the *Environment Protection (Kwinana) (Atmospheric Wastes) Policy* (or Kwinana EPP) threshold value, a re-determination under the EPP will be required to provide an emission limit for the project.
	Results of the modelling of other non-SO_2 emissions from the stack are considered reliable and ambient impacts acceptably small (if emissions estimates are correct). In the case of pollutants for which ambient measurements have been made in the Kwinana area, ENVIRON has shown that the increments due to the WtE plant are small (Table 21). Assessment of relevant emissions also appears to be reliable with acceptably small results. Modelling was done using the same model for SO_2	Noted. It is also noted that the DER Air Quality Management Branch has been provided with all modelling input and output data, to facilitate an independent and detailed review of the model configuration and results. As such, it is pleasing to receive confirmation that the modelling of the potential impacts for non-SO_2 emissions are also considered by the DER to be "reliable and ambient impacts acceptably small (if emissions estimates are correct)". It should be noted that the results for the Hillman Child Health Centre presented in **Table 21 PER Appendix F** (re-produced as **Table 32 (p139)** in the PER) are not representative of the proposal, since the monitoring station is outside

Submitter	Submission and/or issue	Response to comment
	– the best available for tall stacks at Kwinana. DER's Air Quality Services obtained similar results from another model, providing further confidence. The emissions to air from the combustion source should be tested for small diameter particles (<100 nano metre (nm)) and this will be discussed during licence development. This is likely to be a licensing matter but in order to lessen the potential for community concern, consideration should be given to a source emission test, during commissioning and when at full production, for ultra-small diameter particles such as nanoparticles from all combustion based WtE plants in WA, in spite of the fact that there are, currently, no health derived ambient standards.	the model domain (an 8 km by 8 km grid, with the emission source at its centre) used for components other than SO_2, **Figure 38** in **PER section 10.2.1.5.6 (p108)** presents a particle number and size distribution for a combustion type WtE plant with a fabric filter (Baghouse) and a semi-dry flue gas treatment system. This indicates that the average particle size in the cleaned flue gas was approximately 100 nm. However, as highlighted in **PER Figure 39 (p109)**, the particulate emissions of a well-designed and operated WtE plant pale into insignificance when compared to other man-made emission sources – particularly those from vehicles, which are emitted at ground level. With regard to testing, Phoenix Energy will always strive to apply international best practice testing and reporting, and will rely on its project partners MHIEC and Covanta Energy Corporation for guidance with regard to emission testing, and in particular, the testing of particulate matter. In our discussions with the DER, it has come to our attention that our summary of components to be measured by the CEMS incorrectly refers to the measurement of Particulate Matter as PM_{10}. In accordance with current European legislation, i.e. European Industrial Emissions Directive 2010/75/EU, Part 6 – Monitoring of emissions, Section 2.1, the correct terminology is 'Total dust', rather than just PM_{10}. As such, **PER section 10.2.1.6.4 (p157)** is amended as follows: "As a minimum, the components to be measured will be those stipulated by current legislation, which comprise: • Sulphur dioxide (SO2) • Nitrogen oxides (NOx, expressed as NO2) • Hydrogen chloride (HCl) • Hydrogen fluoride (HF) • Volatile organic compounds (Total Organic Carbon) • Total dust

Submitter	Submission and/or issue	Response to comment
		• Carbon monoxide (CO)"
	It should be noted that nanoparticle emissions can occur from a number of sources including industry and vehicles. Emission information from these sources is required for developing the knowledge of nanoparticle emissions and consequent ambient levels in WA.	This is a matter for the DER to consider. **PER section 10.2.1.5.6 (p103-109)** provides details on typical particulate emissions from modern WtE facilities with similar APC systems to that proposed for the Kwinana WtE Project, and demonstrates that these facilities are not significant emitters of nanoparticles.
	The proponent should provide details of the primary NOx reduction measures which will be used at the plant such as the use of low NOx burners, flue gas recirculation or starved air systems. Secondary measures detailed in the PER should be considered, as the application of primary NOx control is unlikely to achieve optimal environmental performance.	The Proposal will utilise Flue Gas recirculation as a primary NOx control. However, it is not intended to utilize Low-NOx burners for the following reasons: • The burners typically operate for short periods of time (~12 hrs during start-up and shutdown) • The burners are designed for only ~60% of the total boiler heat release • The burners will utilise clean burning natural gas fuel • The Air Pollution Control system will be operational as well as CEMS to ensure that NOx emissions associated with the temporary use of the auxiliary burners remain within emission limits.
	The proponent should also detail the temperature that the waste gases exit the boiler to ensure gas streams are cooled sufficiently to avoid reformation of dioxins.	Flue gas exits the economizer section of the boiler at a temperature of ~230 ^{o}C after which it is promptly quenched with water and cooled to ~170 ^{o}C, well below temperatures at which de-novo formation of dioxins could potentially occur.
	Licence conditions are likely to request monitoring and management with contingency solutions for the Selective Catalytic Reduction (SCR) technology. A SCR technology will be used to reduce NOx emissions by injecting NH_3 or urea into the flue gas in presence of a catalyst. This process is used by other plants in Kwinana and there have been	We note the DER's recommendations. Full details of NOx abatement control systems and monitoring parameters will be discussed and agreed with the DER during Part V Works Approval and Licencing.

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	issues with the addition of more ammonia than required which has resulted in excessive emissions of ammonia. The proponent for the Phoenix project should demonstrate a level of monitoring and contingency that would avoid such a situation. One possible control measure is the installation of a CEMS to monitor NH_3 at the stack to ensure excess ammonia is not being emitted through the stack.	
Bel Air Homes, Lynn MacLaren MLC, BGC, City of Rockingham, ACE and public submitters.	There is a recommendation about a need to review air modelling, how could anything be tabled without this being complete?	It is unclear what this statement is referring to.
	The comparison with the Perth air-shed is also not valid.	The Air Quality assessment with respect to annual emissions of nitrogen oxides gives consideration to both the Kwinana Airshed and the Perth Airshed as a whole, to put the scale of the Proposal into context with both the local and Perth Airsheds. Thus demonstrating that the facility will not significantly increase emissions of nitrogen oxides relative to other existing emission sources.
	There is enough industry in Kwinana, they do not need the additional burden of the project. How will Kwinana cope?	The environmental impact assessment undertaken for the Proposal, as reported in the PER, shows that the Proposal is consistent with the Conclusions and Recommendations of the EPA (Report 1468), that "It has been demonstrated internationally that modern waste to energy plants can operate within strict emissions standards with acceptable environmental and health impacts to the community when a plant is well designed and operated using best practice technologies and processes." Kwinana and indeed the entire region stands to benefit from the increase in resource recovery as well as the economic benefits associated with construction jobs, new operational staff jobs and additional business for local support service providers.
	Claims regarding the quality of the air emissions are very high, and the respondent urges third party	It is pleasing to receive confirmation that the modelling of the potential impacts for both SO_2 and non-SO_2 emissions are also considered by the DER

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	verification.	to be "reliable and ambient impacts acceptably small", though these findings are qualified "(if emissions estimates are correct)". The performance of the Air Pollution Control system will be designed to be consistent with the requirements of the EU Waste Incineration Directive air emission limits as recommended in EPA Report 1468, *Advice to the Minister for Environment on the Environmental and Health Performance of Waste to Energy Technologies.* As the proposed emission limits are set so as to protect both the environment and human health, and since they have been applied to a large majority of the 1000 or more operating WtE facilities world-wide, the community can have confidence that the proposed emission limit settings are both appropriate and achievable in practice.
	The respondent strongly supports adherence to the EPA recommendations. Combustion gases leaving the hot combustion zone need to be cooled rapidly to lower temperature in the post combination zone to minimise the production of dioxins, which form in the temperature window 200ºC to 450º *Environment* *Australia (1999) Incineration and Dioxins: Review of Formation Processes).*	The proposal includes a water quenching chamber for rapid quenching to ~170 ^{o}C immediately downstream of the boiler economiser section.
	On page 115 the stack temperature is stated as 405ºK (i.e. 268ºC). This would indicate that the temperature upstream in the emissions control system and bag-house would be very high. Secondly the exit temperature at the stack is within the dioxin forming window, which would suggest that dioxins could be forming in the atmosphere after exit from the stack.	The conversion of ^{o}K to ^{o}C in the submission is incorrect. The correct conversion of ^{o}K to ^{o}C is as follows: 405^{o}K – 273 = 132 ^{o}C
	Page 140 of the proposal states that "A further	This statement has been taken out of context – the context being a

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	complication is that the pollutant emissions are naturally dependent on nature and composition of the feedstock". This statement highlights the environmental risk associated with lack of control over the feedstock including sorting and the removal of dioxins, and the risks associated with an uncontrolled "hot" incineration process.	description of why actual stack test results may or may not include other pollutants for which a WID/IED limit value is not prescribed in the EU directive. The notion that the combustion process is uncontrolled is completely incorrect, as it would have been impossible for any of the 1000 or more similar WtE plants operating world-wide to obtain an Environmental approval to operate.
	Many toxic heavy metals and other compounds are vapourised in the Martin Grate incineration process, and if not captured in the APC would be emitted to the atmosphere.	The small concentrations of volatile heavy metals and other compounds which report to the flue gas leaving the combustion chamber are readily captured in the purpose designed and built APC, which indeed is the purpose of the APC system.
	The proponent admits that "limited available reference plant data" is available in the Kwinana area, however concludes that the "Kwinana WtE plant will not significantly contribute to the pollutant inventory in the Kwinana airshed". It is recommended that the validity of the methodology of the emissions modelling is reviewed, in terms of plume modelling and ground/base station testing, and the levels of emissions.	As stated in **PER section 10.2.1.5.12 (p140)** "Given the prevalence of WtE facilities of similar capacity and technology to the proposed facility operating under the WID/IED, with many operating close to major population centres, suffice to say that if any of these non-WID/IED controlled components were regularly being emitted at rates which would be of potential harm to human health or the environment, they would be included in the WID/IED." With regards to the validity of the methodology of the emissions modelling, it is once again noted that the DER Air Quality Management Branch has been provided with all modelling input and output data, to facilitate an independent and detailed review of the model configuration and results. As such, it is pleasing to receive confirmation that the modelling of the potential impacts for all emissions are also considered by the DER to be "reliable and ambient impacts acceptably small", with the qualification "(if emissions estimates are correct)".
	With reference to the PER page 84, it could be concluded that 20% of ferrous metals and 40% of non-ferrous metals are lost in combustion and hopefully collected in the fly-ash or by other means. If not, these pollutants would be emitted to the	As described on **PER p84**, the bottom ash is subjected to metals recovery upstream of the Brick Plant. The metal recovery rates have no impact on emissions to the atmosphere, other than avoided GHG emissions associated with the recovery (for recycling) of ferrous and non-ferrous metals, which would otherwise end up in landfill, to replace the production of virgin metals.

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	atmosphere. The estimate for the proposed Kwinana WtE Facility is conservatively estimated to add approximately 132 tonnes of NO_x to the Perth air-shed (Appendix F page 44). This is said to represent an addition of 0.5% to the Perth air-shed. I calculate this at 2% of NO_x in the Kwinana air-shed. No evidence of the figure quoted of 132 tpa has been given. My calculations based on the emission rates from Table 9 which give NO_x at 8.4 g/s give an annual total of 302.8 tonnes assuming 24/7 operation. This is about 5% and becoming significant. All emissions should be regulated to the best standard in the world now, and any new standards. All emission testing results should be made available to the EPA and for public scrutiny in a clear and transparent manner, within 24 hours, with notification of exceedances. This should include details of the standards measured against, and the current world best standards. Who will data be made available to and when?	The estimated annual total NOx emission rate of 132 tpa as presented in **PER Appendix F** section 6.6 and reproduced in **PER section 10.2.1.5.9 (p119)** was based on a single grate/line operating for 365 days per year, rather than both lines operating simultaneously for approximately 330 days per year. As such, the annual total NOx emission rate for the entire facility operating at full capacity for ~330 days per year (note that the facility will operate at up to half capacity for ~60-70 days a year to accommodate planned boiler maintenance periods), is estimated to be 240 tpa, or ~0.9% addition to the total Perth airshed and ~3.6% addition to the Kwinana airshed. While it is indeed unfortunate that this was not picked up during preparation of the Air Quality and Odour Impact Assessment Report, the corrected results do not change the initial assessment, by ENVIRON, that it remains difficult to reliably quantify the impact of such a small increase in the overall NOx emissions as the change in the total NOx emissions to the airshed is very small and would be no more than "noise" in any numerical modelling assessment. The Proponent agrees that emissions should be regulated to international best practice now. Potential new standards will be implemented as required by the relevant authorities. **PER section 10.2.1.6.4 (p158)** states that: "Emissions reporting will be publicly available via the plant website and in accordance with future operational licensing requirements, to be determined prior to operation of the facility." While it is expected that the results of continuous emissions monitoring and periodic sampling and testing will be made available online alongside details of the standards measured against, as the data becomes available (i.e. in real time or with a short delay), the specific reporting requirements and format will be established in consultation with both the project Community Advisory Group and the DER, under the Part V Licensing approval process.

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	The methods of collecting emission samples must be firstly continuous, and secondly, from points in the plant, engineered to give the best chance of providing a true reading of those emissions.	**PER section 10.2.1.6.4 (p158)** states that: "In addition to the continuous monitoring of emissions, there are a range of emissions (including dioxins, furans and heavy metals) for which extractive emissions testing must be undertaken in accordance with the European WID/IED." and "compliance with the flue gas temperature condition (minimum 850^{o}C for two seconds) will be demonstrated by determination of flue gas temperature at an appropriate temperature measurement location in the furnace." The primary sampling point for atmospheric emissions monitoring will be at the discharge of the ID Fan i.e. downstream of the APC system. The specific requirements for collecting emission samples will be agreed with the DER during the Part V Licensing approval stage, with input from our experienced project partners.
	If emissions standards are exceeded, then the reporting should include a special report to the EPA, on locating the source of the exceedance, the actions taken at the time to rectify the problem. Non-compliance of emission levels, should involve plant shutdown.	As stated in **PER section 10.2.1.6.5.1 (p159)**, "If an emission limit exceedance occurs, this shall be documented and reported to the EPA along with any corrective actions undertaken by plant staff to mitigate the upset condition and either to bring the line to a safe shutdown condition, or to rectify the problem and re-start the feed to the line."
	As technology and knowledge improve and of emission standards are updated, monitoring methods improve; the new standards should be met. This should include emission particles and their health effects, gathering the best available technology and knowledge from the rest of the world and applying it to this plant.	Indeed, the Kwinana WtE project stands to benefit from the decades of WtE plant design and operating experience gained around the world. As these facilities are designed for 20+ years of operation, it is not uncommon for components and systems to be upgraded or replaced for both operational reliability requirements as well as to ensure the facility is compliant with best practice emission standards.
	New chemicals or combinations of chemicals harmful to health may be discovered and therefore need to be monitored with the projects systems.	This possibility is why the ongoing DER Part V licence renewal process provides an opportunity for the plant operator and the regulator to ensure the facility continues to meet international best practice with respect to emissions.
	This proposal is unacceptable considering the lack	The PER air quality assessment clearly demonstrates that even when

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	of current emission background data, the development of a major commercial/industry precinct to the north east and the lack of a viable business plan.	operating at full capacity and at WID emission limits, the predicted ground level concentrations of key pollutants, which may be emitted by the Proposal are well within accepted standards and are also considered by the DER to be "reliable and ambient impacts acceptably small", with the qualification "(if emissions estimates are correct)".
	The project is proposing to use "mass burn incineration" technology. This technology has a terrible reputation due to very poor air pollution control. If this technology has been used overseas for decades, are there any better technology choices with a lower risk of air pollution?	Coupling the market leading, flexible and reliable Martin grate stoker technology to a modern Air Pollution Control system designed to achieve international best practice emission standards is still the most reliable and efficient, tried and proven (both commercially and environmentally) approach for recovering energy and other resources from residual MSW.
	The proponent continues,"…even under worst cast meteorological conditions". What conditions?	The air dispersion modelling utilises representative meteorological data in the case of pollutant modelling using DISPMOD and in the case of the Odour assessment using AERMOD), inclusive of: • wind speed; • wind direction; • temperature; • atmospheric pressure; As such, the model predictions take into consideration a range of representative meteorological conditions, which include worst case conditions for plume dispersion. Meteorological conditions are considered to be 'worst case' where the atmospheric conditions reduce plume dispersion and/or are predicted to cause the plume to reach the ground before significant dispersion has occurred. The modelling takes all these factors into consideration in predicting maximum ground level concentrations, which are then considered in the light of background ground level concentrations of pollutants and applicable environmental standards.
	The DER monitoring of Sulfur Dioxide (SO_2), Nitrogen Oxide (NO_2) PM10 and PM2.5 and ozone have been conducted annually. DER's Background	This is a matter for the DER and how it determines to best utilise its resources in carrying out its duties.

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	Air Quality Study which included monitoring of volatile organic compounds (VOCs), Carbonyls, heavy metals, polycyclic aromatic hydrocarbons (PAHs) and ammonia was only conducted once. This is inadequate.	
	Where are the nearest air emission monitors and how close is this compared to other businesses or homes?	The site is located in the heart of the Kwinana Industrial Area and is surrounded by other heavy industrial businesses. The DER emission monitoring stations are spread both inside and beyond the KIA buffer zone, to monitor pollutant concentrations adjacent to sensitive residential receptors, as shown in **PER Figure 31 (p99)**. [Please note that the Hillman Child Health Centre is incorrectly shown as being near the Kwinana Town Centre, whereas it is in fact north of Rockingham and outside the 8 km by 8 km air dispersion model domain.] These emission monitoring stations have been chosen by the air quality consultant because they monitor pollutants deemed to be applicable to the Proposal and their selection has been reviewed by the DER Air Quality Management Branch and deemed to be appropriate. The nearest sensitive receptor to the proposal is the Naval Base Hotel, which is approximately 1.2 km from the WtE plant stack, while the nearest residential receptors are approximately 3 km from the site.
	Locations of only two monitoring stations for SO_2 – Rockingham at Kwinana Beach and Wattleup. There is no monitoring at a site in between which would be impacted during north-westerly, westerly and south-westerly winds, the three most prevailing winds would occur.	The modelling of potential SO_2 emissions from the Proposal has been carried out in strict accordance with DER procedures and guidelines applicable to the *Environment Protection (Kwinana) (Atmospheric Wastes) Policy* (or Kwinana EPP), utilising SO_2 emissions monitoring data deemed to be appropriate by the DER Air Quality Management Branch.
	Table 7 of the Air Quality report (p15) shows many gaps for unavailable data as cells filled so that complete comparison is lacking. The percentages of readings as percentages of National Environmental Protection Measure – Air Quality	The background monitoring data used in the PER Air Quality assessment has been reviewed by the DER Air Quality Management Branch and deemed to be appropriate. With reference to Table 7 of the Air Quality report in **PER Appendix F**, notes (6) and (8) indicate that the measured maximum concentrations were “Attributed to smoke haze”.

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	Standards and Goals (NEPM) at Calista and Hillman are both well over 200%. The statement on Particulate Matter where it is described those emissions after filtering "are equivalent to 70 motor vehicles (including 5 trucks) travelling constantly along a 1 km stretch of highway" is misleading. Vehicles travelling along a stretch of highway do not stop and start. How much greater will be the contribution of the PE incinerator's total operation including transport to NO_X in the Kwinana air-shed be?	The comparison of the particulate matter emissions from a modern WtE plant and that from 70 motor vehicles (including trucks) travelling constantly along a 1 km section of highway (see **PER section 10.2.1.5.6, p107**), is simply to provide a reality check regarding the scale of PM emissions from a modern WtE plant (with its highly controlled air pollution control system) and that from an everyday, largely uncontrolled emission source – motor vehicles. The PER air quality assessment does not include emissions from trucks bringing waste and consumables to the facility, nor does it need to, for a number of reasons: • With or without the proposal, the majority of those trucks will already be travelling on the surrounding roads, stopping and starting outside every house that has put out a bin and at intersections all the way to the existing (or future) landfill or transfer station • It is noteworthy that trucks will be indoors while stationary and tipping in the WtE plant tipping hall, rather than outdoors at the landfill • Trucks do not have the benefit of a tall stack to help disperse their emissions, but rather the emissions are released near ground level and are therefore likely to remain in the local vicinity of the road. As such, truck movements within the KIA associated with the proposal would not be expected to contribute significantly to ground level concentrations at receptors and monitoring stations (such as the Calista Primary School), which are beyond the pre-existing KIA buffer zone. In fact, by bringing those trucks into the KIA with its existing buffer zone and off the roads surrounded by residential areas on the way to the current landfill site, it could be argued that the proposed location of the Kwinana WtE plant is actually providing greater protection to sensitive receptors, with respect to emissions from garbage trucks • When not stopped at traffic lights, trucks are moving sources of

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		emissions, which makes it impractical to include in an assessment of static point source emissions, even if there was a valid reason to do so • The daily truck movements (~200 truck visits per weekday) associated with the Kwinana WtE project are insignificant in comparison to total traffic volumes on surrounding roads (as noted earlier)
	SO_2 is said to be the "key gaseous component from a cumulative modelling perspective. What we read in relation to monitoring of SO_2 itself is of larger concern if this gas is the key to the rest of the modelling.	Monitoring of SO_2 emissions from KIA and enforcement of the Environment Protection (Kwinana) (Atmospheric Wastes) Policy (or Kwinana EPP) is a matter for, and the responsibility of, the DER.
	Page 6 of Appendix F states that "the expected SO_2 emissions from the proposed WtE facility are above the threshold rate of 2 g/s." There is nothing in the text to enable the reader to relate this to micrograms per cubic metre so it's impossible to relate this to the table on page 12 of Appendix F). Expecting to read that redesign of the plant would be a consequence of this; we get instead, "it is likely that a redetermination of the Maximum Permissible Quantities would be required to be undertaken." This in the context of an EPA requirement for the project to be "highly precautionary".	**PER Table 26 (p115)** shows that the modelled emission rate of SO_2 for the Proposal is 19 g/s, conservatively assuming both grate lines are operating at full capacity and simultaneously at their WID limit values. The Kwinana EPP establishes a threshold (2 g/s) above which a new SO_2 emission source (within the policy area) is considered to be significant enough to warrant the prescribed redetermination of the Maximum Permissible Quantities. Exceeding the threshold value simply means that a new emission source will trigger the necessary scrutiny by the regulator, but does not in itself imply any significant air quality impacts – which is why an air quality impact assessment must be (and has been) carried out. Furthermore, there is no relationship between the threshold value from the Kwinana EPP and the results of cumulative ground level concentration monitoring of SO_2 in the policy area (i.e. as reported in **Table 5** on page 12 of **PER Appendix F**).
	The principles of the Kwinana Environment Protection (Kwinana Atmospheric Wastes) Policy governing such determination include references to "all reasonable and practicable measures" and "the reasonable needs of an industry, with allowance for viability as appropriate to that industry". Environ's	Indeed, the DER, in its submission during the public consultation period for the PER, has commented on the Atmospheric Emission study results presented in the PER for SO_2 and notes that: "Results of sulfur dioxide (SO_2) modelling appear reliable and ambient impacts are considered acceptably small. This modelling directly followed the 2009 modelling for re-determination of Kwinana industry emissions limits. Phoenix WtE makes a

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	text expands this as "to accommodate new industries or variations to existing industry emissions. While the secure allocations are "not to be reduced to make room for new sources" there is also the possibility of "emission permits in excess of a secure allocation".	small, acceptable addition to $S0_2$ concentrations. NOTE: a re-determination under the EPP will be required to provide an emission limit for this project. No changes are anticipated to be necessary to emission limits for other Kwinana area industries."
	Finally Principle 6 (page 7) we read "Ambient CO_2 monitoring can reduce only to the extent that licensed emissions limits reduce". Is this what they mean? Or do they mean Ambient CO_2 limits?	Regarding the intent of Principle 6 "Ambient SO_2 monitoring can reduce only to the extent that licensed emissions limits reduce, thereby reducing the likelihood of an exceedance", as quoted in **PER Appendix F**, section 3.1.2, it is noted that this principle is taken from the Department of Environment and Conservation, W.A., July 2009, Redetermination of maximum permissible quantities of sulphur dioxide under the Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999. Principle 6 states that 'ambient sulphur dioxide monitoring can reduce only to the extent that licensed emissions limits reduce, thereby reducing the likelihood of exceedance of the EPP Standards and Limits'. It is noted that a reduction in ambient SO_2 monitoring is not being sought by Phoenix Energy, and furthermore, any such decision would be the responsibility of the DER.
	Why is there a reference to the Hillman Child Health Centre. Figure 1 Appendix F p 53 shows the child health centre being near the Kwinana Hub Shopping Centre, when Hillman is a suburb of Rockingham? Why are there two monitoring stations within about 200 metres of each other?	The Air Quality consultant (ENVIRON) has advised that **Figure 1** from **PER Appendix F**, and reproduced as **Figures 31 & 40** in the PER, does not correctly represent the location of the Hillman Child Health Centre. This site is actually located in the North Rockingham area, approximately 8 km south of the proposed WtE facility, and not next to the Kwinana Town Centre and the Calista Primary School as shown in the figure. While this site is indeed a DER air quality monitoring site for NOx and $PM_{2.5}$, this location falls approximately 4 km outside the modelling domain (an 8 km by 8 km grid, with the emission source at its centre) used for the air quality assessment. The model domain is set to restrict model computation to the area most likely to be exposed to emissions from a static emission source being modelled. Outside the model domain, predicted ground level concentrations associated with the emission source become indistinguishable from background Ground

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		Level Concentrations (GLCs). Consequently, all references to Hillman and the Hillman Child Health Centre in relation to NOx and $PM_{2.5}$ are considered to be unrepresentative and are to be ignored. This includes the column entitled Hillman in **Table 21** from **PER Appendix F**, reproduced as **Table 32 (p139)** in the PER.
	While predictions for the maximum one hour average NO_2 ground level concentration (GLCs) are no more than 23% of the NEPM Standard (Appendix F Page C1), this does suggest that NO_2 is one of the more significant emissions and the possible impacts of combinations of this with other higher volume emissions should be considered. The group III metals listed in Table C1, described in Table 4 page 10 of Appendix F as carcinogens – Arsenic, Cadmium, Chromium VI, Lead and Nickel – are a further concern. The emission limits for these in Table C1 are all 0.0005 grams/second. By simple arithmetic the limits for these five carcinogens per day are 2.592 kilograms (kg) in total or 937 kg per year. Even though PE claim (page C4) that the GLCs for these and other metals comply with air quality criteria singly and are highly conservative, who would volunteer to work in such air or live nearby if they had a choice? And this without adding dioxins and furans to the cocktail.	The emission rates presented in **Table C1** of **PER Appendix F** are based on WID limit values only, and assume that the facility is operating at full capacity with both grate-lines (which are in fact independent and operate in parallel) each emitting at the maximum WID pollutant emission concentrations. As such, these emission rates are considered to be highly conservative and therefore unrepresentative of the expected operating plant emission rates. As such, the results presented in **Table C2** of **PER Appendix F** are provided for information only, and while they are expected to be unrepresentative of the performance of the Kwinana WtE facility, they still demonstrate that even under these extremely conservative assumptions, the results for the majority of key pollutants of interest indicate that the GLCs associated with the facility operating in isolation, are generally well below the applicable guideline values. The DER Air Quality Management Branch has been provided with all modelling input and output data, to facilitate a detailed review of the model configuration and results. As such, it is pleasing to receive confirmation that the modelling of the potential impacts for all emissions are considered by the DER to be "reliable and ambient impacts acceptably small", with the qualification "(if emissions estimates are correct)".
	A similar concern arises from consideration of averages. I do not have sufficient mathematics to argue this but there does appear to be in effect a massaging away of issues under the guise of "Maximum Annual Averages". Common arithmetic	The model predicts the hourly averaged GLC at each location in the model domain (the grid over which ground level concentrations are predicted) based on a time referenced set of meteorological data, for every hour of the modelled years. The predicted hourly concentrations are then averaged to generate 24-hour and annual averages as required. The term 'maximum

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	would tell us that 11 months of low maximum figures and one month high figures would still give a low annual average. Does this phrase mean the average of the maxima for each day of each monitoring throughout the year or does it mean the Maximum of annual averages over several years. A graphic distribution would be much more informative.	annual average' as referenced in **PER Appendix F section 6.4** and **Table 22** refers to the highest of the annual average GLCs predicted for the 1980, 1995 and 1996 modelled years (i.e. the maximum of the annual averages predicted for the three modelled years). The term 'annual average' as used throughout the rest of the report refers to the average of GLCs predicted over a single modelled year. This may be in reference to the annual average for a nominated receptor or may refer to the highest annual average GLC predicted for any receptor throughout the modelled domain, depending on the context of the report. For example, the annual average GLCs presented in **Table 20** of **PER Appendix F** represent the highest annual average GLCs predicted for any given point throughout the modelled domain for each of the modelled years, while the annual average GLCs presented in **Table 21** of **PER Appendix F** represent the annual average GLC predicted for the nominated receptors.
	Assuming that dilution through dispersion means the problem has gone 'away'. This is important especially given that the EPA recommended "a highly precautionary approach" (PER p 171).	There are two aspects to the control and monitoring (management) of emission of flue gas from a WtE plant stack. First is the application of limits to the concentration of individual pollutants in the flue gas. In WA, the EPA (Report 1468) has recommended the application of the European WID/IED limit values, which has been adopted in this Environmental Impact Assessment. The second is the prediction of the dispersion of the flue gas in the atmosphere and the resultant concentrations at ground level receptors. These ground level concentrations are monitored against accepted standards such as the Kwinana EPP and the NEPM standards, which have been established to protect human health and the environment. As such, dilution plays a part in dispersion, but control at the source is critical, which is why up to one third of the capital cost of the WtE plant goes into the Air Pollution Control system and associated plant and equipment.
	Nitrogen oxides were 90% of the emission limit values (ELV) and particulates were 10% of ELV.	This submission relating to nitrogen oxides and particulates is actually in reference to a case study in the Stage 2 WSP Report to the EPA and not to the proposal. The air quality modelling for the Proposal has considered the highly conservative scenario of the plant operating at full capacity with both

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		lines simultaneously at their European WID/IED limit values. The results demonstrate that ground level concentrations are well below the relevant air quality standards.
	There is no mention of the cumulative effects of the three or four highest pollutants.	Cumulative impacts of the Proposal on ground level concentrations was undertaken for those components where meaningful background concentration data exists. Predicted ground level concentrations for all pollutants, were found to be well below the accepted standards.
	It is not sufficient to state that non-continuous monitoring shall occur from the company running the plant.	It is unclear whether this comment is regarding the periodic sampling and testing, which will be defined by the Part V Licensing approval process, or monitoring at sensitive receptors, which will occur continuously at existing DER air quality monitoring stations, or intermittently during DER air quality monitoring campaigns.
	Evidence from Belgium refers to emissions of dioxins from an incinerator being under European Union (EU) limits but the soils nearby were way over.	The Proponent is not aware of what "evidence" is being referred to. However, it is important to remember that due to the stringent emission limits placed on controlled combustion processes such as WtE facilities, dioxins are predominantly generated by uncontrolled combustion processes such as bushfires and fireworks displays, rather than from combustion processes with dedicated Air Pollution Control systems.
	What frequency of monitoring including heavy metals hazardous chemicals and dioxins would occur after the first two years? What is the methodology for the monitoring to be conducted?	The frequency of periodic sampling and testing for monitoring those pollutants will be agreed with the DER during the Part V Licensing approval stage. That said, both MHIEC and Covanta Energy Corporation have much experience with sampling and testing in the US, Canada, European and China (Covanta) and Japan and South East Asia (MHIEC).
	How would emissions be controlled during non-standard operating conditions?	The Air Pollution Control system continues to operate during normal operation and during start-up and shutdown. If there is a failure of a component of the APC system, then a general Operating Procedure is presented in **PER Section 10.2.1.6.5.1 (p159)**.

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	A submitter supports all measures that ensure that emission limits are not surpassed in practice, including but not limited to: • Screening of feed stock, with further consideration of other practical measures over and above the screening of radiation and metals (p46); • The APC system on both grate lines consisting of combustion control, lime dosing, bag house filters, injection of activated carbon and catalytic reduction of NO_x; • Continuous emissions monitoring system (CEMS) interlocked with these control systems in order to manage non-steady-state or exceptional events; • A periodic CEMS inspection and recalibration regime (p158) but which is also aligned with independent sample testing; • Periodic testing of emissions that do not fall within the feasibility of CEMS (p49); and • The proposal to stream emissions data to a publicly available website (p175) in close-to-real-time. Consideration of the cumulative impacts of	Noted. Please refer to the earlier **Responses to Important Matters to be Addressed** for a full response to this issue.

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	emissions from existing and future industry, including other WtE proposals in the Kwinana and Rockingham areas. The greenhouse gas modelling needs to be specific to Perth and a study is recommended. Modelling should be reviewed to include plume modelling and ground/base station testing, and the levels of emissions claimed in the proposal information. Further details should be provided regarding the operation of the APC and the CEMS, in particular as to how that CEMS interfaces with the APC to control the operation of the plant if emission limits are exceeded. How will the CEMS interface with the APC to control the operation of the plant if emission limits are exceeded?	The issue of greenhouse gas modelling has been covered in the section above entitled **Greenhouse Gases**. The air quality assessment discussed in the PER and presented in **PER Appendix F** involves plume dispersion modelling by air quality consultants with expertise in air quality assessment. Furthermore, the DER Air Quality Management Branch has been provided with all modelling input and output data, to facilitate a detailed review of the model configuration and results. As such, it is pleasing to receive confirmation that the modelling of the potential impacts for all emissions are considered by the DER to be "reliable and ambient impacts acceptably small", with the qualification "(if emissions estimates are correct)". Firstly, as described in **PER section 10.2.1.6.5.1 (p159)**, if emission limits are exceeded, feed to the line will be shutdown and the APC system will be inspected to identify the cause of an exceedance. However, due to the presence of approach to limit alarms, feeding of MSW will already have been reduced. The CEMS monitors a range of key pollutants in the flue gas at the discharge of the ID Fan i.e. after the flue gas has passed through the APC system. Feedback regarding pollutant concentrations, as provided by the gas analysis equipment associated with the CEMS, is used directly as input to some of the APC dosage control systems e.g. for flow ratio control for Urea or Ammonia injection. The CEMS also provides the measurements used as inputs to the approach to limit alarms in the plant Distributed Control System (DCS). The key aspects of the process control systems associated with the control and operation of the APC system and the CEMS will be reviewed with the DER during the Part V Works Approval process.

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	Clarification is required on which of the two wind data sets have been used in the pollution distribution modelling, and if the older data set was used, the reasons for using that data set should be explained.	Of the two annual wind roses presented in **PER Figure 28 (p90)**, the Alcoa Mudlakes 2011 data has been used in the Odour assessment, which was carried out using AERMOD. Furthermore, two different meteorological data sets have been used to undertake the Air Quality and Odour assessment presented in **PER Appendix F**, because the DER Air Quality Management Branch specifically requested that DISPMOD be used for modelling of ALL pollutants, including SO_2, whereas AERMOD was only used for the Odour Assessment (for reasons described **PER section 10.1.2.7.1 (p89-90)**. Meteorological datasets used in DISPMOD were developed by the DER for the 1980, 1995 and 1996 calendar years, consistent with the approach used for the most recent redetermination (DER, 2009). Previous studies conducted by the DER have determined that these years are considered representative of meteorology in the region. As noted above, AERMOD was used for the Odour dispersion modelling assessment. The AERMOD modelling utilised 2011 calendar measured meteorological data from the Alcoa Mudlakes meteorological monitoring station, located approximately 3 km east of the proposed WtE facility. The DER Air Quality Management Branch was provided with all modelling input and output data, to facilitate a detailed review of the model configuration and results.

Submitter	Submission and/or issue	Response to comment
Public Submitter	**Human Health** There are large amounts of people moving into the Rockingham area. Please think about the rapidly growing population of the area including the health of those living here, the thousands of young children and the inevitable cancer rates that will occur amongst our children. Please relocate the plant to a safe and remote area.	By locating the WtE facility within the Kwinana Industrial Area, the proposal will benefit from the pre-existing buffer zone, to prevent future encroachment by sensitive receptors and sensitive land uses. According to the EPA (Report 1468, 2013), "It has been demonstrated internationally that modern waste to energy plants can operate within strict emissions standards with acceptable environmental and health impacts to the community when a plant is well designed and operated using best practice technologies and processes." Indeed, this is why the majority of WtE plants operating around the world (in the UK, Europe and Japan) are located very close to the densely populated urban centres, which they serve – simply because those locations do not have the luxury of buffer zones and because, in both Europe and Japan, waste heat from the WtE plant is used for district heating and/or for heating aquatic centres or baths in aged care facilities.
	It should be established that the adjacent site is free of existing contamination.	The adjacent site is currently under development by others, so contamination levels are the responsibility of the developer and the land owner (LandCorp).
	There is only a brief mention of rainfall and no accounting for the impacts of rain on deposition of particulates and other toxic emissions. While it is clear that the proponent has proposed measures to clean the emissions from the boiler, it is also clear and admitted that there will still be particles and up to 20 or so chemicals even after the cleaning. It appears that particles greater than 10 micrometres in diameter tend to settle to the ground by gravity in a matter of hours whereas the smallest particles (less than 1 micrometre) can stay in the atmosphere for weeks and are mostly removed by rain.	If the effects of precipitation were significant enough to warrant special consideration in the air dispersion modelling, this would be stipulated in the DER's Air Quality Modelling Guidance Notes (2006), and would also be carried out as a matter of course by the Air Quality Consultant. The resultant PM_{10} and $PM_{2.5}$ GLCs predicted away from the source (i.e. outside of the KIA boundary) are considered conservative as they do not factor in the potential deposition of particles nearer the source. The 24-hour average PM_{10} and $PM_{2.5}$ GLCs predicted at the nearest residential receptors to the proposed WtE facility are approximately 0.2 µg/m^3 and represent less than 1% of the applicable guidelines. According to ENVIRON air quality consultants, wet deposition is expected to have minimal impact on total deposition experienced in the area. It is also noted that particulate emissions from the proposed WtE facility are expected to be low in relation to other localised sources (e.g. roads, vehicles, wind erosion). Furthermore, it is also

Submitter	Submission and/or issue	Response to comment
		noted that the DER Air Quality Management Branch has been provided with all modelling input and output data, to facilitate a detailed review of the model configuration and results. As such, it is pleasing to receive confirmation that the modelling of the potential impacts for all emissions, including particulate matter, is considered by the DER to be "reliable and ambient impacts acceptably small", with the qualification: "(if emissions estimates are correct)".
	Rain is also likely to cause the deposition of diesels emissions from the frequent truck movements and from the sorting machinery inside the plant. The proponent has not accounted for these and diesel emissions have been found to contain 38 toxic substances including 17 that are known carcinogens. Data on the impacts of rain on emission deposition are needed relevant to the topography and weather patterns affecting the suburbs of Kwinana Town and East Rockingham; this would include GLC contamination, soil and food chain analysis.	As noted earlier, the emissions from Trucks have not be included in the air quality assessment, primarily because, in the absence of the Proposal, the majority of the truck movements associated with the proposal would be travelling on the same roads to unload at a landfill, rather than at the WtE plant. As noted above, wet deposition (due to rain) is expected to have minimal impact on total deposition experienced in the area.
	The proponent has not considered the effects to human health such as reproductive effects, respiratory disorders, reduced immunity, higher rates of ear, nose and throat infections, increased respiratory symptoms, longer durations of infections, asthma, toxins in breast milk, cancers including childhood cancers and leukaemia.	If any of these "effects to human health" were indeed attributable to the operation of one or more of the more than 1000 WtE facilities currently operating world-wide, then the independent study, which formed the basis for EPA Report 1468, *Advice to the Minister for Environment on the Environmental and Health Performance of Waste to Energy Technologies* would not have allowed the EPA to conclude that: "It has been demonstrated internationally that modern waste to energy plants can operate within strict emissions standards with acceptable environmental and health impacts to the community when a plant is well designed and operated using best practice technologies and processes." The Proponent has reviewed a number of independent human health risk and/or impact assessments in relation to existing or proposed WtE facilities (see **PER section 10.2.1.6.2.1 (p146)**, and each has come to the same conclusion as the EPA.

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	The effects of the air quality on workers who spend numerous hours working in the Kwinana Industrial Area have not been considered.	A detailed and conservative Air Quality impact assessment has been undertaken for the PER and is presented in **PER Appendix F**. The assessment considered a modelling domain of 8 km by 8 km centred on the Proposal and the model inputs and results have been independently reviewed by the air quality experts from the DER Air Quality Management Branch. As such, it is pleasing to receive confirmation that the modelling of the potential impacts for all emissions, including particulate matter, is considered by the DER to be "reliable and ambient impacts acceptably small", with the qualification: "(if emissions estimates are correct)".
	There is no proposed monitoring for potential toxics other than sulfur dioxide and dust. Within the buffer there are two caravan parks which are permanent homes to over 200 people. It appears that both (Rockingham Holiday Village on Dixon Rd and the Kwinana Beach Caravan Park on Governor Rd) are within the Buffer of the PE plant this has not been considered.	The DER conducts monitoring at a number of air quality monitoring stations surrounding the KIA, covering SO_2, NOx, particulate matter. Air quality monitoring campaigns are undertaken by the DER from time to time, such as the Kwinana Background Air Quality Study (BAQS), which considered heavy metal concentrations, and was undertaken at various locations between 2005 and 2010. It is noted that the Kwinana Beach Caravan Park on Govenor Road is some 6.5 km south west of the Proposal, while Dixon Road is some 7.5 km south of the proposal, both of which are well outside the air quality model domain i.e. predicted concentrations of pollutants, which may be emitted from the Proposal would be indistinguishable from the background ambient air due to dispersion at these distances from the source.
	Sensitive receptors should include Medina, Leda and Hillman primary schools.	Due to the proposed location and existing buffer zones, each of these primary schools is either at the edge or beyond the air quality model domain (an 8 km by 8 km grid, with the emission source at its centre), as such, the dispersion of potential emissions from the Proposal would mean that such emissions would be indistinguishable from background ground level air quality. • Medina Primary School is ~3.7 km south east of the Proposal. • Leda Primary School is ~6 km south east of the Proposal. • Hillman Primary School is ~8.3 km south of the Proposal. The nearest sensitive receptor is the Naval Base Hotel, which is located approximately 1.2 km to the north of the Proposal, while the nearest

Submitter	Submission and/or issue	Response to comment
		residences are approximately 3 km from the Proposal. The air quality assessment undertaken for the PER (specifically PER Appendix F) clearly demonstrates that predicted ground level concentrations for all potential pollutants considered in the analysis will be within the relevant air quality standards for both the Naval Base Hotel and other sensitive receptors within the model domain, whether the proposal is considered in isolation or cumulatively, with existing emission sources. However, it is important to note that the air quality assessment considers potential ground level concentrations at ALL locations within the model domain, and compares those predictions against the relevant ambient air quality standards. The analysis recognises that air quality is just as important for neighbouring industrial premises as it is for sensitive receptors. As such, the air quality assessment undertaken for the proposal clearly demonstrates that by adhering to WID/IED emission limit values, predicted ground level concentrations will remain within the relevant air quality standards and the Proposal will not significantly impact on ambient air quality either in isolation or cumulatively, with existing emission sources.
	Monitoring should be based firmly on recorded GLC data, not on modelling. While pre-mixing may well reduce the concentrations of chlorinated wastes being burnt, it does nothing to mitigate the accumulating amount of toxic products over periods of time. Given the size of this operation it may be that the time that the contents of the waste bunker take to be consumed may well be quite short and so the level of pollutants from even well mixed MSW may well exceed limits.	Except for the Hillman Child Health Centre monitoring data, all monitoring data presented in **PER Appendix F** is measured ground level concentration data obtained from DER approved air quality monitoring stations in the region, which are deemed to be applicable to the location of the Proposal. The Hillman Child Health Centre is ~8 km south of the Proposal site and is therefore outside the modelling domain for air quality assessment. The second part of this submission has already been addressed in section **1 The Proposal – General Comments**.
	What are the possible health impacts for the end users?	All by-products of combustion produced for sale or re-use will be required to satisfy agreed DER *Material Guidelines* for re-use, including leach testing and confirmation that they will achieve relevant quality standards applicable to

Submitter	Submission and/or issue	Response to comment
		construction materials.
	Japan has the most dioxins in their peoples' body of any country on Earth.	The relevance of this statement to the proposal is unclear as is its veracity, given that no reference has been provided.
	How would the public know if dioxins are exceeding to modelled limits?	Dioxins are readily controlled by the design and operation of a modern WtE plant as described in section **1 The Proposal – General Comments**. Confirmation of the emissions of dioxins and other compounds, which cannot currently be reliably monitored online, will be achieved through periodic stack sampling and testing, as is best practice internationally.
	Would ground samples be taken at the 3 primary schools within 5 kms of the site on a monthly ongoing basis?	The Proposal is but one potential and a very minor emitter of dioxins, relative to other existing emitters in the Kwinana Industrial Area. The type of ground sampling as suggested would not, due to the cumulative effects of all emitters, be able to identify the source of the emissions. In other words, it would be an amalgamation of all emissions derived from not only the KIA but also local industry, local transport, fires and other such sources. In **PER section 10.2.1.6.3 (p155)**, the air quality consultant concluded that "The contribution of emissions from the proposed WtE facility to the total dioxin and furan emissions released within the Kwinana airshed is therefore expected to be negligible. The predicted deposition rate associated with such emissions would also be expected to be negligible, particularly in comparison to other significant regional sources including bushfires, motor vehicles and domestic fuel burning." As such adherence to emission limit values i.e. in accordance with international best practice WID/IED limit values, will be a much more effective approach.
	The scale and potential public health concerns has not been fully accounted for in this PER and the public health claims by PE are challenged by communities around the world where these plants are operating.	It is important to note that the WA Department of Health has reviewed the PER and has not raised any specific concerns. Furthermore, the PER is broadly in line with the conclusions of the independent study, which formed the basis for EPA Report 1468, *Advice to the Minister for Environment on the Environmental and Health Performance of Waste to Energy Technologies* would not have concluded that: "It has been demonstrated internationally that

Submitter	Submission and/or issue	Response to comment
		modern waste to energy plants can operate within strict emissions standards with acceptable environmental and health impacts to the community when a plant is well designed and operated using best practice technologies and processes."
	The Kwinana and Rockingham communities are already disproportionately affected by air pollution from the Kwinana industrial strip. This project will pose an additive, cumulative and synergistic air pollution threat to these communities. There is no comfort in claims that predicted emissions will meet air quality protection standards while communities do not breathe air pollutant averages and those applicable NEPMs do not currently protect public health. There is no safe level of exposure to dioxin and mercury and any addition of those Persistent Organic Pollutants however, small, to our air shed compromises our public health, particularly our children.	Both the European WID/IED limit values and the NEPM air quality standards (and other applicable ambient air quality standards) are set to protect human health and the environment. Persistent Organic Pollutants have very low regulatory emission limits because they are to be controlled to the maximum extent achievable. The air quality consultant concluded that "The contribution of emissions from the proposed WtE facility to the total dioxin and furan emissions released within the Kwinana airshed is therefore expected to be negligible. The predicted deposition rate associated with such emissions would also be expected to be negligible, particularly in comparison to other significant regional sources including bushfires, motor vehicles and domestic fuel burning."
	The word "cumulative" as used in the PER refers only to the combination of discrete toxic pollutants from the existing air-shed with expected emissions from a proposed incinerator. This is not what the community understand as "cumulative". The prolonged exposure of human beings to chemicals is a second dimension of "cumulative". It is illogical and unscientific to claim as claimed in Appendix F page 47 that, because lifetime risks from exposure to each of the carcinogenic pollutants modelled are low, there is somehow nothing else to worry about and there would be no	The Incremental Carcinogenic Risk (ICR) assessment presented in **PER Appendix F section 6.4** is considered to be highly conservative as it is based on annual GLCs predicted using maximum emission rates, assuming continuous release over the modelled years and it assumes that a person is exposed to the highest predicted annual average concentrations (which, according to the air dispersion modelling, are expected to occur within the KIA boundary) continuously, over the course of their lifetime. It also assumes that each potentially carcinogenic pollutant is emitted simultaneously, which may not be the case due to the variable nature of the feedstock. Indeed, some of the carcinogenic pollutants modelled may not be present at all much of the time, especially as source separation and diversion programs improve over time with community education and participation. When

Submitter	Submission and/or issue	Response to comment
	compounded effect from exposure to all seven at once. There is no attempt to account for exposure to all of these seven pollutants together even though it is likely that they would be emitted simultaneously. The PE incinerator is close (much closer than the 5.5 km used in other studies) to gardens and domestic fruit trees. Further south are the market gardens and vineyards. Arsenic and mercury should be considered in air quality tables. Every cubic metre of air at the monitoring sites one of which is within the grounds of a primary school has some 32/33 pollutants in admittedly minuscule amounts. Totalling the amounts for all three gives us 0.033 micrograms per cubic metre for annual averages and 24 hourly maxima close to 0.3 micrograms per cubic metre for worst case scenarios.	pollutants are present in higher concentrations in the flue gas leaving the boiler, this simply means that the Air Pollution Control system will have to work a little harder to ensure that what is actually being emitted is still well below the permitted emission limits. With regard to cumulative impacts of carcinogenic compounds, which may or may not be present in emissions from the WtE facility, it is noted that the percentages of the ICR guidelines can be summed to calculate the potential total Incremental Carcinogenic Risk from exposure to multiple compounds as a result of the WtE facility. The sum of the percentages of the ICR guidelines presented in **Table 22 of PER Appendix F** is equal to 10.7%, which represents a risk value of 1.07E-07 and remains well below the USEPA recommended de minimus (i.e. so small as to be considered negligible) risk value of 1.00E-06. It is noted that the 33 pollutants referred to by the respondent, relate to **PER Figure 32 (on p100)**, which summarises the results from a DER air quality monitoring campaign undertaken between 2005 and 2010. This data comes from **existing** controlled and uncontrolled emission sources and encouragingly, shows that measurements confirm that background concentrations of those compounds met existing 24 hr and annual guidelines. Furthermore, Calista and Hillman are beyond the 8 km by 8 km square model domain considered to be relevant to the assessment of potential air quality impacts of potential non-SO_2 pollutant emissions from the proposal.

4.5 Amenity

Submitter	Submission and/or issue	Response to comment
DER	**Odour** Assuming the odour emission estimate is reliable, and noting the conservative assumptions used in modelling, the modelling adequately demonstrates that odour concentrations will be well below the Queensland odour guideline, which is an appropriate criterion. Conservative assumptions made in modelling were: Odour is assumed to escape from the building, ignoring the benefit of the tipping hall being under negative pressure (combustion air drawn from the tipping hall); and Odour emission is calculated as an average over a two-hour shift (doors open for 90 minutes in the two hours), but this emission is modelled as continuous, i.e. 24/7 or 168 hours per week) whereas the door are opened only during 2 x 2-hour shifts on weekdays, i.e. 2 x 2 x 5 = 20 hours per week. Some aspects of the meteorological data and processing are questionable but changes would not alter the significant margin of compliance with the odour criterion. The modelling is supported by a "worst case" calculation using AUSPLUME (at DER's request), also indicating easy compliance. Uncertainty and likely non-representativeness of	Agreed Noted Agreed

Submitter	Submission and/or issue	Response to comment
	the Specific Odour Emission Rate (SOER) for the tipping hall should affect the odour modelling results. There uncertainties are ubiquitous to odour modelling and should be mitigated by odour management systems some of which are proposed for this site. The SOER of 0.97 ou.m3/s/m2 comes from the Eastern Metropolitan Regional Council project and has been obtained from a flux hood sampling device. It is therefore a potentially significant underestimate. The assumption that the odour emission rate exiting the building through open doors is equivalent to the emissions from the surface area of exposed waste within the building is arguable. It is not possible to conclude whether it is conservative or not. An interlock system should be installed on the two fast doors for the entrance and the exit of the trucks. Such a system should prevent both doors from being open simultaneously. It is particularly of interest in this project where the two sets of doors are face-to-face and aligned North-South. The absence of such a system may result in significant odour emissions, e.g. with the hall being flushed with both doors simultaneously open under a southerly or northerly wind. Will such a system be installed and kept operational?	The Proponent believes that the entire hypothetical odour assessment presented in **PER section 10.1.2.5 (p88)** is highly conservative since it completely ignores all physical odour mitigation and management, as noted above by the DER, and described further in the Proponent's responses below. As the majority of modern WtE facilities are located within major urban population centres, odour management and mitigation is well understood. In fact, many combustion type WtE facilities (in particular the Japanese plants) do not even have entry and exit doors on their tipping halls, preferring instead to use air curtains and doors on the waste bunker unloading bays (please see photograph inserted below). Furthermore, it is essential that truck movements through the facility are not restricted, in order to prevent delays to those trucks performing a collection service and to prevent congestion either within the tipping hall or on internal and surrounding roadways. In addition to roller doors at the Tipping Hall exit and entrance, **PER section 10.1.2.9.1 (p92)** describes a number of odour management and mitigation methods, including: • Automatic, remotely operated doors on each unloading bay, meaning

Submitter	Submission and/or issue	Response to comment
		that the waste bunker is also largely sealed off from the Tipping Hall. The photo below shows the MHIEC-Martin Minato-Tokyo WtE reference facility waste bunker with unloading bay doors. • The combustion air intakes are situated above the waste bunker, while louvres help to ensure air ingress into the waste bunker at all times, when the unloading bay doors are closed. This measure maintains a negative air pressure within the waste bunker (the only section of the facility where putrescible waste is stored) and Tipping Hall at all times, when either one or both Martin grate lines are operating. It is also noted that the demand for combustion air will be greater than for alternative technologies, which either rely on partial combustion of the waste, or do not require combustion air at all and therefore, must rely solely on ventilation systems and biofilters. [Note that biofilters are not required for a WtE facility, which like the Proposal, uses single-stage combustion of for energy recovery.]

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		 Such abatement measures are more than adequate to manage and mitigate odours emanating from the enclosed waste bunker. In addition, the hypothetical odour assessment undertaken as part of the air and odour assessment, clearly demonstrates that even without taking account of the basic abatement measures, ground level odour concentrations are still well below the applicable standards. As such, an interlock system is considered to be unnecessary for a combustion type WtE facility employing best practice odour management and mitigation measures, and presents a risk to the smooth operation of the facility, by increasing the likelihood of traffic congestion both inside and outside the Tipping Hall.

Submitter	Submission and/or issue	Response to comment
ACE and Public Submitters	Ten days of storage will be unbearable inside with odour. What if the negative pressure ever fails, there does not appear to be a back-up plan? This would result in excessive odour.	As noted in **PER section 10.1.2.9.1 (p92-93)** and above, odour is readily managed in WtE facilities using the same or similar technology as the Proposal. The negative air pressure cannot simply fail, since there are two Martin grate boiler lines operating independently in parallel. If both lines are required to be shutdown for a plant turnaround, **PER Table 20 (p93)** describes the typical control measures and preventative procedures to manage this irregular scenario.
	Appendix F, page 43. The consultant has modelled a number of conditions and is confident that odour emissions comply comfortably with odour limits. The results do appear to be surprisingly optimistic. The respondent recommends this forecast (and its underlying assumptions) be independently verified. Has this occurred?	On the contrary, the results of the Odour assessment are both to be expected and also considered to be highly conservative. With most of the 1000 or more similar WtE plants world-wide operating either within or adjacent to the major population centres they serve, odour management is important, well understood and readily manageable. The DER Air Quality Management Branch has reviewed the modelling as described in the section above.
	Organic leachate would become putrid very quickly. What is the plan for emptying and cleaning the waste bunker (in some WtE plants this is carried out once a day)?	Any leachate which is not re-absorbed by the constant fluffing of the waste by the automated grab cranes will drain into a leachate collection pit via the graded floor of the waste bunker. The leachate can either be re-absorbed into the waste or sprayed into the combustion chamber.
	The waste receival regime is an attempt to minimise the smell, noise, vermin and other noxious by-products that a proposed 400,000 tonnes of municipal solid waste causes. Putting 400,000 tonnes of mixed rotting garbage on wheels then funnelling it to a specific location enhances the likelihood of accident, spillage, leakage, noise and visual pollution. Costs again borne by the community.	On the contrary, international experience associated with the more than 1000 similar operating WtE facilities is a testament to the Proposed approach to both managing waste and recovering valuable resources from waste, by avoiding spillages, leakages, noise, odour and visual pollution associated with current landfill disposal practices.
	How would odour emissions be managed in the	**PER Table 20 (p93)** describes the typical control measures and preventative

Submitter	Submission and/or issue	Response to comment
	event of a shutdown? There needs to be an odour study with contingency plans. Given the potential concentration of fugitive odours around vehicle shifts (p46), the proposed Odour Management and Mitigation Plan (p93) should deliver a management framework that does not unreasonable interfere with the amenity of BGC employees working in proximity.	procedures to manage the very irregular scenario of a full plant shutdown. **PER Section 10.1.2 (from p88)** deals entirely with the hypothetical odour assessment undertaken for the PER as well as the key odour mitigation, management and preventative measures typical of these types of tried and proven WtE facilities. The EPA objective of protecting the local amenity from odour will be met at all times. International experience with the proposed approach to waste management demonstrates that such facilities can be successfully integrated into the urban environment.
DER	**Noise** The DER recommends that consideration for re-designing or minimisation of truck movements will be needed because truck movements along the ring road around the facility within the proposed property may exceed the new noise boundary level on the eastern boundary of the proposed plant. The Plant is located in the centre of the KIA, with the closest residences about 1.5km away in Hope	Noted. The Proposal will comply with the *Environmental Protection (Noise) Regulations 1997* as amended in December 2013,

Submitter	Submission and/or issue	Response to comment
	Valley/Naval Base. Furthermore, most of the major operations proposed for this project will be conducted within purposely built enclosures. DER agrees that the proposed project will generally comply with the noise regulations at the nearest noise sensitive premises, and notes the predictions made by the noise impact assessment report seem reliable and the proposed noise mitigation measures also seem effective. The *Environmental Protection (Noise) Regulations 1997* were amended in December 2013, which gives the industries in the KIA much higher boundary noise levels – 75, 85 and 90 dB (A), as stated by the proponent. Therefore, compliance with the new assigned noise levels on the boundary of the proposed project can also be readily achieved. DER notes that there is potential for the noise emission levels caused by truck movements to exceed the new boundary level on the eastern boundary, due to the closeness of the proposed ring road to the boundary in the current design. The proponent's acoustic consultant proposes a 2.4m high wall on the eastern boundary, which can be supported by DER's Noise Regulation function group. It does not seem that the proponent will definitely adopt this proposed noise mitigation measure. Instead, the proponent states in the PER that "Compliance with assigned noise levels for industrial receivers along the eastern boundary will	

Submitter	Submission and/or issue	Response to comment
	be achieved by adjustments to plant layout, such as the re-location of the ring road or by the construction of an appropriately sized noise barrier, as proposed in the Acoustic consultant's report". DER agrees that re-designing the truck ring road by creating a larger buffer between the road and the eastern boundary, or reducing/preventing the truck movements near the eastern boundary, can also help solve this potential noise non-compliance problem. DER reiterates that compliance with the new assigned noise levels on the eastern boundary must be achieved and supports any noise mitigation measures that can meet this requirement.	
City of Rockingham	There is insufficient detail in the noise report to substantiate claims of compliance with the *Environmental Protection Noise Regulations 1997.* Additional detail is required on the performance or practicality of suggested acoustic attenuation measures to enable peer review against the *Noise Regulations,* and whether or not these are already included in the noise modelling. Physical measurements of noise should be undertaken to quantify the risk of cumulative noise emissions.	Compliance with the *Environmental Protection (Noise) Regulations 1997* as amended in December 2013, will be considered during the Part V Works Approval process. Physical measurements of noise was indeed carried out during the 2010 upgrade and review of the Kwinana Industries Council (KIC) Acoustic Model, by the same consultant who undertook the acoustic assessment of this Proposal. This information is referred to in the Acoustic Consultant's Report provided in **PER Appendix G**.

4.6 Waste/Waste Characterisation

Submitter	Submission and/or issue	Response to comment
DER	The management procedures for incoming waste should be reviewed for suitability of appropriate feedstock to the waste to energy (WtE) plant.	The Proposal will accept residual waste generated either directly or indirectly from municipal kerbside collection. Incoming trucks will be registered, to confirm the source and municipality from which the waste is coming. Subsequent visits will be monitored by the vehicle recognition system at the gate house. Standard Operating Procedures for waste delivery acceptance will be developed during detailed design.
	While this is likely to be a component of the works approval process under Part V of the *Environmental Protection Act 1986,* the proponent will need to clarify and establish rigorous and accountable quality assurance/quality control procedures including that for incoming waste quality. For example, the proponent states that in response to some hazardous waste entering the combustion unit, plant performance will be adjusted to minimise pollutants to atmosphere through increasing firing temperature and reduction in firing rate.	The reference in the PER to the ability of the control system to increase the firing temperature and/or reduce the firing (waste feed) rate, is simply to indicate that there are multiple handles available to safely process the incoming mixed residual waste (99.6% non-"household hazardous" and 0.4% "household hazardous" waste, see **PER Figure 20 (p75)**), even before the flue gases reach the Air Pollution Control system.
	The PER does not adequately detail procedures for identifying and segregating unsuitable wastes prior to loading into the combustion unit and procedures for storing such waste prior to being removed off-site for disposal.	The PER does not detail procedures for identifying and segregating unsuitable wastes prior to loading into the combustion unit because doing so is not considered to be international best practice, and is both impractical and unnecessary for a grate combustion type WtE facility processing municipal solid waste. The PER relates to residual MSW, collected in a standard Mobile Garbage Bin (MGB), which limits the size and quantity of any undesirable materials to that which can fit into a standard MGB. At an average weight of 14.3kg per MGB per week (from Rivers Regional Council 2011 Waste Audit data), there will be over 500,000 MGBs collected and processed each week at the WtE facility, once the facility is operating at its full capacity of 400,000 t/yr.
	The proponent should also detail the maximum time that waste is stored on site, from the time it is unloaded and prior to entering the combustion unit.	The maximum time that waste is stored on-site in the waste bunker will be confirmed during detailed design, but is expected to be approximately 10 days, to reflect the operating and maintenance requirements of the facility – primarily driven by the annual maintenance cycle associated with each

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		operating boiler.
Waste Authority	**Waste Feed** The Waste Authority is concerned that the size of the plant (up to 400,000 tpa) will result in local governments being required to sign long-term contracts committing the majority of their residents' waste to the Phoenix plant prior to implementing better practice source separation. In the absence of any reliable mechanism or firm commitment to ensure that source separation will be implemented by local governments it would be premature to support the development of this facility at this time. The Waste Authority notes that the facility will lock up only the residual waste from collection systems where best practice source-separation of recyclables has been implemented. It would be preferable for the situation that applies under EU Directive 2008/98/EC to be pursued as a priority in Western Australia, namely that implementation of source-separation collection services is mandatory if residual waste is to be processed through waste to energy facilities. Overall, the Waste Authority supports this type of development, which will make a significant contribution to the waste diversion targets; provided that the proponent implement in practice the commitment that it has made 'in principle' to support the source separation of recyclables by	Phoenix Energy fully agrees that it is desirable for the implementation of best practice kerbside source separation and our waste supply agreements with participating councils cater for this eventuality. However, there is no evidence to suggest that councils will not implement such systems because a WtE plant exists. In fact, the experience in Europe and the US (e.g. Berenyi (2003) referred to in the PER) indicates that communities with a WtE service tend to recycle more than those communities without such a service. In its June 2013 *Communication on the Waste Hierarchy*, the Waste Authority made it clear that "The [waste] hierarchy is not intended as a standalone assessment tool, rather, it should be used alongside other assessment tools to analyse the full environmental, economic and social impacts of waste management options." This is consistent with, EU Directive 2008/98/EC (28) "as a means to facilitating or improving its recovery potential, waste should be separately collected if technically, environmentally and economically practicable, before undergoing recovery operations that deliver the best overall environmental outcome. Member States should encourage the separation of hazardous compounds from waste streams if necessary to achieve environmentally sound management." The existence of household hazardous waste diversion programs such as battery recycling, waste oil, paint and solvent drop-off points etc. helps to facilitate the second part of the Directive. Furthermore, Article 10 (2) states "to facilitate or improve recovery, waste shall be collected separately if technically, environmentally and economically practicable and shall not be mixed with other waste or other material with different properties." It is therefore noted that for a council to commit to implementing "better practice source separation", not only does this require an approved business case, it also requires viable resource recovery options (i.e. infrastructure) and markets for those additional source separated materials – otherwise, those

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	only treating residuals left after better practice source separation practices have been applied.	materials will end up in stockpiles and/or landfill. The issue of councils being locked into long term waste supply contracts is readily managed through considered negotiation of minimum committed volumes, as is common practice with long-term waste supply agreements. Indeed, with the City of Kwinana having already signed up to the Proposal and contractual negotiations well under way with other councils, it is quite clear that local councils are ready and willing to act in the best interests of their constituents.
City or Rockingham, Lynn MacLaren MLC, Bell Air Homes, ACE and public submitters.	WtE does not curb or reduce people's usage of waste, as they see it being made into energy as a good thing – making their contribution unaccountable. There is no incentive for the people who get paid to have more tonnage, to reduce their waste. What would be in place to ensure that municipal waste is not being created just to make tonnage/money?	In the absence of WtE, most rate payers are unaware of the legacy of burying residual waste in a landfill – including the need to manage landfill gas and leachate issues for years after the landfill is closed. Landfills are also unsafe and unpleasant for the public to visit, whereas WtE facilities are clean, quiet and odourless in the surrounds and within the public viewing corridors throughout the facility. By incorporating waste management education, public and school group plant tours and public open days, the challenge of reducing waste generation and managing waste as a resource can be discussed. This along with other community engagement programs, which are common practice to our O&M service provider (Covanta Energy Corporation), will raise awareness about the importance of source separation, the available waste diversion programs (such as battery and e-waste recycling) and increase participation rates. Two safeguards are in place: 1.) Contracted councils will need to commit to a minimum tonnage, which they determine based on expected population/housing growth, whilst being cognisant of increased participation in source separation by householders 2.) EPA Recommendation 6 (EPA Report 1468) states that: "Waste to Energy operators should not rely on a single residual waste stream over the longer term because it may undermine future recovery options."

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	Evidence in Sweden shows that they now need to import waste from other countries just to make power.	The overcapacity experienced in some European nations that have utilised WtE for many decades and prior to current practices in source separation and the development of markets for recyclables, should be contrasted against the boom in WtE plant construction in the UK, which has vast under-capacity, as it races to meet its obligations as a signatory to the EU Landfill directive and avoid substantial penalty fees. The key for WA and indeed Australia, is to ensure that WtE plants are suitably located to service the population centres generating the waste, and that WtE plant capacity is matched to the available waste supply streams: with due consideration of future growth in population and housing, while also contemplating lower rates of waste generation per capita, as households continue to reduce, reuse and recycle more materials.
	There is insufficient detail of how mixing will be achieved or guaranteed.	Mixing of waste is achieved by two fully automated grab cranes, which work constantly to fluff and mix the waste in the bunker.
	What waste processing agreements are in place with suppliers of waste?	The Proponent has signed a twenty year waste supply and service agreement with the City of Kwinana and is the preferred tenderer for the Rivers Regional Council's tender for the 'Receipt and Processing of Waste for Resource Recovery'.
	What quantities' of MSW would come from each council?	Waste volumes associated with the waste supply agreements are commercial in confidence.
	It is unclear as to how Phoenix has developed its waste stream data projections.	Waste stream data is available from numerous sources including local council public records and Waste Authority waste audit reports. Waste data projections are largely based on projections of increases in population and associated housing growth.
	The proponent should specify who is going to underwrite the cost of a third green waste collection bin as per the proposal.	The Proposal does not relate to a waste collection service, since this is the responsibility of the local council's to provide to their rate payers, but does provide a resource recovery service as an alternative to landfill disposal. The introduction of a third bin will be at the sole discretion of local councils.

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	The proponent should provide data on the anticipated composition, energy content, and calorific value of the proposed facility's waste intake.	The anticipated composition of the residual MSW is presented in **PER Figure 20 (p75)**, and is based on actual WA local council waste audit data. Information relating to the energy content of waste will be proprietary to the Project and the basis for the detailed design of the boiler.
	Further details of how recycling contaminated bricks back into the brickmaking process eliminates contamination, and state whether this process emits some or all of the contaminated material into the atmosphere.	Bricks which fail to pass quality testing either for their mechanical properties or their chemical properties can be crushed and returned to the brick making process, to be reprocessed, similar to the treatment of other types of off-spec masonry products at conventional brickworks. The process of brick making is not a means of magically eliminating undesirable compounds, but rather to ensure that they are either bound together with other materials such that they do not leach or to ensure that they are present in such low concentrations that they cannot leach and cause contamination of the surrounding environment in which they may be used.
	Why would we want to be reliant on a material if in the future we are going towards a greener way of dealing with and reducing our waste products?	Please refer to the above response in relation to Sweden and the UK experience with WtE.
	Broad assumptions have been made up about the waste composition in MSW. Has this been proven by any audit data from prospective councils near Kwinana?	The anticipated composition of the residual MSW is presented in **PER Figure 20 (p75)**, and is based on actual WA local council waste audit data.
	If the plant is working to capacity the MSW would be stacked some 8-9 metres high within the receival area. How would this be managed?	The waste bunker will be sized to manage the expected volume of residual MSW when the plant is operating at full capacity.
	In the three bin system there are often recyclables in the MSW bins. For such a large project how is it promoting recycling?	The Proposal includes a metals recovery area to recover ferrous and non-ferrous metals from the bottom ash for recycling. Furthermore, once operational, the facility will provide a focal point for educating the community

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		about the importance of source separation and participation. Studies in the US have demonstrated that communities served by a WtE facility tend to have higher than average recycling rates, while those countries in Europe with the highest installed base of WtE also have the highest recycling rates (please refer to **PER Figure 5 (p41)**).
	I would like the proponent to describe of how they are going to manage the recycling in the MSW bin prior to incineration.	The Proposal includes facilities to recover for recycling, ferrous and non-ferrous metals, otherwise destined for landfill disposal. However, the Proposal follows international best practice for those facilities receiving source separated residual MSW, and does not include any upfront pre-sorting. As **PER Figure 20 (p75)** demonstrates, recyclable plastic containers comprise only 1.8% of the anticipated residual MSW, with a further 5.2% being glass, some of which may be recyclable, and 12.8% paper or cardboard, of which much will be contaminated. Even if a pre-sorting system is available to sort 400,000 t/yr of mixed residual MSW, only a fraction of those contaminated recyclables could potentially be recovered. When considering the cost and energy to recover such a small portion of "potentially" recyclable materials upfront, it is easy to appreciate why the majority of combustion type WtE plants do not have upfront pre-sorting and why empowering households to source separate is clearly the more effective alternative.
	Phoenix Energy's proposal does not adequately account for the following waste stream criteria: • WtE is a linear process that destroys vast amounts of already manufactured products losing in the process the embodied energy needed to create them. It creates further CO_2 pollution in the process and only recovers a small amount of the embodied energy of the feedstock.	The EPA (EPA Report 1468) has concluded that "Conclusion 1 Waste to energy plants have the potential to offer an alternative to landfill for the disposal of non-recyclable wastes, with the additional benefit of the immediate capture of stored energy."

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	• The proposal is to process 400,000 tpa of residual waste. The South Metropolitan region does not generate 400,000 tpa of MSW. It is unlikely that the whole of WA produces this quantity of true residual waste. It is therefore likely that the plant would burn non residual waste; this is contrary to the WA Waste Hierarchy, EPA recommendations and is unsustainable.	While the PER indicates that the Proposal will initially accept ~300,000 t/yr of residual MSW, it is common practice to design such a facility to accommodate future expected growth in waste generation over the 20 plus year life of the Proposal, essentially due to population growth resulting in new houses and apartments being built – each of which will have a new residual waste bin, which will require collection and disposal/recovery. Our response to Recommendation 5 (**PER section 2.3 (p20)**) clearly indicates that the Proposal is strictly targeting the residual waste bin in a 2 or 3 bin municipal waste collection system.
	• The processing of green top bins which contain a mix of waste streams including putrescible organics, recyclables and other compostable wastes and that compliance with this recommendation is undertaken with "random spot checks". This would not ensure that this recommendation is met and that only residual wastes will be burnt.	Waste collection vehicles are typically marked to indicate which source separated waste stream they are collecting and carrying. Random spot checks will simply help to ensure compliance with waste supply agreements, which will clearly stipulate which waste is deemed Acceptable and which waste is deemed to be Unacceptable for processing at the facility.
	• The residual waste stream can be further source separated to remove up to 30% of recyclable and compostable materials. Further community education and better source separation and collection services should mean our residual waste fraction should be declining. This mass incinerator would then be continually looking for new waste streams to keep it viable. It is then highly likely that the plant will seek industrial waste and changes in licensing to facilitate the incineration.	This contingency is covered by establishing minimum contractual volumes as part of the waste supply agreements with participating councils. Any change to feedstock type will necessitate approval from the DER under Part V Licensing approval. That said, this Part IV assessment specifically relates to residual MSW.

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	• The plant is relying on an increase of waste generated by a growing population (PER p 20). National and state studies show that despite population increases, in previous years waste volumes are reducing through increased education and improved recycling and composting strategies. The premise of waste increasing with increased population does not represent a solid scientific justification.	WA in particular, is coming off a very high baseline for waste generation per capita, due to the late adoption of source separation and resource recovery when compared to the eastern States, combined with very rapid population growth in recent decades. While it is indeed correct that per capita waste generation has reduced over time, with better product stewardship, better waste education regarding source separation and the availability of collection services for source separated waste streams, every additional new home and apartment built will add another bin to the waste system. Furthermore, as described earlier, the introduction of a 3rd bin for collection and recovery of source separated garden organics presents a number of logistical and commercial challenges, which (like the resource recovery service described in this Proposal) will take time to be resolved at the local council level, and importantly, gain acceptance from the wider community.
	• Mass combustion incinerators seek the highest calorific value fuels available to burn as this increases the efficiency of their energy.	This might be the case where wholesale electricity prices are high, but this is not the case in Australia, where wholesale electricity prices are low and therefore, gate fees are more important to the commercial viability of a WtE Proposal.
	Is there sufficient waste to promote such a large scale project?	Yes
	There are concerns as to what will happen to the waste material which is not accepted for combustion and how will it be moved off site and disposed of.	Waste loads from approved waste collection vehicles carrying acceptable waste will proceed to the tipping hall to unload into the waste bunker. Waste loads which are: (1) not approved based on vehicle identification, (2) deemed to be carrying unacceptable waste or (3) found to have an unacceptably high level of radiation, will not be allowed to proceed to the Tipping Hall, but will be returned to a location agreed to in the applicable waste supply agreement, for inspection and disposal by the waste supplier.
	The proponent claims 100% diversion from landfill.	The project is seeking approval to divert 100% of the waste feedstock **away**

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	It is questioned whether this is possible and what evidence is there to substantiate such a claim?	**from** landfill, by incorporating an on-site Brick Plant and/or selling the bottom ash as a construction aggregate, once a Material Guideline is approved in consultation with the DER. As described in **PER section 10.1.1.6.8.1 (p82)**, in Europe and the UK, it is common for bottom ash to be reused for construction applications, while in Japan, 100% diversion away from landfill has been achieved through high temperature vitrification of fly ash and the production of bricks.
Lynn MacLaren MLC, City of Rockingham, ACE and public submitters	**Hazardous Waste** It is interesting that there is a radioactive detection procedure, but not for any other hazardous waste. Why must fly-ash be disposed at a waste facility?	It is important to recognise that the quantity of undesirable materials, in particular 'household hazardous' waste, is typically only a very small fraction of the total residual waste stream (see **PER Figures 20 and 21 (on p75)** for the anticipated waste composition from Rivers Regional Council member council waste audit data) and WtE plants are both designed and operated to handle this contingency by: (a) constantly premixing the waste in the waste bunker, to reduce the likelihood of significant quantities of inappropriate waste being fed to the grate, (b) safely treating the waste feedstock at high temperatures, (c) cleaning of the flue gas (predominantly nitrogen, carbon dioxide and water vapour) leaving the combustion chamber in the Air Pollution Control system, and (d) continuously monitor the concentrations of key pollutants in the flue gas stack. An example characterisation of fly ash is presented in **PER Table 17 (p85)**. Fly ash tends to have higher alkalinity and higher heavy metal content than bottom ash, due to the preferential partitioning of volatile heavy metals into the flue gas under normal combustion temperatures. As such, the fly ash must either be stabilised and rendered non-leaching by chemical transformation (e.g. through brick making), or cement solidified by mixing with cement and water prior to disposal, or it is characterised and disposed of at an appropriately classed landfill.

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	Why is this solely relying on source separation, thus no checking of loads and all waste accepted including hazardous materials which are then burnt and released to the atmosphere or become pavers? Why is there not any screening for and removal of hazardous waste?	This is solely dictated by international best practice, whereby source separation and educating the community about the availability of diversion options for potential household hazardous wastes, is far more efficient and effective than trying to pre-sort the waste to remove that minute fraction of undesirable materials. On the other hand, the Air Pollution Control system will be required whether or not there is upfront pre-sorting of the waste, which is why it is international best practice to design the APC system to handle the small fraction of emissions resulting from the safe combustion of those 'household hazardous' waste components.
	Broad assumptions have been made up about the waste composition in MSW. Has this been proven by any audit data from prospective councils near Kwinana?	Indeed, the waste composition presented in **PER Figure 20 (p75)** is entitled "West Australian Rivers Regional Council Domestic Waste Audit: All councils consolidated composition of general waste (Source: APC 2011)"
	In reference to page 79 how can premixing of the waste in the waste bunker reduce the likelihood of significant quantities of inappropriate waste (e.g. undesirable or hazardous waste) being fed to the grate?	Premixing of the waste in the waste bunker is common practice to partially homogenise the heterogeneous residual MSW. The BREF (2006) describes the process as follows: "The mixing of wastes helps to achieve a balanced heat value, size, structure, composition, etc.". This mixing simply helps to reduce the likelihood that a batch of waste will all come from the same source.
	What standard operating procedure, in addition to radioactive screening is planned for screening and rejecting inappropriate/hazardous waste?	The primary screening for inappropriate or hazardous waste will be at the gate house, where only appropriately licensed and approved vehicles will be accepted onto the site.
	How is radioactive screening done and what selection criteria (pass/fail) are applied to each load?	Radiation detection sensors permanently mounted at the weighbridge will detect (and alarm) if a particular waste load has an unacceptably high level of radiation. The operational experience of our project partner Covanta, indicates that If a load of waste is found to have a radiation level of 5 standard deviations above the background radiation levels at the project site,

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		the vehicle will not be allowed to proceed to the Tipping Hall. Since waste with an unacceptable radiation level will not be accepted for processing, it will remain the responsibility of the contracted council to assess and dispose of appropriately. All instances of radiation detection alarms will be documented and reported.
	Why is there not any screening for and removal of hazardous waste?	As described above, international best practice for combustion type WtE facilities dictates that where waste is source separated, it is unnecessary to screen for and remove the tiny fraction of 'household hazardous' waste, which may or may not be present in each load of residual MSW, which is deposited into the waste bunker. Since no screening system is perfect, the facility would always be required to have an APC system for flue gas clean-up, so it also makes sense that international best practice is not to bother with a largely ineffective up-front screening process at the WtE plant, but rather to design the APC system for all contingencies.
	Due to the known variable nature of hazardous waste in MSW (typ.3%), this is a high risk strategy.	If the proposed approach was indeed considered high risk, which it is not because it is readily manageable, then international best practice for high temperature combustion type WtE facilities would dictate otherwise. Due to the large number of households contributing waste to the WtE facility (~540,000 households per week at full capacity of 400,000 t/yr), a change in the percentage of household hazardous waste from 0.4% (from WA waste audit data, PER Figure 20 (p75)) to "typ. 3%" (quoted and unreferenced by the respondent) would mean that either (a) a large number of households would need to start putting inappropriate waste into their residual waste bin or (b) a fewer number of households would need to start dumping substantial quantities of inappropriate waste. Neither is plausible and neither is consistent with international experience and best practice.
	The characterisation should be much finer grained. It should be established how frequent in kerbside bins and in public drop offs to transfer stations are	While this "finer grained" characterisation information might be of academic interest, at 0.4% of the overall waste stream, it is readily manageable by best practice combustion control systems and APC system design and operation,

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	the following: batteries, Polyvinyl chloride, electronic equipment, computers, toys, smoke alarms and other hazardous wastes (pesticides, paints and fuels).	along with Continuous Emissions Monitoring.
	Recyclables, oils, batteries, electronic waste, pesticides, plastics, pvc and vinyls. Their assessment process relies on Local Government providing and enforcing diversion of recyclables and hazardous wastes.	Agreed. Diversion options are already in place in most municipalities and it will be in the best interest of the proposal (i.e. to reduce operating expenses associated with APC system consumables) to ensure that the public is well informed and educated as to their accessibility and availability.
	The EU guidance on Best Available Control Technology for thermal waste to energy systems provides a clear reference to this issue. Firstly, management systems should be in place to identify and divert hazardous or unsuitable waste types. Secondly, waste should be homogenised in terms of calorific value, moisture content and density.	Please see discussion of both of these points above.
	How does anyone know if any hazardous waste would be incinerated without prior sorting and screening?	Please see discussion above regarding international best practice and experience.
	What waste processing agreements are in place with suppliers of waste?	This item has been addressed in the previous section.
	What quantities of MSW would come from each council?	This item has been addressed in the previous section.
	It is unclear as to how Phoenix has developed its waste stream data projections.	This item has been addressed in the previous section.

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	The proponent should specify who is going to underwrite the cost of a third green waste collection bin as per the proposal.	This item has been addressed in the previous section.
	The proponent should provide data on the anticipated composition, energy content, and calorific value of the proposed facility's waste intake.	This item has been addressed in the previous section.
	Further details of how recycling contaminated bricks back into the brickmaking process eliminates contamination, and state whether this process emits some or all of the contaminated material into the atmosphere.	This item has been addressed in the previous section.
	The disposal of fabric filters is important as they capture virtually all particulates, dioxins and furans. The manner in which these filters will be disposed should be adequately described.	The mechanism for capturing dioxins and furans is physical adsorption onto the surface of the activated carbon in the "cake" residing on the outer surface of the fabric filter bags. This "cake" is periodically dislodged by air pulse until such time as a leak is detected and the bag is replaced. However, it is not the filter bags that will contain dioxins and furans, but the "cake". With 46 WtE facilities under management, many of which have fabric filters, Covanta operating staff will be well trained in the safe handling of worn or ruptured filter bags. Worn or ruptured bags will be disposed of in accordance with local regulations.
	The proponent should provide standard operating procedures for screening and rejecting all inappropriate or hazardous material (essentially, condition based risk management materials) in the MSW.	As described above, the primary screening for inappropriate waste will be at the gate house, where only appropriately licensed and approved vehicles will be accepted onto the site.
	The ability to manage and mix waste feedstock is	We assume that the word "construction" is meant to read "combustion".

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	vital to minimising dioxin and furan formation during construction. Japanese incinerators have burnt radioactive material. How would it be assured that this would not occur at this plant? There is an oversight with covering the checking and pre-sorting aspects of the hazardous waste including plastic (PET) batteries and medical wastes.	Managing and mixing the waste is but one aspect of minimising dioxin formation. Of more importance are (a) combustion temperature control and (b) rapid quench of the flue gas exiting the boiler. We are unaware of any evidence to support this assertion. Furthermore, a radiation detection system will be in place as noted in **PER section 5.1.2.1 (p46)** and **PER section 10.1.1.6.4.1 (p79)**. The issue of pre-sorting has been discussed at length above.
Bel Air Homes, ACE and public submitters	**Pre-sorting** Pre-sorting and removal of recyclables is a component of the waste hierarchy but is not included in the proposed plant, and there is no proposed method of screening for toxic waste, or any other undesirable waste streams. The waste stream does not conform to "residual" waste.	The *Waste Avoidance and Resource Recovery Act 2007* contemplates resource management options as a hierarchy with 3 levels, from the most preferable 'avoidance', followed by resource recovery (which includes energy recovery), and the least preferable outcome being disposal. 5. Objects of this Act (1) The primary objects of this Act are to contribute to sustainability, and the protection of human health and the environment, in Western Australia and the move towards a waste-free society by — (a) promoting the most efficient use of resources, including resource recovery and waste avoidance; and (b) reducing environmental harm, including pollution through waste; and (c) the consideration of resource management options against the following hierarchy — (i) avoidance of unnecessary resource consumption; (ii) resource recovery (including reuse, reprocessing, recycling and energy recovery); (iii) disposal. (2) The principles set out in the EP Act section 4A apply in relation to the objects of this Act.

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		The Kwinana WtE Project is providing a resource recovery service to councils (by recovering energy and other resources), not a waste collection service, and seeks to prevent the disposal to landfill of 100% of the waste feedstock. The facility will only accept MSW from municipalities that employ source separation through the provision of either a 2 or 3 bin collection service. The facility will not accept waste from municipalities which have a single bin collection system. The facility will be designed to recover resources from the residual waste bin (after source separation by the householder), which would otherwise be destined for landfill disposal. The proposal does not include an up-front Materials Recovery Facility (MRF) for a number of reasons as detailed in the PER (please refer to **PER section 5.1.2.1, p47**), but does include the recovery of ferrous and non-ferrous metals from the bottom ash. International best practice for those robust and flexible WtE technologies whose performance is not susceptible to changes in feedstock composition and moisture content, is to ensure effective source separation through: • provision of collection services for source separated materials which are either undesirable to be processed through a WtE facility or for which a higher order recovery alternative exists, and • by effective education of the community. As illustrated in **PER Figure 20 (p75)**, actual waste audit data across multiple WA local council areas shows that the portion of recyclable plastic containers is very small (1.8% of the total mixed waste composition). While paper (including tissue paper) and cardboard contributed a larger fraction, much of that material would be contaminated either from the products it enclosed or from contact with other materials in both the mobile garbage bin and the garbage truck compactor. Setting aside the additional significant cost to the rate payer to build a facility to recover this small fraction of potentially recyclable materials, just considering the energy and carbon footprint impacts

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		associated with (a) the initial recovery of these potentially recyclable materials from the total mass of mixed waste, (b) transporting those materials to another facility, and (c) re-processing those materials deemed to be suitable for re-processing into saleable products, it is no surprise to those who have studied the WtE industry that current best practice is to recover the energy content of the material directly, rather than to try to recover the small fraction of potentially recyclable materials from a wet mixed waste stream. Furthermore, as community participation and education increases, any upfront sorting process will become largely redundant, thus placing an unnecessary legacy cost on participating councils and their rate payers. By considering practical, social and economic aspects, this assessment is complementary to the application of the Waste Hierarchy, as described by the Waste Authority in its June 2013 *Communication on the Waste Hierarchy*: "The [waste] hierarchy is not intended as a standalone assessment tool, rather, it should be used alongside other assessment tools to analyse the full environmental, economic and social impacts of waste management options." (p4). Another key aspect is service reliability. The Facility will be required to provide a reliable service to multiple participating councils, who will maintain their usual household collection cycles for their rate payers. Even if suitable MRF technology exists at the scale required to handle the expected volumes of MSW (up to 400,000 t/yr), there are significant implications for operational reliability associated with adding a large number of additional mechanical materials handling equipment items upfront of the Martin grate lines. All of that additional equipment will consume electricity, thus increasing the plant parasitic load and reducing the amount of electricity available to offset baseload fossil fuel electricity. As described in the PER documentation, once operational, the Facility will provide a regional focal point for waste management education through the provision of Facility open days and regular site tours. There will also be

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		opportunities for local schools and universities to partner with the Facility for both educational and research purposes. Our Plant Manager and Operations & Maintenance service provider, Covanta Energy Corporation, also brings a wealth of experience in community engagement and outreach programs, which create a tangible connection between the local WtE facility, the local community and the municipalities it serves. This connection will help drive further improvements in participation rates and positive source separation behaviour in the communities being served by the Facility. Regarding "screening for toxic waste, or any other undesirable waste streams", the following response is provided: As described in the PER, incoming loads will be screened to detect unacceptable levels of radiation, which are typically associated with the incorrect disposal of medical related equipment or waste materials. It is also well understood, from decades of operation around the globe, that while most households will do the right thing and take advantage of the various drop-off and collection services for undesirable waste materials (such as batteries, fluorescent light globes, paints, solvents and household medical products), a minority will either consciously or unconsciously put those materials into their residual waste bin. However, as illustrated in **PER Figure 20 (p75)**, actual waste audit date across multiple WA local council areas shows that the so-called 'household hazardous' component of the waste stream is only a very small fraction of the total mixed waste composition. As it is impractical to contemplate trying to remove every last battery and light bulb from the total mixed waste feedstock, WtE plants are designed to handle this contingency as described in the PER (please refer to **PER section 10.1.1.6.4, p79**). Most importantly, a large portion of the total capital expenditure on plant and equipment is dedicated to the flue gas clean-up Air

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		Pollution Control system, which is designed to capture those pollutants, which emanate from both the general waste and the so-called 'household hazardous' materials. Furthermore, the Continuous Emissions Monitoring System (CEMS) is in place to monitor the process, provide input to the automated control systems and alert the operations staff if there is a potential for a pollutant to approach a limit value.
	If, as is proposed by the proponent, a third party waste collection bin system were introduced, what are the anticipated sources, composition and calorific value of such? Why are there not opportunities to recover green-waste and remove some recyclable material up front, prior to combustion? It is noted that oversized items will be removed.	The introduction of a 3rd bin and associated collection and recovery service is the sole responsibility of the local council. The impact on the residual waste bin composition is presented in **PER Figure 21 (p21)**. The hypothetical waste composition conservatively assumes 100% diversion of garden/vegetation waste into the 3rd bin. Since garden/vegetation waste is high in moisture, this is expected to reduce the overall moisture content of the residual MSW, which will also likely increase its calorific value. The removal of recyclable materials up front is currently achieved by the householder participating in the existing source separation recyclable collection service. However, residual ferrous and non-ferrous metals, being non-combustible, are readily recovered from the bottom ash and recycled.
	Please provide audit details of typical bin contents of MSW in Japan.	The contents of a typical MSW bin in Japan is not considered to be relevant to the Kwinana WtE Project, given that the process design will be based on local MSW waste audit data as presented in **PER Figure 20 (p75)**.
	The claim of 100% diversion has no world precedents, what are the justifications?	As discussed in the PER, it is now common place in Europe, the UK and Japan, to utilise WtE plant combustion residues for construction applications or to create construction products, such as bricks and pavers, rather than defaulting to landfill disposal. By applying proven brick and paver making technology to both the bottom ash and fly ash by-products of combustion (after ferrous and non-ferrous

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		metal recovery), we avoid the need to dispose of these by-products to landfill and therefore achieve the stated 100% diversion target. As an alternative, or in addition to brick/paver production, the bottom ash (which is not classed as hazardous in most jurisdictions with WtE facilities) can be safely utilised in construction applications, where the product meets the material specification (within the Material Guidelines for the use of waste-derived materials as waste-derived fill and/or construction products) being developed by the DER as part of its regulation of the use of waste-derived materials.
	Non-sorting of waste delivered would contribute to non-residual wastes being burnt.	Residual MSW is pre-sorted by the householder, which is precisely why there is very little recyclable material evident in the anticipated residual bin composition, as presented in **PER Figure 20 (p75)**. Increasing education and community participation in diversion programs and source separation services will further reduce these small residual quantities of potentially recyclable materials, whose recovery and recyclability is uncertain.
	What is the recycling commitment that this facility would adhere to?	As the Facility will NOT accept source separated recyclable materials it will operate along-side existing recycling services by providing a resource recovery service (including the recovery of recyclable ferrous and non-ferrous metals) for materials otherwise destined for landfill disposal. This is consistent with international experience and best practice as highlighted in **PER Figure 5 (p41)**.
	You claim that MSW is not entirely predictable. How will you manage incompatible waste streams going to the incinerator?	The Proposal, as presented in the PER, is to accept residual MSW. Due to existing diversion programs and source separation, relevant waste audit data (as presented in **PER Figure 20 (p75)**) clearly indicates that there is very little incompatible/undesirable waste in the waste stream. The small fraction of this material will be readily handled by well-established plant operation (e.g. pre-mixing), process controls (e.g. combustion controls) and Air Pollution Control.

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	There does not appear to be resource recovery up front.	Residual MSW is pre-sorted by the householder, which is precisely why there is very little recyclable material evident in the anticipated residual bin composition, as presented in **PER Figure 20 (p75)**. International best practice for facilities such as the Proposal, is not to place unnecessary resource intensive pre-sorting, but rather to recover recyclable ferrous and non-ferrous metals from the bottom ash, and recover non-combustible materials (dirt, bricks, concrete, ceramics etc.) for sale as alternative construction materials or for use as landfill daily cover – to replace virgin quarried materials.
	The project does not demonstrate any compliance with the State Government Waste Strategy as they propose to burn all of the waste which is received on site.	The project is fully compliant with the State Government Waste Strategy since it is targeting source separated residual MSW otherwise destined for landfill disposal, and will therefore have a significant positive impact on Western Australia achieving its waste diversion and resource recovery targets. As a side benefit, the project will also contribute a significant amount of new base load renewable electricity generation capacity.
DER	**By Product/Bricks Pavers** The proponent reviews the information provided to justify suitability of using fly ash and bottom ash in the brick making plant. The proponent has not demonstrated in the PER the health and environmental safety and integrity of the proposed use of bottom ash in the brick making process. Before any re-use is proposed, issues need to be considered beyond the creation of a suitable product to the whole life cycle of the product, as in accordance with the EPA Waste to Energy report (Report Number 1468. EPA, 2013). The assessment should include both leaching while	It is expected that new *Material Guideline Schedules* will be developed in consultation with the DER for each of the waste-derived by-products produced by the WtE facility. This has been flagged to the DER during the recent industry consultation period for the DER's *Draft guidance statement: Regulating the use of waste-derived materials*. The *Material Guideline Schedules* will as a minimum detail the applicable quality standards that the alternative construction products (e.g. bricks, pavers, aggregate) will need to achieve in order to be used as an alternative to an existing construction material. However, it is yet to be agreed with DER whether requirements for product testing (e.g. leaching tests) will be incorporated into the Material Guidelines or whether these will be specified in the Part V Licence approval (or both).

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	the product is in use and the potential impacts when the product is disposed of. Until it can be demonstrated that the material used in specific applications can meet acceptable contaminant release thresholds, the EPA report should recommend that bottom ash be disposed of to landfill. The same assessment should be undertaken for fly ash. The proponent has provided minimal detail on the brick making process and has stated that the only atmospheric emissions will be ventilation air. Further detail is required including but not limited to site layout and description of technology used in the process, an assessment of the emissions that will be discharged from the plant and the abatement installed to treat such emissions.	Please refer to **Section 3 Responses to Important Matters to Be Addressed** for a detailed testing program for all residues and by-products anticipated to be produced by the Proposal. As it is proposed that fly ash will be incorporated in the brick making process where the crystalline characteristics required for strength and durability of the bricks will also act to stabilize that material and facilitate its value added re-use as an alternative construction material, the development of the *Material Guidelines* will also consider the development of a testing regime to ensure the integrity of the proposed waste derived materials over the entire product lifecycle. The process description provided in the **PER section 10.2.1.5.3.1 (p97)** is clarified further below: With reference to Figure 30, the ash (bottom ash (aggregate) and fly ash) is mixed with quick lime, hydrated lime or lime kiln dust (10-12%) and water, and blended in a high intensity mixer. The raw material mix is inserted into a metal die and pressed using a hydraulic or mechanical press. Adding pigments before pressing or applying coatings to the finished pieces produces coloured products. The raw material is then removed, stacked on a pallet, and cured at ~195 ^{o}C in an autoclave for six hours, by pressurising the autoclave to 14.8 bar with saturated steam (to be sourced from the WtE plant steam turbine)~~using indirect steam heating~~. This curing process forms tobermorite mineral (calcium silicate hydroxide hydrate) crystals, which tightly bond with the ash to create a strong, weather resistant building product. After curing, the autoclave is depressurised and the residual steam is recovered for re-use in the process. After cooling, the finished Brixx^{TM} are removed from the autoclave and inspected for defects. All defective Brixx^{TM} can be crushed and completely recycled, resulting in no production waste.

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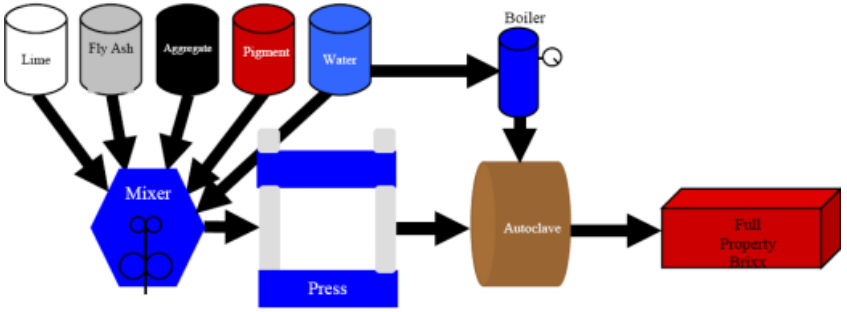
		PER Figure 30– A simplified process schematic of the patented PMET Brixx™ process  The process is similar to that used in conventional calcium silicate (CS) brick making. In fact, PMET have demonstrated their brick making process using a conventional CS plant in Germany. The description provided in the **PER section 10.2.1.5.3.2 (p97)** is clarified further below: It is intended to utilise steam from the WtE plant (i.e. low pressure pass-out steam form the steam turbine) as the heat source for the autoclave, as such the only atmospheric emissions will be ventilation air associated with a dust extraction system for the mixer area, which is expected to pass through a baghouse prior to emission. Due to the nature of the process, all rejects and residues can be crushed and recycled to the mixer to make new brick/paver products. There are no aqueous or liquid emissions to the environment as the process is a net water consumer, with all water condensate recovered from the autoclave being recycled to the mixer. A conceptual commercial scale Brixx™ plant general arrangement floor plan from PMET is provided in **Appendix C**. Additional details are provided below in relation to proposed Brick Plant dust control, extraction and recovery:

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		Dust extraction is expected to be located over the high intensity mixer (i.e. specifically for use during loading and operation of the mixer), and it is typically also required for the board cleaning area, after cured bricks are removed from the boards and stacked prior to dispatch. Given that the brick making process is a batch process (the PMET curing process takes 6 hours), potential dust generating activities will occur only intermittently throughout the day, as a new batch of ingredients is metered into the mixer and blended with water and lime. In any case, the ventilation air extraction rate is expected to be orders of magnitude smaller than the WtE plant flue gas emission rate (which is from a continuous process). That is the main reason why this potential emission source was not specifically included in the detailed air quality assessment, but is noted in **PER Table 21 on p96**. Where a high level of capture efficiency is desired for dusts which may contain sub-micron particle sizes, a two stage dust extraction system is typically specified. The two stage system can be described as follows: • 1st stage baghouse, for high efficiency recovery of "coarser" particles down to 1micron (and possibly below) • 2nd stage High Efficiency Particle Arrestor (HEPA) filtration, for polishing and high efficiency recovery of fine particles below 1 micron • ID Fan with silencer and vent, to ensure that the fan is only exposed to clean air, and • Dust recovery – recovered dust is expected to be returned to the process, typically via an enclosed bin, or mechanical or pneumatic conveyance system. Information provided by a potential equipment supplier in relation to their German supplier's standard filter materials for the 1st stage of filtration (baghouse) indicates that a recovery efficiency of 99.9% is achievable and can be certified for filter fineness from 0.1 micron to 5 micron.

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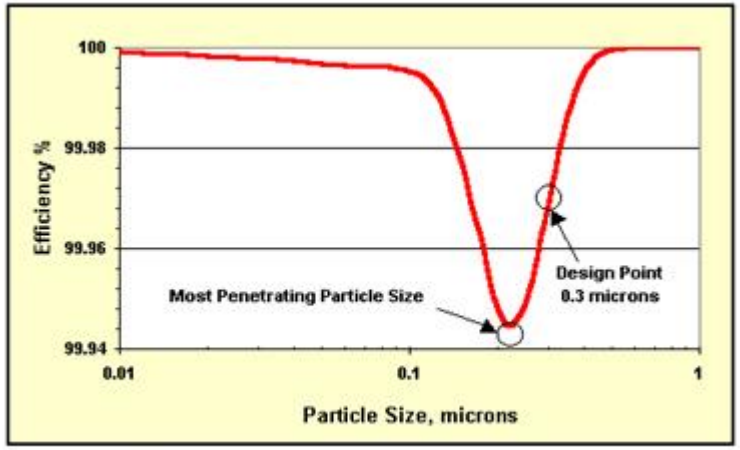
		In relation to the performance of the 2nd stage HEPA Filter, filter media performance is typically presented in terms of the recovery efficiency achievable for 0.3 micron particles. For example a HEPA 99.97% Filter is rated to recover 99.97% of 0.3 micron particles, with a typical performance curve presented below (**Source:** http://www.berriman-usa.com/tutorial_2_air_purifiers.htm, Figure referenced to *Filtration of Airborne Microorganisms: Modeling and Prediction*, W. J. Kowalski, W. P. Bahnfleth, & T. S. Whittam).  ***Figure 1:*** *Typical Performance of a HEPA 99.97% Filter.*

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KIA, BGC, Bel air Homes, ACE and public submitters	The KIA considers that the proposal would result in the production of inert materials (road aggregate, brick pavers etc.) from bottom and fly ash, not limited to that which is produced on-site, and which is currently destined for landfilling.	The production of inert alternative construction materials (road aggregate, bricks, pavers etc.) will be from bottom ash and fly ash produced on site, along with other additives such as lime and pigment (for colouring).
	Characterisation standards should be set during the 'commissioning stage'.	Characterisation standards will likely be set prior to commissioning and in conjunction with Part V Licensing of the Proposal. This may also occur earlier or in parallel with the development of *Material Guidelines* for waste derived products (e.g. bricks, pavers, aggregate), to be developed in consultation with the DER.
	Incinerators produce toxic fly ash. What risk is there to homeowners that the bricks are not toxic particularly including in cases such as when holes are drilled into them?	
	How would these bricks meet Australian Standards?	The bricks and pavers (and any other alternative, waste derived construction products) would, through product testing, need to demonstrate that they comply with applicable Australian Standards e.g. in relation to compressive strength and water absorption.
	PE states that "production of bricks and pavers will provide a highly effective means for containing and eliminating the potential dispersion of manufactured nanoparticles". This result would be conditional on the test results, hence 'would' should be used not 'will'. PE's confidence is premature given that little is known about the actual contents of West Australian MSW, and from this PER little more is likely to be known unless the EPA require further analysis.	Our confidence is based on the formation of tobermorite mineral crystals during the hydrothermal curing process step, which tightly bond with the ash to create a strong, weather resident building product. Naturally testing will be undertaken to confirm that the product means *Material Guidelines* for the use of a waste derived product.

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	What is meant by "manufactured nanoparticles" here? Does this refer to particles already present in the feedstock but potentially liberated by combustion? Or does it refer to particles created by the combustion process itself? Or does it refer to the brick making process? If it refers to the second or third of these, there should be an accounting given of the production of manufactured nanoparticles and measures required to ensure that the particles are eliminated.	From EPA Report 1468, manufactured nanoparticles are defined as nanoparticles in manufactured goods. The EPA Report indicates that "the bulk of the nanoparticles are found in the fly ash and bottom ash". Nanoparticles associated with the combustion process will also be captured by the Air Pollution Control system (in the Fabric Filter (Baghouse)). It is important to note that almost all combustion processes will release nanoparticles and the EPA Report 1468 (p17) provides a qualifier: "However, it is important to remember that waste to energy plants are only one source of nanoparticles and would only contribute a small amount when compared with other sources, including industrial, transport and natural."
	Producing bricks and pavers, however environmentally sound it may sound, is not a means of "containing and eliminating the potential dispersion of manufactured nanoparticles" but rather a means to ensure their dispersion to residential driveways, patios, pathways and gardens throughout the community. It needs to be ascertained exactly how contained are residues of Western Australia MSW, not using data from the United States.	It is important to realise that if manufactured nanoparticles appear in the residual MSW stream, this implies that that household has already been directly exposed to the manufactured nanoparticles contained in the consumer product, the residual of which has ended up in the waste stream. Whether or not the bricks and pavers approved for use in "residential driveways, patios, pathways and gardens throughout the community" will depend on the Material Guidelines to be developed with the DER, which will help to define approved uses for the proposed alternative building materials.

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	Testing for leaching should involve commonly occurring household substances such as hydrochloric acid, used vehicle oil, detergents, garden fertilisers as well as the slightly acidic rainfall we experience. Testing should also be conducted over a sufficient period of time to demonstrate the safety specified. The public, already concerned at what happened with asbestos, deserve to be thoroughly reassured. Testing of bricks from copper mine tailings are likely to be completely different from those produced in PE's burning of MSW (PER p98).	Leach testing procedures will be incorporated as part of the *Material Guidelines* to be developed with the DER, for the waste derived products. There are a number of valid, internationally approved leach testing standards, which may be applied to the testing regime to be agreed with DER under the Part V Licensing process and as part of the development of *Material Guidelines*. Please refer to **Section 3 Responses to Important Matters to Be Addressed** for a detailed testing program for all residues and by-products anticipated to be produced by the Proposal.
	The proposal does not demonstrate how it would meet the avoidance part of the waste hierarchy or the pre-collection sorting stage. Waste to Energy is complementary to recycling if the waste remaining has had householders remove recyclable plastics, glass and metals from their household waste. Overseas plants operate on high levels of removal recyclables like plastics and organics mostly through source separation (see PER Table pages 41 and 64).	This issue has been dealt with in detail in **PER section 10.1.1.6.1 (P64)** and as well as in earlier in this response document. The Proposal seeks to process residual MSW, which has been subjected to source separation by the householder – the most effective and efficient pre-sorting process.
	BGC has expressed its interest to the Proponent in the potential off-take of heat, bottom ash and fly ash. Analysis of the ash streams would be required to assess suitability.	This is an example of one of the potential synergies associated with locating the WtE facility in close proximity to existing (and future) industry, which may benefit from either locally generated renewable energy, and/or locally produced alternatives to quarried materials (subject to assessment to confirm their suitability). Phoenix Energy looks forward to working with the Kwinana Industries Council to unlock synergies between the Proposal and existing (and future) industry in the KIA, to enhance energy security and employment

Submitter	Submission and/or issue	Response to comment
		security in the region. The KIC is highly supportive of both the Proposal and such initiatives.
	The fly-ash will comprise a concentrated cocktail of heavy metals and other pollutants extracted from the exhaust gas stream. How safe is it to use this material in bricks or pavers?	The Proponent will work with the DER to develop a *Material Guideline* for each waste derived product and alternative construction material proposed to be produced by the proposal. Quality assurance testing will be required to ensure that all materials are fit for purpose, meet their mechanical performance requirements under Australian Standards, and meet their environmental performance requirements under the applicable Material Guidelines.
	Page 83 (PER) shows the permissible uses of bottom ash but there are not similar tables for fly ash which would presumably have the heavy metals and other contaminants. It is not clear that the brick making process is capable of stabilising and safely binding the contaminants from the fly-ash.	**PER Table 16 (p82-83)** specifically relates to construction applications for bottom ash. Please refer to the comment above relating to the development of local Material Guidelines in consultation with the DER.
	The volume of contaminated waste is to be reprocessed in an on-site brick factory. There is no evidence provided that such a brick plant could work to Australian material or commercial standards, or that there is a market to sell them to.	Phoenix Energy is not aware of any reason why the bricks produced on-site could not meet Australian material or commercial standards if they have been demonstrated to meet accepted international standards as described in **PER section 10.2.1.5.3.1 (p97)**. Phoenix Energy expects to enter into a marketing and distribution agreement with one or more masonry product wholesalers and/or retailers, and will seek to engage with participating councils to utilise the alternative construction materials for beneficial public works projects, as an alternative to quarried products.
	Where will the pavers be stored pending sale?	Either in a warehouse section of the Brick Plant or at an off-site wholesaler warehouse.
	The EPA Chairman stated that “the manufacture of	Phoenix Energy is not aware of any such statement by the EPA Chairman.

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	bricks from the bottom ash would be required in a separate PER". Why is the brick plant included in this PER?	Furthermore, the Environmental Scoping Document for the Proposal, as prepared and issued by the EPA, specifically included the Brick Plant in the Proposal, and specified a number of work requirements, which have been addressed in the PER.
	Also the United States EPA has approved the use of ash but this is coal ash, please provide details of where fly ash has been approved by other countries for pavers?	The work done by PMET in developing their Brixx™ process to commercial scale, involved rigorous pilot plant demonstration work, which included making shaped masonry products (bricks or pavers) from mixtures of both bottom ash AND fly ash. They have also applied their technology to bottom ash from a WtE facility processing MSW, however, the details of that work are confidential. Please refer to **PER Appendix J** for a letter confirming this from PMET.
	The proponent intends to produce bricks from fly ash with other ash to make bricks or pavers. What is the alternative plan should the quality of the bricks not meet Perth standards and therefore no demand for the bricks.	Please refer to **PER section 6.2.3 (p55)**: "In the event of a market failure for some or all of the by-products available for sale, each combustion residue that cannot be exported from the facility for an approved reuse application will be characterised, subjected to leach testing and then disposed of to an appropriate landfill."

4.7 Public Consultation

Submitter	Submission and/or issue	Response to comment
Public Submitters	Public consultation is woeful. Phrases like "PE seeks …to ensure that each project meets or exceeds international best practice for…community consultation" and the following paragraph on "key elements of an effective stakeholder engagement" read like excerpts from a first year text book.	Prior to the release of the PER, the majority of our initial engagement with the community have been via their elected officials, as we work with them to secure the waste supply agreements which will underpin the commercial viability of the Proposal. That said, **PER Table 46 (p176)** lists multiple community engagement and public consultation activities undertaken prior to the release of the PER. The release of the PER has allowed the project to engage directly with the community, as is the purpose of the Public Environmental Review.
	A submitter believes that few stakeholder groups have been communicated and met with. To the submitters knowledge the first that the general community of Kwinana/Rockingham knew about this project was the appearance in the local media in December 2013 of a glowing article about Kwinana signing a 20 year waste agreement for the proposed plant.	The Proposal has received regular media coverage; especially after the Premier the Hon. Collin Barnett visited one of the MHIEC reference facilities in Tokyo in 2011. The Proposal was also featured in an ABC1 7:30 Western Australia report, which went to air on 12-July-2013. Links to multiple media reports relating to the Proposal can be found on the Phoenix Energy website (http://www.phoenixenergy.com.au/latest-news/ and http://www.phoenixenergy.com.au/media-room-2/press-releases/).
	The stakeholder organisations engaged have been listed in the PER but do not include the Hillman Residents Association or the Medina Residents Group. They also do not include the parents and citizens of the nine schools most directly affected or the numerous sporting clubs whose players would be exposed to the emissions.	Stakeholder engagement activities for the Proposal, which commenced in 2010, will continue to be expanded as the project moves further through its development approvals and design phases. Community consultation and engagement will be on-going for the life of the project and has continued with multiple consultation and engagement activities since the closure of the PER public review period.

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	The EPA "expects the proponent to fully consult with interested members of the public and relevant stakeholders…(demonstrated when)…stakeholders are included in the consultation process…,kept informed about the potential and actual environmental impacts; and receive responses to the concerns raised…"	
	The actions taken by the proponent in consulting with members of the local community have been far from a full consultation. Even though there have been two open days, on in Kwinana and one on site, meetings and some advertisements in local papers advertising both the PER and open days, this is hardly adequate.	Please see responses to similar comments above.
	Advertising though local papers are problematic. An alternative is for the proponent to engage in genuine consultation by visiting door to door. Concerned community members have done this and discovered that of the people answering the door the majority have not heard of the project. Residents of Hillman in particular expressed horror at the idea of burning green waste, about the risks of air pollution adding to what they already experience, and at the proximity of the plant within 2.5 km and the possibility of another plant 4 km further away.	Phoenix Energy advertised the PER in the West Australian as well as two local papers twice during the public consultation period. Two community information sessions were run on separate days during the 6 week public consultation period. We were very pleased with the attendance at these sessions, and the worthwhile conversations, where attendees were prepared to sit and discuss their questions and concerns. The Proposal has received regular media coverage; especially after the Premier the Hon. Collin Barnett visited one of the MHIEC reference facilities in Tokyo in 2011. Links to past media articles on the Proposal can be found on the Phoenix Energy website (http://www.phoenixenergy.com.au/latest-news/).

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	PE shows and talks about community consultation but none happened.	**PER Table 46 (p176)** lists public consultation activities from 2010 up the time of the release of the PER. A number of public events have occurred since, either at public presentations/forums or to specific resident and industry groups hosted at the project site.
	A submitter states that PE has refused to answer questions that were put directly to them. This makes it impossible to write a proper submission in the 6 weeks.	Phoenix Energy spent the best part of two days talking with members of the local community and others during the PER public consultation period. Phoenix Energy is pleased to be able to respond to written submissions, which the OEPA deems relevant and appropriate to the Proposal.
	Hundreds of signatures have been received on a petition from people against this incinerator. Many knew nothing about the proposal. In fact 94% of people spoken to have signed the petition. Residents of Kwinana do not want an incinerator.	The Proposal has received regular media coverage; especially after the Premier the Hon. Collin Barnett visited one of the MHIEC reference facilities in Tokyo in 2011. Multiple articles on the Proposal have appeared in the local media, some of which are noted on the Phoenix Energy website (http://www.phoenixenergy.com.au/latest-news/ and http://www.phoenixenergy.com.au/media-room-2/press-releases/).
	PE quotes Japan all through their document but would not supply a submitter with any hard facts.	Facts about Japanese waste are not relevant to a Proposal to be located in Western Australia. If Japan was the only country with WtE facilities such as proposed for Kwinana, it may be more relevant. The 409 or so operating or approved Martin reference sites are located in 33 different countries, serving over a hundred different municipalities, each with a unique waste composition. A true testament to the flexibility and robustness of the technology.
	A submitter advises they have not seen this proposal advertised in the local media. When was it advertised and how were comments/issues raised during this consultation recorded and addressed?	The proposal was advertised twice in 3 separate newspapers during the 6 week PER public consultation period. Advertising occurred as follows, in accordance with local newspaper publication schedules: 6-June-2014 Kwinana Weekend Courier 9-Jun-2014 The West Australian (General News) 11-Jun-2014 Sound Telegraph (General News) 2-Jul-2014 Sound Telegraph (General News)

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		4-Jul-2014 Kwinana Weekend Courier (General News) 7-Jul-2014 The West Australian (General News) The public were invited to make a submission directly to the Office of the EPA, which has resulted in this response document.
	Community forums no. 1 and 3 seems to be have been incorporated in Kwinana Industry Forums (KIF) meetings. The KIF meeting which I attended had a presentation from Peter Dyson for a short 15 to 20 minutes.	The Communities and Industry Forum (CIF) purpose is to build a bridge of understanding between local industries and the community. The Executive consists of two community members, two industry members, two members from local government (City of Kwinana and City of Rockingham) and two members from government regulatory agencies (DER and DMP). The Forum is an independent body which is supported but not controlled by, the Kwinana Industries Council and the Department of State Development. As such the CIF provides an ideal and appropriate opportunity to present to the community new initiatives such as this proposal. Both Forums listed were well advertised in the community and well attended.
	There were less than five local community members along with the industry and state agency representatives. Would this be classed as public consultation?	The Kwinana WtE project is part of a regional solution for the integrated management of waste as a resource. As such, industry and state agency representatives are just as entitled to be considered to be party to public consultation as the local community from the Kwinana Area.
	On the first of this month (July) PE held a meeting at the local community centre that was not advertised prior to the event.	As part of the 6 week PER public consultation period, Phoenix Energy voluntarily conducted two free public consultation sessions; one on 1-Jul-2014 at the Darius Wells Centre and a second on 2-Jul-2014 at the Project Site. These opportunities to meet the project development team and to discuss the PER and the Proposal were advertised in The West Australian and two local newspapers (the Sound Telegraph and the Kwinana Courier), and on the Phoenix Energy website along-side the PER documentation. Judging by the number of people form the local community who made the effort to drop in to both the Community Centre or to the project site the following day, the advertising clearly worked.

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	The proponent has been very selective in engaging with the community.	Prior to the release of the PER, the majority of our initial engagement with the community have been via their elected officials, as we work with them to secure the waste supply agreements which will underpin the commercial viability of the Proposal. That said **PER Table 46 (p176)** lists multiple community engagement and public consultation activities undertaken prior to the release of the PER. The release of the PER has allowed the project to engage directly with the community, as is the purpose of the Public Environmental Review.

Public Environmental Review

Response to Submissions

Part B - Appendices A, B, C, D, E, F

Kwinana Waste to Energy Project

Assessment No.: 1945
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Kwinana Waste To Energy Project

Public Environmental Review – Response to Submissions
Part B - Appendices

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Kwinana Waste To Energy Project

Public Environmental Review – Response to Submissions
Part B - Appendices

9 October 2014

Anthony Douglas
Project Engineer
Phoenix Energy Australia

Issued via email

Dear Anthony,

Re: Potential for cumulative impacts associated with proposed Kwinana WtE facility and East Rockingham WtE and MRF

ENVIRON Australia Pty Ltd (ENVIRON) was requested by Phoenix Energy Australia (Phoenix Energy) to provide comment regarding the potential for cumulative impacts associated with atmospheric emissions from Phoenix Energy's proposed Kwinana Waste to Energy (WtE) Facility and the proposed New Energy Corporation (New Energy) East Rockingham WtE and Material Recovery Facility (MRF).

This letter considers the results presented in the New Energy air quality impact assessment for the proposed East Rockingham facility, in conjunction with the results of the air quality impact assessment undertaken for the proposed Kwinana WtE facility and the meteorological characteristics of the region. The findings presented in this letter report are based on a qualitative review of the relevant data.

Background

Phoenix Energy's proposal for the Kwinana WtE facility is currently under assessment by the Environmental Protection Authority (EPA). ENVIRON understands that in response to submissions received by the EPA regarding the proposed Kwinana WtE facility, Phoenix Energy has been asked to consider the cumulative impact of emissions from existing and future industry within the Kwinana and Rockingham areas, in particular the recently assessed East Rockingham WtE and MRF.

The location of the proposed East Rockingham facility is approximately 4.7 km south of the proposed Kwinana WtE facility (Figure 1). An air quality impact assessment for the proposed East Rockingham facility was carried out by Synergetics, the results of which indicate that the ground level concentrations (GLCs) of the modelled emissions will comply comfortably with the relevant ambient air quality regulatory criteria for both the main (operational) and emergency emissions scenarios (Synergetics, 2013). Synergetics (2013) also undertook a cumulative assessment of nominated emissions from the proposed East Rockingham facility and other regional emission sources, utilising ambient air quality monitoring data published by the Department of Environment Regulation (DER). The cumulative GLCs presented for these compounds fell within the applicable assessment criteria (Synergetics, 2013).

ENVIRON (2014) undertook an air quality impact assessment for Phoenix Energy's proposed Kwinana WtE facility. The results of this assessment indicate that the predicted GLCs associated

with emissions from the proposed Kwinana WtE facility are predicted to comply with the applicable short-term and long-term ambient air quality guidelines for each of the modelled compounds (ENVIRON, 2014). The cumulative impact of emissions from the proposed WtE facility and other existing sources within the Kwinana Industrial Area (KIA) was also assessed at nominated receptors where ambient air quality monitoring data are available[1] (ENVIRON, 2014). The results of the cumulative impact assessment indicate that increases in the predicted GLCs associated with emissions from the proposed Kwinana WtE facility are expected to be minimal (ENVIRON, 2014).

Discussion

As noted above, the proposed New Energy East Rockingham facility will be located approximately 4.7 km south of the proposed Kwinana WtE facility (Figure 1). Given the location of each site, the potential for cumulative impacts to occur as a result of interaction between emissions from both facilities would be limited to specific meteorological conditions; namely winds occurring in a northerly or southerly arc.

Review of the meteorological datasets developed by the DER for the 1980, 1995 and 1996 calendar years and utilised in the air quality impact assessment for the proposed Kwinana WtE facility, indicates the region is dominated by south-southwesterly and easterly winds (ENVIRON, 2014). The frequency of occurrence of north-northwesterly through north-northeasterly winds, which could potentially align emissions from the proposed Kwinana WtE facility with the proposed East Rockingham facility, is less than 3.2%. In the event of such winds, emissions from the proposed Kwinana WtE facility would need to travel more than 4.7 km south before any interaction with emissions from the proposed East Rockingham facility could occur (noting emissions from the East Rockingham facility would also be dispersed in a southerly direction).

Review of the contours presented in ENVIRON's (2014) air quality impact assessment for the proposed Kwinana WtE facility indicates that the short-term (1-hour average) GLCs predicted at the southern boundary of the modelled domain (located approximately 1 km north of the East Rockingham facility) are diluted by a factor of more than 10,000, in comparison to the concentration of emissions at the point of release. The resultant GLCs are expected to be negligible and represent a very small percentage of the relevant ambient air quality criteria. For example, the 1-hour average HCl GLC predicted at the southernmost extent of the Phoenix Energy modelled domain is less than 4 µg/m^3 (<2.6% of the relevant ambient criteria) and the predicted GLC would be even smaller at the East Rockingham facility further south. Any contribution by the proposed Kwinana WtE facility to cumulative impacts associated with emissions from the East Rockingham facility is therefore expected to be negligible.

Similarly, emissions from the proposed East Rockingham facility would need to travel more than 4.7 km north before interaction with emissions from the proposed Kwinana WtE facility could occur (noting emissions from the Kwinana WtE facility would also be dispersed in a northerly direction). The frequency of occurrence of south-southwesterly through south-southeasterly winds, which could potentially align emissions from the proposed East Rockingham facility with the proposed Kwinana WtE facility, is less than 7.6%.

Review of the contours presented in Synergetics (2013) air quality impact assessment for the proposed East Rockingham facility indicates that the short-term (1-hour average) GLCs predicted at the northern boundary of the modelled domain (located approximately 1.6 km south of the Kwinana WtE facility) are diluted by a factor of more than 12,000, in comparison to the

[1] A cumulative impact of emissions of sulphur dioxide from the proposed Kwinana WtE facility and from existing sources within the KIA was undertaken using the emissions inventory developed for the most recent Kwinana Environmental Protection Policy (EPP) redetermination.

concentration of emissions at the point of release for the main operating scenario. The resultant GLCs are therefore expected to be negligible compared to the relevant ambient air quality criteria. For example, the 1-hour average GLC of NO_x (as NO_2) predicted at the northernmost extent of the New Energy modelled domain is less than 3 µg/m^3 (<1.2% of the relevant guideline) and the predicted GLC would be even smaller at the Kwinana WtE facility further north. Any contribution by the proposed East Rockingham facility to cumulative impacts associated with emissions from the Kwinana WtE facility is therefore expected to be negligible.

In summary, the likelihood of cumulative impacts occurring in association with emissions from Phoenix Energy's proposed Kwinana WtE facility and the proposed East Rockingham facility is considered to be very low given the location of each site in relation to one another; and the infrequency with which meteorological conditions occur that could potentially result in an alignment of emissions between the two facilities. Furthermore, the GLCs predicted at distances of 3 km or more from each of the proposed facilities are many orders of magnitude below the concentration of emissions at the point of release. The GLCs at distances of 4.7 km or more from the proposed facilities (the distance over which emissions would be dispersed before plume interactions could occur) would be even lower, and as such, the potential for cumulative impacts to occur in association with the two proposals is considered negligible.

* * *

Sincerely,
ENVIRON Australia Pty Ltd

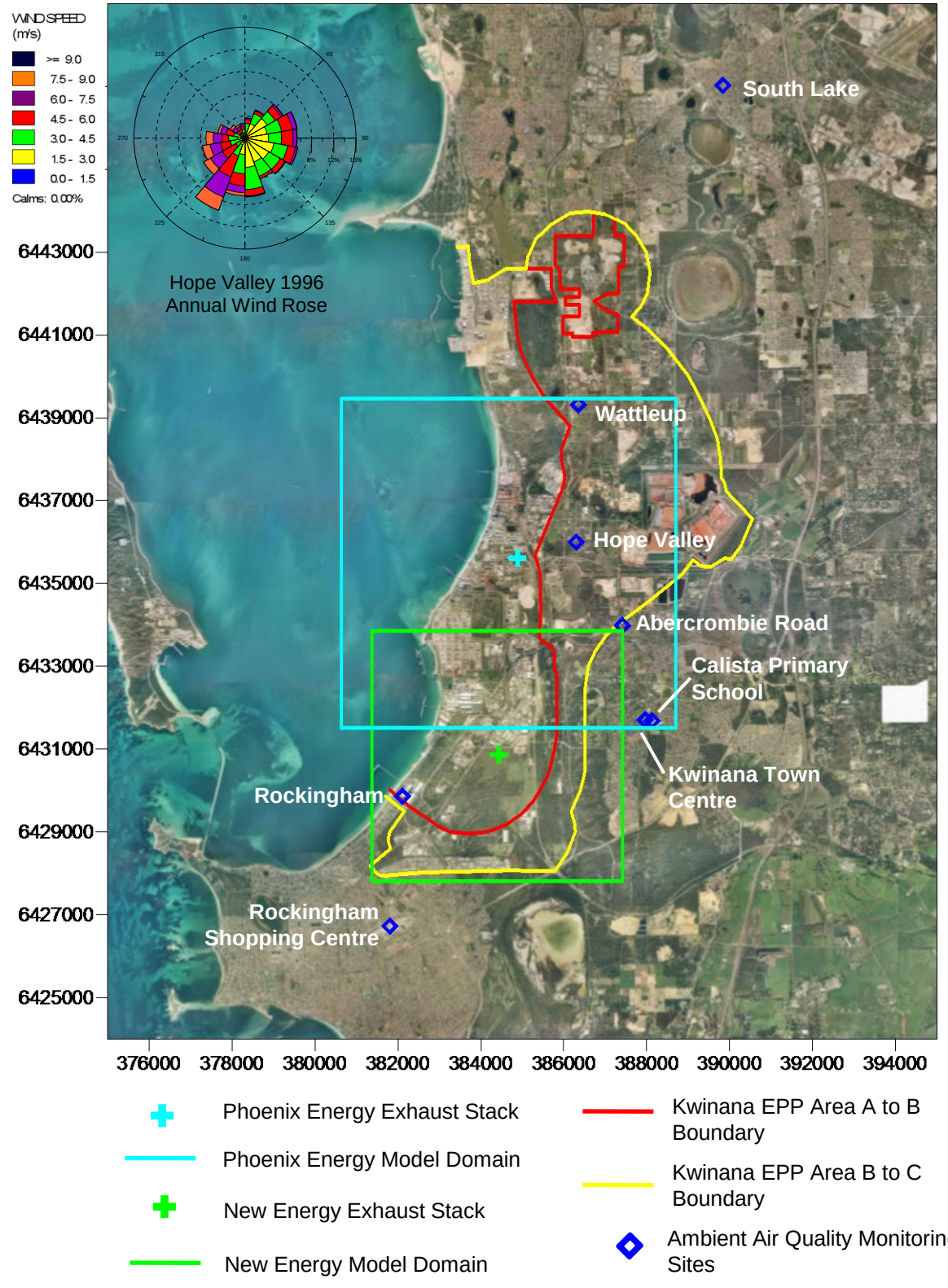
Brian Bell
Principal

References

ENVIRON Australia (ENVIRON). 2014. Phoenix Energy Kwinana WtE Project – Air Dispersion Modelling Assessment. Report prepared for Phoenix Energy Australia, 23 May 2014.

Synergetics. 2013. Final Report: Air quality impact assessment of the proposed waste gasification power station in East Rockingham, Western Australia. Report prepared for New Energy Corporation, 21 October 2013.

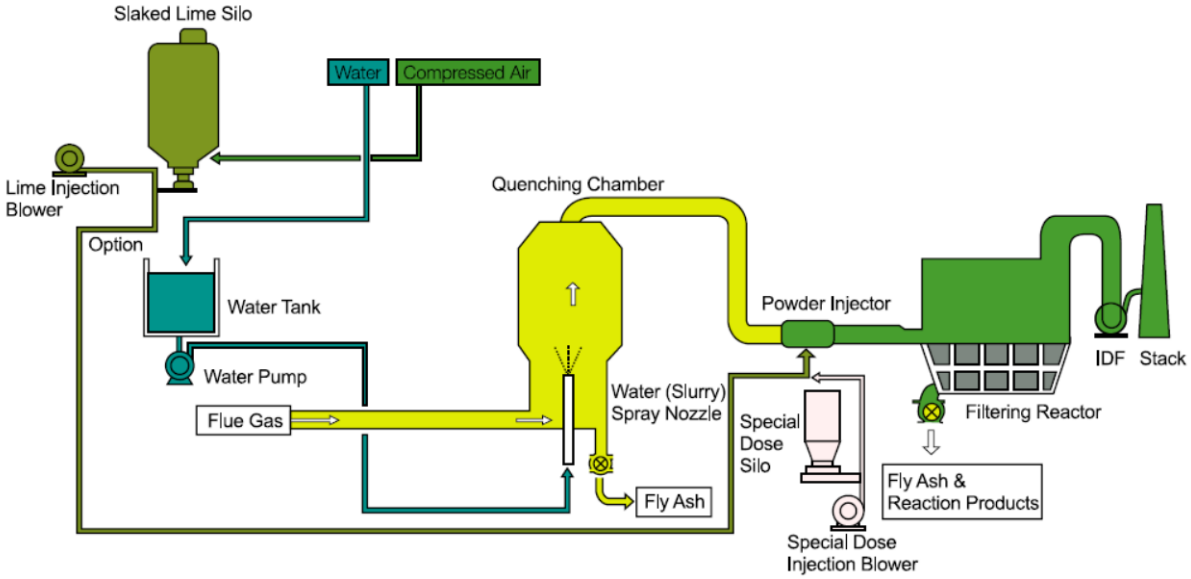
Figures



Phoenix Energy Kwinana WTE Project - Air Dispersion Modelling Assessment	Phoenix Energy and New Energy Air Dispersion Model Domains

ENVIRON JOB NO: AS110691 DATE: October 2014 FIGURE 1

Appendix B – Typical schematic of the MHIEC Dry Scrubbing System



This system is similar to the MHIEC semi-dry scrubbing system proposed in the PER document, except that the reactants are injected in dry form downstream of the Quenching Chamber. This configuration avoids the use of a high speed rotary atomiser required to inject the reactant (lime) slurry-water mixture into the Quench Chamber, as required for the semi-dry scrubbing system.

Kwinana Waste To Energy Project

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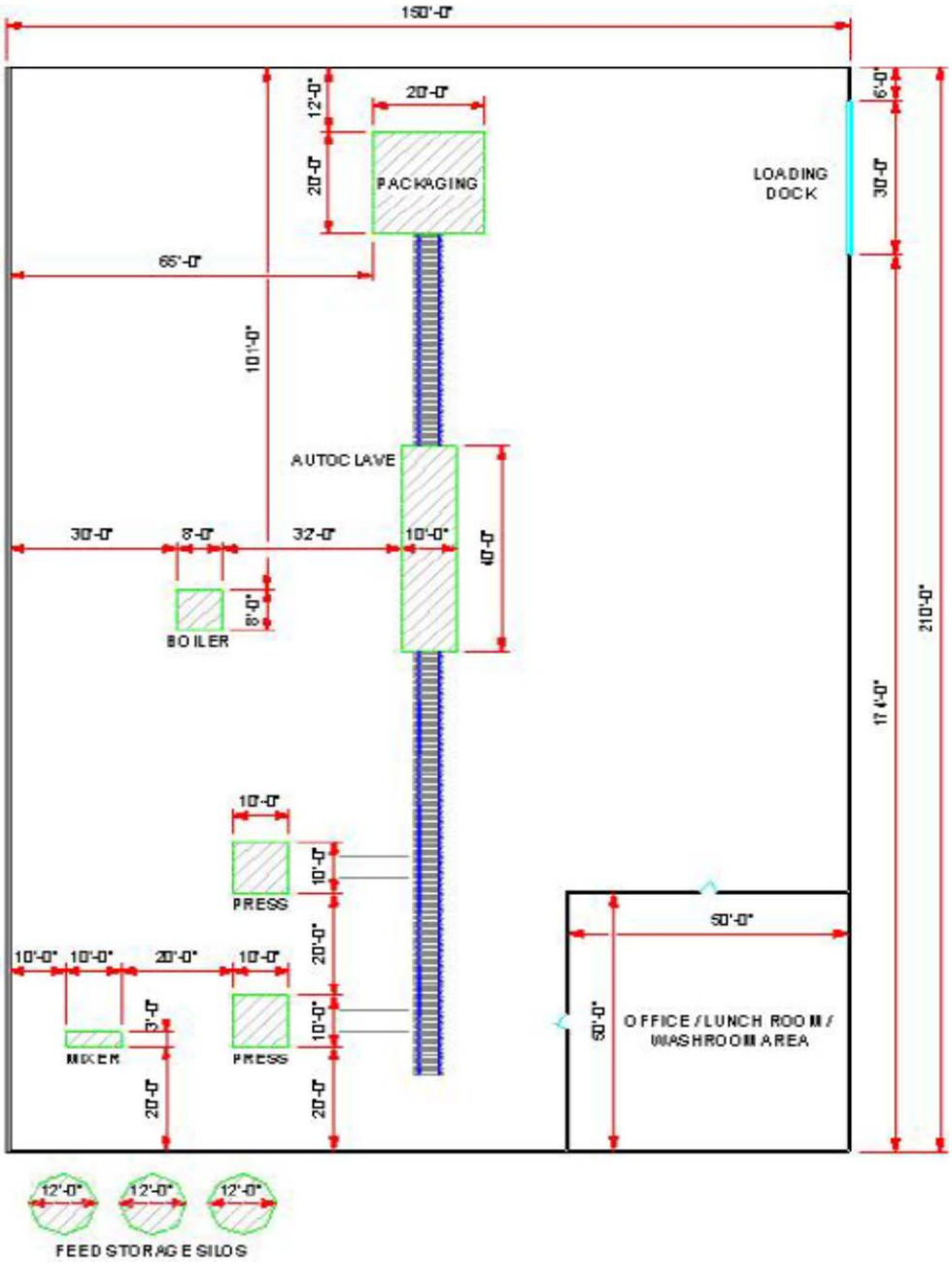
Appendix C – Conceptual Commercial Scale Brixx™ Plant General Arrangement Floor Plan



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Appendix D – Clearing Permit CPS 5251/1 issued to BGC (Australia) Pty Ltd and associated Clearing Permit Decision Report

Kwinana Waste To Energy Project

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GOVERNMENT OF
WESTERN AUSTRALIA

CLEARING PERMIT

Granted under section 51E of the Environmental Protection Act 1986

Purpose Permit number:	CPS 5251/1
Permit Holder:	BGC (Australia) Pty Ltd
Duration of Permit:	4 January 2014 – 4 January 2019

ADVICE NOTE:
This Permit does not confer upon the Permit Holder authorisation to access the land to which the Permit relates.

The Permit Holder is authorised to clear native vegetation subject to the following conditions of this Permit.

1. **Purpose for which clearing may be done**
   Clearing for the purpose of constructing a hollow core manufacturing plant, gantry, hard stand and associated infrastructure.

2. **Land on which clearing is to be done**
   Lot 14 on Deposited Plan 39572 Donaldson Road, Kwinana Beach.

3. **Area of Clearing**
   The Permit Holder must not clear more than 6 hectares of native vegetation within the area hatched yellow on attached Plan 5251/1.

4. **Application**
   This Permit allows the Permit Holder to authorise persons, including employees, contractors and agents of the Permit Holder, to clear native vegetation for the purposes of this Permit subject to compliance with the conditions of this Permit and approval from the Permit Holder.

M Warnock
MANAGER
NATIVE VEGETATION CONSERVATION BRANCH

Officer delegated under Section 20
of the Environmental Protection Act 1986

5 December 2013

Plan 5251/1

LEGEND

Clearing Instruments
- Areas Approved to Clear
- Road Centrelines
- Cadastre

Perth Metropolitan Area
Central 15cm Orthomosaic - Landgate 2012

N

0 100 m

Scale 1:4000
(Approximate when reproduced at A4)

Geocentric Datum Australia 1994

Note: the data in this map have not been projected. This may result in geometric distortion or measurement inaccuracies.

M. Warnock Date 5/12/13

Officer with delegated authority under Section 20 of the Environmental Protection Act 1986

Information derived from this map should be confirmed with the data custodian acknowledged by the agency acronym in the legend.

* Project Data is denoted by asterisk. This data has not been quality assured. Please contact map author for details.

Clearing Permit Decision Report

Government of Western Australia
Department of Environment Regulation

1. Application details

1.1. Permit application details

Permit application No.: 5251/1
Permit type: Purpose Permit

1.2. Proponent details

Proponent's name: **BGC (Australia) Pty Ltd**

1.3. Property details

Property: LOT 14 ON PLAN 39572 (Lot No. 14 DONALDSON KWINANA BEACH 6167)
Local Government Area: City of Kwinana
Colloquial name:

1.4. Application

Clearing Area (ha)	No. Trees	Method of Clearing	For the purpose of:
6		Mechanical Removal	Industrial

1.5. Decision on application

Decision on Permit Application: Grant
Decision Date: 5 December 2013

2. Site Information

2.1. Existing environment and information

2.1.1. Description of the native vegetation under application

Vegetation Description	Clearing Description	Vegetation Condition	Comment
Beard Vegetation Association: 3048 - Shrublands; scrub-heath on the Swan Coastal Plain (Shepherd et al. 2001). Beard Vegetation Association: 998 - Medium woodland; tuart (Shepherd et al. 2001). Heddle Vegetation Complex: Central and South Cottesloe Complex - Mosaic of woodland of Eucalyptus gomphocephala (Tuart) and open forest of Eucalyptus gomphocephala (Tuart) - Eucalyptus marginata (Jarrah) - Corymbia calophylla (Marri); closed heath on the Limestone outcrops (Heddle et al.1980).	The proposed clearing consists of 6 hectares of native vegetation within Lot 14 on Deposited Plan 39572, Kwinana Beach for the purpose of constructing a hollow core manufacturing plant, gantry, hardstand and associated infrastructure.	Degraded: Structure severely disturbed; regeneration to good condition requires intensive management (Keighery 1994) To Completely Degraded: No longer intact: completely/almost completely without native species (Keighery 1994)	The majority of the vegetation under application has been previously cleared. There is a high impact of weeds within the application area. There are no overstorey species present. The vegetation is in degraded to completely degraded (Keighery 1994) condition. The vegetation consists predominately of Acacia saligna and Acacia rostellifera, with a ground cover of Eragrostis curvula. Other species include Acacia cochlearis, Jacksonia sp., Ricinus communis, Euphorbia sp., Ehrharta calycina and Schinus terebinthifolius Vegetation description and condition was determined through aerial imagery and a site inspection (DEC 2012a).

3. Assessment of application against clearing principles

(a) Native vegetation should not be cleared if it comprises a high level of biological diversity.

Comments **Proposal is not likely to be at variance to this Principle**
The proposed clearing consists of up to 6 hectares of native vegetation within Lot 14 on Deposited Plan 39572, Kwinana Beach for the purpose of constructing a hollow core manufacturing plant, gantry, hardstand and associated infrastructure.

The vegetation under application is in degraded to completely degraded (Keighery 1994) condition. The majority of the vegetation has been previously cleared several times (BGC (Australia) Pty Ltd 2012). Weeds have significantly impacted the application area (DEC 2012a).

There are numerous records of priority flora within the local area (10 kilometre radius). The closest record occurs on the same soil and vegetation type as the application area and is located approximately 2.9 kilometres away. Given the condition of the vegetation and the high impact of weeds, it is unlikely that priority flora occur within the application area.

There are nine priority ecological communities (PEC) within the local area (10 kilometre radius). The closest of these is a Northern Spearwood shrublands and woodlands community (priority 3). This community is described as heaths with scattered Eucalyptus gomphocephala occurring on deeper soils north from Woodman Point. The heathlands in this group typically include Dryandra sessilis, Calothamnus quadrifidus, and Schoenus grandiflorus (DEC 2012b). The vegetation under application is not representative of this community.

Given the condition of the vegetation under application and the lack of large habitat trees and native understorey species, it is unlikely that the application area provides significant habitat for fauna.

The proposed clearing is not likely to be at variance to this principle.

Methodology References:
- BGC (Australia) Pty Ltd 2012
- DEC 2012a
- DEC 2012b
- Keighery 1994

GIS Datasets:
- Heddle Vegetation Complexes
- Pre European Vegetation
- SAC Biodabases
- Soils, Statewide

(b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.

Comments **Proposal is not likely to be at variance to this Principle**
There are numerous fauna species of conservation significance mapped within the local area (10 kilometre radius). These include Carnaby's cockatoo (Calyptorhynchus latirostris; rare or likely to become extinct, Wildlife Conservation Act 1950; endangered, Environment Protection and Biodiversity Conservation Act 1999), forest red-tailed black-cockatoo (Calyptorhynchus banksii subsp. Naso; rare or likely to become extinct, Wildlife Conservation Act 1950; vulnerable, Environment Protection and Biodiversity Conservation Act 1999) and Baudin's cockatoo (Calyptorhynchus baudinii; rare or likely to become extinct, Wildlife Conservation Act 1950; vulnerable, Environment Protection and Biodiversity Conservation Act 1999) (DPaW, 2007-).

Given the condition of the vegetation under application and the lack of large habitat trees and native understorey species, it is unlikely that the application area provides significant habitat for fauna. Therefore, the proposed clearing is unlikely to be at variance to this principle.

Methodology References:
- DPaW 2007-

(c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.

Comments **Proposal is not likely to be at variance to this Principle**
There are 14 records of rare flora within the local area (10 kilometre radius). Only one record occurs on the same mapped soil and vegetation type as the application area.

Given the condition of the vegetation under application and that it is not representative of the mapped vegetation type, it is unlikely that this species occurs within the application area.

The proposed clearing is not likely to be at variance to this Principle.

Methodology GIS Datasets:
- Heddle Vegetation Complexes
- Pre European Vegetation
- SAC Biodabases
- Soils, Statewide

(d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.

Comments

Proposal is not likely to be at variance to this Principle

There are numerous threatened ecological communities within the local area (10 kilometre radius). The closest community occurring on the same mapped soil and vegetation type as the application area is a Melaleuca huegelii Melaleuca acerosa shrublands on limestone ridges community.

The vegetation within the application area is not representative of this ecological community (DEC 2012a), therefore, the proposed clearing is not likely to be at variance to this principle.

Methodology

References:
- DEC 2012a

GIS Datasets:
- Heddle Vegetation Complexes
- Pre European Vegetation
- SAC Biodabases
- Soils, Statewide

(e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

Comments

Proposal is not likely to be at variance to this Principle

Aerial photography indicates the local area (10 kilometre radius) is approximately 40 per cent vegetated.

The national objectives and targets for biodiversity conservation in Australia has a target to prevent clearance of ecological communities with an extent below 30 per cent of that present pre-1750, below which species loss appears to accelerate exponentially at an ecosystem level (Commonwealth of Australia 2001).

The vegetation associations mapped over the application area retain over 30 per cent of their pre-European extents within the Swan Coastal Plain IBRA Bioregion (Government of Western Australia 2011).

Therefore the proposed clearing is not likely to be at variance to this principle.

	Pre-European (ha)	Current Extent (ha)	Remaining (%)	Extent in DEC Managed Lands (%)
IBRA Bioregion*				
Swan Coastal Plain	1,501,209	587,832	39	34
Shire*				
Town of Kwinana	11,998	4,597	38	9
Beard Vegetation Association in Bioregion*				
998	50,867	19,595	38.5	40.6
3048	10,415	3,316	31	25
Heddle Vegetation Complex **				
Cottesloe Complex Central and South	44,995	18,474	41.1	8.8

* Government of Western Australia 2011
** Heddle et al. 1980

Methodology

References:
- Commonwealth of Australia 2001
- Government of Western Australia 2011
- Heddle et al. 1980

GIS Databases:
- Heddle Vegetation Complexes
- NLWRA, Current extent of Native Vegetation
- Perth Metropolitan Central 15cm Orthomosaic Landgate 2011
- Pre-European Vegetation
- SAC Biodatasets

(f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

Comments

Proposal is not likely to be at variance to this Principle

There are numerous watercourses and wetlands within the local area (10 kilometre radius). The closest of these is located approximately 600 metres from the application area.

A DEC site inspection (2012a) did not identify any vegetation growing in, or in association with, a watercourse or wetland.

Given the above, the proposed clearing is not likely to be at variance to this principle.

Methodology

References:
- DEC 2012a

GIS Datasets:
- Geomorphic Wetlands, Swan Coastal Plain
- Hydrography, Linear

(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

Comments

Proposal may be at variance to this Principle

The soil within the application area is mapped as B24, which Northcote et al. (1960 - 1968) describes as undulating dune landscape underlain by aeolianite which is frequently exposed with small swales of estuarine deposits and chief soils of siliceous sands with smaller areas of brown sands and leached sand.

The main land degradation risk associated with this sandy soil type is wind erosion. Without vegetation cover, the proposed clearing may result in wind erosion causing appreciable land degradation and may be at variance to this principle.

Wind erosion management practises would assist in managing and mitigating the impacts land degradation.

Methodology

References:
- Northcote et al. 1960-1968

GIS Datasets:
- Soils Statewide

(h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

Comments

Proposal is not likely to be at variance to this Principle

Within the local area (10 kilometre radius), there are numerous conservation areas and Bush Forever sites.

The closest conservation area is an unnamed conservation park, which is located approximately 3.1 kilometres from the application area. The closest Bush Forever site is located approximately 1.6 kilometres from the application area.

The proposed clearing in not likely to impact upon the environmental values of these conservation areas.

The proposed clearing is not likely to be at variance to this principle.

Methodology

GIS Datasets:
- Bush Forever Sites
- DEC Tenure
- NLWRA, Current extent of Native Vegetation
- Perth Metropolitan Central 15cm Orthomosaic - Landgate 2011

(i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

Comments

Proposal is not likely to be at variance to this Principle

There are no watercourses or wetlands within the application area and therefore the proposed clearing is unlikely to cause deterioration in the quality of surface water.

The groundwater salinity within the application area is 500-1000 milligrams per litre of Total Dissolved Solids. This level of groundwater salinity is considered to be marginal.

The application area does not occur within a Country Area Water Supply Act 1914 area or a Public Drinking Water Source Area.

Given the above, the proposed clearing is not likely to be at variance to this principle.

Methodology GIS Datasets:
- CAWSA Areas
- Geomorphic Wetlands, Swan Coastal Plain
- Groundwater Salinity, Statewide
- Hydrography, Linear
- PDWSA

(j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

Comments **Proposal is not likely to be at variance to this Principle**
The soil within the application area is mapped as B24, which Northcote et al. (1960 - 1968) describes as undulating dune landscape underlain by aeolianite which is frequently exposed with small swales of estuarine deposits and chief soils of siliceous sands with smaller areas of brown sands and leached sand.

Given the porous nature of the sandy soils of the application area, the proposed clearing is unlikely to cause or exacerbate flooding.

The proposed clearing is not likely to be at variance to this Principle.

Methodology References:
- Northcote et al. 1960 – 1968

GIS Datasets:
- Soils, Statewide

Planning instrument, Native Title, Previous EPA decision or other matter.

Comments

The application area is located within the Cockburn Groundwater area covered by the Rights in Water and Irrigation Act 1914.

The application area is zoned as General Industry under the Metropolitan Scheme Zone.

No public submissions have been received in response to this application.

The applicant has obtained planning approval from the Town of Kwinana and entered into a lease with LandCorp to access Lot 14.

Methodology GIS Datasets:
- RIWI Groundwater Area
- Town Planning Scheme Zones

4. References

BGC (Australia) Pty Ltd (2012) Clearing Permit Application CPS 5251/1 - Lot 14 on Diagram 39572, Kwinana Beach (DEC REF: A543455).

Commonwealth of Australia (2001) National Objectives and Targets for Biodiversity Conservation 2001-2005, Canberra.

DPaW (2007 -) NatureMap: Mapping Western Australia's Biodiversity. Department of Parks and Wildlife. URL: http://naturemap.dec.wa.gov.au/. Accessed 28/11/2013

DEC (2012a) Site Inspection Report for Clearing Permit Application CPS 5251/1, Lot 14 on Deposited Plan 39572, Kwinana. Site inspection undertaken 27/09/2012. Department of Environment and Conservation, Western Australia (DEC REF: A550611).

DEC (2012b) Priority Ecological Communities for Western Australia version 17, Species and Communities Branch. Department of Environment and Conservation.

Government of Western Australia. (2013). 2012 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of October 2012. WA Department of Environment and Conservation, Perth.

Heddle, E. M., Loneragan, O. W., and Havel, J. J. (1980) Vegetation Complexes of the Darling System, Western Australia. In Department of Conservation and Environment, Atlas of Natural Resources, Darling System, Western Australia.

Keighery, B.J. (1994) Bushland Plant Survey: A Guide to Plant Community Survey for the Community. Wildflower Society of WA (Inc). Nedlands, Western Australia.

Northcote, K. H. with Beckmann G G, Bettenay E., Churchward H. M., van Dijk D. C., Dimmock G. M., Hubble G. D., Isbell R. F., McArthur W. M., Murtha G. G., Nicolls K. D., Paton T. R., Thompson C. H., Webb A. A. and Wright M. J. (1960-68): 'Atlas of Australian Soils, Sheets 1 to 10, with explanatory data'. CSIRO and Melbourne University Press: Melbourne.

Shepherd, D.P., Beeston, G.R., and Hopkins, A.J.M. (2001), Native Vegetation in Western Australia. Technical Report 249. Department of Agriculture Western Australia, South Perth.

Kwinana Waste To Energy Project

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Appendix E – Department of Environment Regulation (DER) Native Vegetation Fact Sheet 9

Kwinana Waste To Energy Project

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Clearing limited to five hectares a year (limited clearing exemptions) *Environmental Protection Act 1986*

When do I require a permit?

The **Environmental Protection Act 1986** (EP Act) requires that any person clearing native vegetation must hold a permit, unless the clearing is for an exempt purpose. These laws apply to private and public lands throughout Western Australia.

How can I check if my activity is exempt?

This fact sheet discusses exemptions from the requirement for clearing permits that apply for clearing for day-to-day activities.

Fact Sheets 5, 6, and 7 discuss exemptions for the purposes of mining and petroleum activities, fire, firewood, wildflowers, seed and timber, and maintaining previously cleared land for pasture, cultivation, forestry, and clearing for pastoral requirements.

For details on all of the exemptions, a publication 'A guide to the exemptions and Regulations for Clearing of Native Vegetation' is available at: www.der.wa.gov.au/nvp or contact the Department of Environment Regulation (DER) on 6467 5020.

Some exemptions are limited to a total of five hectares per year

The types of clearing referred to below, together with other limited clearing allowed under regulations, may not exceed five hectares in a financial year. If more than five hectares needs to be cleared, a permit must be obtained.

To be clear, this is five hectares in total, not five hectares per exemption category.

This exemption does not apply within environmentally sensitive areas (ESAs) described in the Environmental Protection (Environmentally Sensitive Areas) Notice 2005 (refer Fact Sheet 1). DER has an online 'Native Vegetation Map Viewer' at www.der.wa.gov.au/nvp to assist landholders in determining the location of ESAs

Do I need to apply for a clearing permit if I intend to clear less than five hectares?

The activities listed below may be exempt from requiring a clearing permit if the total clearing is limited to five hectares per financial year. The limited clearing exemptions include:

- Clearing to construct a building
- Clearing for firewood
- Clearing to provide fencing and farm materials
- Clearing for woodwork
- Clearing along a fence line on alienated land
- Clearing for vehicular tracks
- Clearing for walking tracks
- Clearing isolated trees.

Can I clear five hectares for each activity?

If you need to clear for more than one of the above listed activities, the total amount of clearing for all the activities combined is not to exceed five hectares per financial year.

If you need to clear more than five hectares, a clearing permit must be obtained.

Does the five hectares limit apply per person or per lot?

The limited clearing exemptions apply to a property, which can be made up of a number of land parcels.

Who can undertake the clearing?

Clearing under these exemptions can only be undertaken by, or with the prior authority of, the landowner. Exemptions relating to clearing for firewood, woodwork or to provide fencing and farm materials can also be undertaken by the occupier of the property, or with the occupier's prior authority.

Environmentally sensitive areas

The exemptions described in this fact sheet do not apply in environmentally sensitive areas.

Environmentally sensitive areas can be viewed from the Department of Environment Regulation's (DER) 'Native Vegetation Map Viewer' at www.der.wa.gov.au/nvp in the 'data' section.

What other requirements are there for the limited clearing exemptions?

Each limited clearing exemption has its own requirements. These are outlined below.

Clearing to construct a building

This limited clearing exemption allows the landowner to clear a site for the lawful construction of a building or other structure. All relevant building approvals must be obtained prior to commencing the clearing. The clearing is to be limited to the extent necessary for the construction.

This exemption does not extend to riparian vegetation. Riparian vegetation includes vegetation growing on the edges of a stream, river or wetland.

Clearing for firewood

This limited clearing exemption allows the landowner or occupier to obtain firewood from their property for their own domestic heating or cooking. This exemption does not allow you to kill live vegetation or prevent the regrowth of vegetation. You can not clear under this exemption if firewood can be obtained from vegetation already cleared for another purpose

Clearing to provide fencing and farm materials

This limited clearing exemption allows the landowner or occupier of the property, on which the vegetation is located, to obtain materials for constructing and maintaining fences, buildings and other structures.

This exemption does not allow you to kill live vegetation or prevent the regrowth of vegetation. You can not clear under this exemption if material can be obtained from vegetation already cleared for another purpose.

Clearing for woodwork

This limited clearing exemption allows the landowner or occupier of the property to clear to provide timber for their own non-commercial woodwork. Woodwork includes furniture making, wood turning or carving. This exemption does not allow you to kill live vegetation or prevent the regrowth of vegetation. You can not clear under this exemption if timber can be obtained from vegetation already cleared for another purpose.

Clearing along a fence line – alienated land

This limited clearing exemption allows the landowner to clear land for a fence line on, or within, the property to the width necessary to provide access to construct or maintain a fence.

Clearing for vehicular tracks

This limited clearing exemption allows the landowner to clear land to construct a vehicular track on their property. Clearing is only exempt if:

- the clearing is no wider than necessary
- the vegetation is not in a road reserve
- there is at least 100m between that track and any other cleared land that can be used for the intended purpose of the track
- the vegetation is not riparian vegetation (unless there is no reasonable alternative route and the track is necessary for the commercial activities carried out on the property).

Clearing for walking tracks

This limited clearing exemption allows the landowner to clear land to construct a walking track on their property. Clearing is only exempt if:

- the clearing is no wider than necessary
- the track is to be used by pedestrians or there is a reasonable expectation that it will be used by pedestrians.

Clearing isolated trees

This limited clearing exemption allows the landowner to clear an isolated tree on their property. A tree is considered to be an isolated tree when it is in a cleared area that is more than 50m from any other native vegetation. For the purpose of this exemption, this is taken to include all trees that are more than 50m away from any other native vegetation.

Legislation

This document is provided for guidance only. It should not be relied upon to address every aspect of the relevant legislation. Please refer to the EP Act and Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (Clearing Regulations), available from the State Law Publisher. Free electronic copies are available from www.slp.wa.gov.au.

Legislation concerning exemptions from the requirement for clearing permits can be found in:

- Schedule 6 of the EP Act for clearing under other laws
- Regulation 5 of the Clearing Regulations for general day-to-day activities that have a low environmental impact.

Compliance assistance documents

Additional publications relating to clearing laws, clearing permits, and application forms are available online from www.der.wa.gov.au/nvp or can be requested by phoning 6467 5020.

Compliance advice

For advice on compliance with clearing laws and clearing permits, or any other related matter, please contact DER on 6467 5020.

For applications related to mineral and petroleum activities contact the Department of Mines and Petroleum's Native Vegetation Assessment Branch on 9222 3333.

Kwinana Waste To Energy Project

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Kwinana Waste To Energy Project

Public Environmental Review – Response to Submissions
Part B - Appendices

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
ENVIRONMENT

GUIDELINES
ON THE INTERPRETATION OF THE R1 ENERGY EFFICIENCY FORMULA FOR INCINERATION FACILITIES DEDICATED TO THE PROCESSING OF MUNICIPAL SOLID WASTE ACCORDING TO ANNEX II OF DIRECTIVE 2008/98/EC ON WASTE[1]

[1] Directive 2008/98/EC on waste and repealing certain Directives – OJ L 312, 22.11.2008, p. 3.

Foreword

The new Waste Framework Directive, which since 12 December 2010 has to be applied by all Member States, marks a shift away from thinking about waste as an unwanted burden to seeing it as a valued resource. The Directive establishes a straightforward five-step waste hierarchy as a priority order for Member States decisions on waste policies and legislation. Waste prevention is regarded as the most desirable option, followed by preparing waste for re-use, recycling and other recovery, including energy recovery, with disposal (such as landfill) as the last resort. When applying the waste hierarchy, EU Member States shall encourage those options that deliver the best overall environmental outcome over the whole life-cycle of products and services.

Recycling of waste by reprocessing it into new products can make the most efficient use of the resources contained in waste. Where waste recycling is not the environmentally preferable option, technically not feasible or economically not viable, waste should be used to generate energy. The new Waste Framework Directive promotes production of energy from waste. With the so-called R1 Formula[2], it has introduced an incentive for municipal waste incinerators to contribute to the energy supply for industries and households. Municipal waste incinerators meeting or exceeding the energy efficiency thresholds of this formula can be classified as facilities for the recovery of energy from waste according to the waste hierarchy.

This guideline is intended to help the authorities in the Member States to interpret and apply the R1 Formula. It could also be used as a reference by economic operators, as they will have to comply with the national laws transposing the Directive. The guidance has been developed together with experts from Member States, industry and NGOs. It reflects the views of the Commission, and as such is not legally binding; binding interpretation of EU legislation is the exclusive competence of the Court of Justice of the European Union. The guidance is a living document and as such may be revised according to experience with the implementation in the Member States and further development of European waste management policy.

June 2011

Karl Falkenberg
Director-General of DG Environment

[2] Annex II, footnote (*) of Directive 2008/98/EC

TABLE OF CONTENT

The following abbreviations for pertinent legislation are used in this document:

Legislation/Guidance	Abbreviation
Waste Framework Directive 2008/98/EC	WFD
Directive on the incineration of waste 2000/76/EC[3]	WID
Directive concerning integrated pollution prevention and control 2008/1/EC[4]	IPPC Directive
Directive 2010/75/EU on industrial emissions[5]	IED
Waste Shipment Regulation (EC) No 1013/2006[6]	WSR
Integrated Pollution Prevention and Control Reference Document on the Best Available Techniques for Waste Incineration, from August 2006[7]	BREF WI

[3] OJ L 332, 28.12.2000, p. 91; repealed by 7 January 2014 by Directive 2010/75/EU.
[4] OJ L 24, 29.1.2008, p. 8; repealed by 7 January 2014 by Directive 2010/75/EU.
[5] OJ L334, 17.12.2010, p. 17.
[6] OJ L 190, 12.7.2006, p. 1.
[7] ftp://ftp.jrc.es/pub/eippcb/doc/wi_bref_0806.pdf.

1 Introduction

These guidelines are destined to provide legal certainty and a level playing field in the application of the energy efficiency thresholds for municipal waste incinerators in Annex II of Directive 2008/98/EC on waste (Waste Framework Directive - WFD).

The new WFD has introduced a **five-step waste hierarchy as a priority order** with waste prevention at the top followed by preparing for re-use, recycling, other recovery including energy recovery and waste disposal as the last resort. The Directive allows municipal waste incinerators to be classified as recovery operations provided they contribute to the generation of energy with high efficiency to promote the use of waste to produce energy in energy efficient municipal waste incinerators and encourage innovation in waste incineration.

In this context, it is important to note that "recovery" means any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy (Art 3 (15) of the WFD).

The non-exhaustive list of recovery operations presented in Annex II of the WFD defines R1 as a recovery operation which is understood as "*Use principally as a fuel or other means to generate energy*". It is clarified in footnote (8) that this includes incineration facilities dedicated to the processing of municipal solid waste (MSW) only where their energy efficiency is equal to or above:

- 0.60 for installations in operation and permitted in accordance with applicable Community legislation before 1 January 2009,
- 0.65 for installations permitted after 31 December 2008,

using the following formula:

$$\text{Energy efficiency} = \frac{E_p - (E_f + E_i)}{0.97 * (E_w + E_f)}$$

In which:

***E_p** means annual energy produced as heat or electricity. It is calculated with energy in the form of electricity being multiplied by 2.6 and heat produced for commercial use multiplied by 1.1 (GJ/year)*
***E_f** means annual energy input to the system from fuels contributing to the production of steam (GJ/year)*
***E_w** means annual energy contained in the treated waste calculated using the net calorific value of the waste (GJ/year)*
***E_i** means annual energy imported excluding E_w and E_f (GJ/year)*
***0.97** is a factor accounting for energy losses due to bottom ash and radiation*

In addition, Annex II of the WFD highlights that this formula shall be applied in accordance with the Reference Document on Best Available Techniques for Waste Incineration (BREF WI).

The "R1-formula" is not strictly speaking an expression of efficiency in physics, but a performance indicator for the level of recovery of energy from waste in a plant dedicated to the incineration of municipal solid waste (MSWI). The practical impact of this provision will have to be monitored in future and the R1 formula may be revised in 2014 in accordance with the provisions of article 37(4) of the WFD, and if necessary to keep it up to date with technological progress.

For historical development of the formula and its link to the Integrated Pollution Prevention and Control Reference Document on the Best Available Techniques for Waste Incineration from August 2006 (BREF WI) see Annex 1.

For better readability, this document specifies major topics in specific thematic areas in shaded boxes and summarises the major elements of guidance in boxes at the end of each chapter.

It should be noted that this guidance only reflects the opinion of the Commission services and is not legally binding. A final binding legal interpretation of EU legislation can only be provided by the Court of Justice of the European Union. This guidance is without prejudice to the position the Commission might take should related issues arise in a procedure before the Court of Justice.

1.1 Scope of the Energy Efficiency Formula

Annex II, footnote (*) of the WFD clearly restricts the scope of the formula to "incineration facilities dedicated to the processing of municipal solid waste" (MSWI). The WFD should, pursuant to its recital 20, clarify when incineration of (MSW) is energy-efficient and may be considered as recovery operation.

Waste incinerators dedicated to the incineration of municipal waste are waste incinerators which have the permit and are technically designed in a way so that they are capable to incinerate mixed municipal solid waste.

The R1 formula does not apply to co-incineration plants and facilities dedicated to the incineration of hazardous waste, hospital waste, sewage sludge or industrial waste.

Installations shall correspond to the IPPC activity 5.2. "Installations for the incineration of municipal waste (household waste and similar commercial, industrial and institutional wastes) with a capacity exceeding 3 tonnes per hour" (it should be noted that the capacity limit in this context is not applicable in the context of the R1 formula). However, this activity description will change under the IED, Annex I, as indicated below:

> 5.2 Disposal or recovery of waste in waste incineration plants or in waste co-incineration plans:
>
> (a) for non-hazardous waste with a capacity exceeding 3 tonnes per hour;
>
> (b) for hazardous waste with a capacity exceeding 10 tonnes per day.

In the context of IED, installations dedicated to the incineration of municipal waste shall correspond to a sub-sector of activity 5.2 recognizing that: (1) only if the facility is dedicated to the incineration of municipal solid waste will it fall within the R1 energy efficiency thresholds of the WFD and (2) that the R1-formula does not apply to co-incinerators.

Municipal waste is classified in chapter 20 of Commission Decision 2000/532/EC on the list of waste. Usually, MSWI are installations permitted for the incineration of 'mixed municipal waste'. Mixed municipal waste is defined in Art 3(3) WID as waste from households as well as commercial, industrial and institutional waste, which because of its nature and composition is similar to waste from households, excluding separately collected fractions of recyclable waste.

In addition, other waste streams can be accepted by MSWI if listed in the permit for the IPPC category 5.2, if applicable, or the permit according to WID. Authorization of any waste input, except for mixed municipal solid waste, shall be in line with the BREF on waste incineration and with the waste hierarchy (Art 4 WFD).

In practice, the waste input into a MSWI is made of different mixed and heterogeneous fractions which are blended before feeding the hopper in order to optimize the combustion process.

The calculation of the R1 formula shall be done on the waste composition which is actually incinerated in a facility, not only on the part of the waste which is classified as municipal waste or mixed municipal waste.

In case an incineration plant has two separate lines (one for hazardous waste and one for MSW), only the line for MSW can apply for the R1 status according to the formula.

Non-municipal wastes can be accepted as long as specified in the permit in accordance with the IPPC and WID and the BREF document, although primarily other treatment options might be preferred. Separately collected waste fractions should be managed in line with the waste hierarchy.

The calculation of the E_w as a parameter for the R1 efficiency is based on the actual waste mix incinerated.

1.2 Principles of self-sufficiency and proximity and the waste hierarchy

Together with the introduction of the R1 formula, the principles of self-sufficiency and proximity have been extended from waste disposal installations to the recovery of mixed municipal waste collected from private households, including where such collection also covers such waste from other producers.

The fact that municipal waste treated in an R1-facility is to be regarded as recovered has to be distinguished from the question of whether the recovery of a certain waste in such a facility is to be seen as a waste management option with the best environmental outcome considering the waste hierarchy and taking into account life-cycle thinking (Art 4 WFD). Certain waste streams like paper, glass, plastic, and metals can be used with higher resource efficiency when they are separately collected from other municipal wastes and recycled.

According to Art 4(2) WFD, Member States should encourage those waste management options that deliver the best overall environmental outcome. For waste streams where recycling is the preferable option, this should include appropriate measures such as introduction of separate collection schemes and other measures supporting recycling, implementing recycling targets and avoiding overcapacities for waste incinerators in waste management plans. National legislation on recycling of certain waste streams might be another option.

Hazardous waste is usually treated in the most appropriate way in incinerators specifically dedicated to the treatment of hazardous waste which are not under the scope of the R1 formula.

The principle of self-sufficiency and proximity (Art 16(1) WFD) is applies to mixed municipal waste from private households destined to incinerators that are classified as recovery. Similar waste from other producers is included when is has been collected together with mixed municipal wastes from households.

The waste hierarchy principle (Art 4 WFD) establishes a 5-step priority order with waste prevention as the most preferable solution, followed by preparation for re-use, recycling, other recovery (including energy recovery) and waste disposal as the last resort. According to Art 4(2) WFD, Member States should encourage those waste management options that deliver the best overall environmental outcome taking into account life-cycle thinking.

2 System Boundaries for application of the R1-formula

2.1 Definition of system boundaries

The definition of system boundaries has considerable implications for the calculation of the energy efficiency, because it affects the energy streams which are to be calculated as E_i, E_f and E_w, thus influencing the R1 factor.

WFD does not contain a definition of the compounds of an "incineration facility", hence definitions in other relevant laws and guidance shall apply. In this context it is important to differentiate between "waste incineration installation" according the IPPC Directive and "incineration facility" according to WID.

The boundaries of a **"waste incineration installation" according the IPPC Directive** are defined by the limits of the operator's permit. "Installation" according to Art 2(3) of the consolidated IPPC Directive means a stationary technical unit where one or more activities listed in Annex I of this Directive are carried out, and any other directly associated activities which have a technical connection with the activities carried out on that site and which could have an effect on emissions and pollution. Depending on local conditions, the "waste incineration installation" according to the IPPC Directive may simply include an "incineration facility" according to WID and its offices or other additional processes/activities, such as:

- ash processing, recovery of metals from ash, on site manufacture of products from those recovered materials,
- other waste treatment processes, such as a sorting facility, aerobic and/or anaerobic digestion facility, station for waste collection vehicles maintenance, etc.
- other activities such as sewage sludge treatment,
- classic boiler (fired with classic fuels), a complex process such as a combined cycle with gas turbine, an industrial complex.

It should be noted, however, that the IED introduces new activity descriptions for which a permit will be required. According to IED, permits issued to incinerators under IED, Annex I, activity 5.2, may also contain provisions for the other waste treatment activities listed in IED, such as Annex I, activity 5.3, given that an installation can contain more than one Annex I activity and be subject to a single permit. However, such pre and post-treatments are not included within the R1 system boundary (see section 2.2).

The **"incineration plant" according to the WID** includes the site and the entire incineration plant with all incineration lines, waste reception area, storage, on-site pre-treatment facilities, waste fuel and air supply systems, waste incineration furnace/combustion chamber(s), boiler(s), a cleaning system for incineration flue gas, and on-site facilities for treatment or storage of residues and water as well as the stack. This definition is generally the same in the IED.

In line with the description in the related BREF Document (Annex 10.4.1, figure 10.14), **the R1 system boundaries** shall comprise only the essential parts of the incineration and energy recovery process. This includes the combustion chamber(s) and boiler(s), the flue gas treatment system, energy transformation and recovery equipment such as heat exchangers and turbine generator set, as well as all electrical systems (e.g. pumps, motors, fans, compressors, trace heating, control systems, etc.) and heat consuming systems needed for their proper functioning.

The inclusion of the turbine into the R1 system boundaries is underpinned by the WID requesting combined heat and power recovery from waste to the extent possible (for more details see BREF document).

The inclusion of the flue gas cleaning system gives the incentive to use also lower temperature heat, which otherwise would be wasted.

The system boundaries for the calculation of the R1-formula are the incineration facility as defined above including incineration furnace/combustion chamber(s), the boiler(s), the incineration flue gas cleaning system and, often, energy transformation and recovery equipments such as heat exchangers feeding a District Heating (DH) or cooling network and/or a Turbine Generator (TG), see Annex 2 to this document.

In order to ensure a correct calculation of the R1-formula, measurement points have to be established at the system boundaries. A basic illustration of system boundaries and energy flows is provided in Annex 2 to this document.

2.2 Pre-treatment, post-treatment, conventional boiler and combined processes

Pre-treatment, post-treatment, conventional boiler, and combined processes shall not be included in the R1-formula system boundaries.

This is justified by the fact that pre-treatment is typically not included in the permit of the installation and is not an essential part of the incineration process. It is also not included in the plant efficiency (Pl ef) calculation formula BREF document, and apart from mixing the waste and crushing or shredding bulky wastes, in general is not essential for the incineration process in MSWI. Furthermore, it is listed as separate recovery operation (R 12) in Annex II to the WFD. R 12 operation can include preliminary waste treatment operations prior to recovery including pre-processing such as, inter alia, dismantling, sorting, crushing, compacting, pelletising, drying, shredding, conditioning, repackaging, separating, blending or mixing.

A similar approach applies to bottom ash (post)treatment, which also is not considered in the WI BREF Document and is classified in Annex II to the WFD as R 4/R 5 operation.

Classic boilers or combined processes (e.g. if the incinerator is coupled with a gas turbine) using conventional fuels included in the installation, if any, are also not included in the R1 system boundaries, even if they are connected to the incineration facility.

2.3 Processes outside the scope of the incineration facility permit

It is important to note that the R1-formula system cannot be extended outside the "incineration facility" nor the "installation" as defined by the permit, and that installations outside the responsibility of the operator are to be excluded from the R1 system boundaries, in particular because the operator has no authority there.

The technical unit used in the definition of the "incineration plant" (according to Art 3(4) WID) dedicated to the thermal treatment of wastes with recovery of the generated combustion heat, as specified in the corresponding WID permit, shall be the decisive factor as regards inclusion or exclusion of scope of a turbine for generation of electricity and their consideration in the calculation of the R1 efficiency.

Therefore, turbine generators set outside the boundary limits of the permit are excluded from the "R1-formula system", so as are classic boilers or combined processes (e.g. if the incinerator is coupled with a gas turbine) using conventional fuels even if installed on the same site.

Existing plant permits may not be changed to include/exclude electricity production in order to reach R1 classification without corresponding plant modification.

3 Energy Flows and Single Factors of the Energy Efficiency Formula

E_w, E_f, E_i and E_{exp} must always be defined as energy flow at the system boundaries. In this context, E_w, E_f and E_i constitute the input to the system, whereas the output from the system to third parties and/or the grid is E_{exp}.

E_p as another important factor of the R1 formula is not related to system boundaries but is clearly defined by means of the formula itself.

It is important to emphasise that the R1 formula does not cover all energy flows that have to be counted for a full energy balance for the system and that the R1 formula is not calculating the boiler efficiency but is considering the part recovered and utilized from the energy generated at the boiler.

A compilation of examples of energy flows allocated to the different parameters is provided in Annex 3a to this document.

3.1 Equivalence factors

Equivalence factors as specified in the calculation formula apply to electricity and heat irrespective whether produced, imported, self-consumed or taken back into the system as

return flow or backflow. No equivalence factor applies for fuels (fuel-oil, gas …), i.e. the factor is 1.

Electricity is to be multiplied with the equivalence factor of 2.6. The equivalence factor for heat (steam or hot water) is 1.1.

The equivalence factors for electricity and heat generation which are taken directly from the BREF WI can be explained as follows:

The factor 2.6 for electricity is based on an average European coefficient of coal plants with 38%, which means an energy demand of 2.6 kWh for the production of one kWh of electricity.

The factor 1.1 for generated heat is based on an average European coefficient of heat plants of 91%.

The factors of 1.1 and 2.6 are to be applied independently whether the energy is used outside or inside the R1 system boundary.

3.2 Energy produced - E_p

3.2.1 Definition of E_p

Annex II to the WFD defines E_p as "annual energy produced as heat or electricity". It is calculated with energy in the form of electricity [...] and heat produced for commercial use [...].

"Produced" in this context is to be interpreted as "produced and utilized" in the meaning of the generated energy that is recovered and effectively used[8] or the "part of the energy generated (…) reclaimed and used"[9] (see) or "recovery of energy from waste" as stipulated in chapter 3.5.4, page194 ff of the WI BREF document or BREF document (page 597). This is not restricted to the exported energy as in the "plant efficiency potential" or "output from the incineration facility" (Pl ef)[10] described in chapter 3.5.6 of the BREF, titled "data comparing energy required by, and output from, the installation".

[8] ECJ C-228/00, para 42.
[9] ECJ C-458/00, para 34.
[10] $$Pl\ ef = \left(\frac{Oexp - (Ef + Etmp)}{(Ef + Etmp + Ectrc)}\right)$$

In the BREF document (page 597) the formula is given for the total specific electricity produced in correlation to the quantity of waste incinerated: Ne sp prod = (Oe exp + Ee circ[11])/ m.

This means that per quantity of waste the produced electricity is the sum of the total exported electricity and the circulated electricity divided by the quantity of waste. When this formula is applied for the total waste incinerated, it transforms to: Oe sp prod = Oe exp + Ee circ.

The same sort of a formula is given in the BREF document for produced heat. By combining the electricity and heat produced, the total energy produced can be calculated. This can be written as: $O_{prod} = O_{exp} + E_{circ}$ or E_p = exported + circulated energy.

This interpretation is confirmed by the Commission non-paper on the energy efficiency draft, issued during the negotiations of the WFD in the European Parliament and the Council, stating that "some operators suggest changing the meaning of E_p from gross amount of energy from the turbine/generator (the actual meaning in COM(2005)667) to the amount of energy actually exported to the grid".

E_p thus includes the energy (heat and electricity) recovered from waste which is exported outside the R1 system boundary to third parties or to other uses within the installation, as well as the energy which is used inside the R1 system boundary, e.g. for heating up the flue gas before the chimney, but not including energy uses influencing the steam/heat production. This distinction is necessary to avoid double-counting of energy flows and is in accordance with table 10.98 of the BREF-WI (footnote 2-4) which is reflected in Annex 3a of this guidance. In order to be counted in E_p, operators shall prove that uses within the system boundary and within the installation are state-of-the-art and technically designed and operated in line with BAT (where relevant).

Note: To be counted in E_p, a commercial use needs to be given for heat. Exported heat shall only be counted in E_p if the operator can prove commercial use by means of valid contracts with third parties. Internal heat consumption (within the permit boundaries) shall also be regarded as commercial use, as it directly replaces primary energy which otherwise would have to be purchased (opportunity cost principle). All internal uses have to be documented in the calculation form as proof of utilisation.

In order to avoid double counting:

- The energy of the steam which is converted into electricity in the incineration facility to generate electricity which is counted as produced electricity cannot be counted as produced heat.

- The electricity generated by a third party using the steam from the incineration facility is not to be counted as electricity but only as produced heat.

[11] Ecirc is circulated energy, energy that is produced and then circulated so that it is used in the installation.

3.2.2 Transport losses, inefficient use by third parties and transformation of heat into electricity by third parties

E_p is the energy produced by the incineration facility. The fact that energy is used inefficiently by third parties shall not be taken into account and shall have no effect on the R1 energy efficiency formula. The same applies in the case of energy losses due to transport of heat energy.

3.2.3 Backflows and return flows of generated energies

Backflows and return flows are energy flows (e.g. steam or warm water) that come back from the air- or water-cooled condensers as condensation water, from internal heat exchangers or from external customers in a closed circuit, e.g. from district heating or a power plant. Although strictly speaking not a "backflow", fresh feed water added as make-up to compensate the blow down and water losses shall be counted with backflows.

Backflows from external sources shall be deducted from E_p as they directly lower the rate of energy recovery from waste. Backflows from internal sources shall be deducted from Ep if they origin from energy flows accounted for in Ep. Backflows from energy streams excluded from EP (see 3.2.1. para7) will not be deducted.

3.3 Fuel inputs - E_f

E_f is defined as annual energy input to the system from fuels contributing to the production of steam (GJ/year).

E_f includes only fuels. Fuels are "combustible non waste substances" (e.g. diesel, natural gas) compliant with the Fuel Quality Directive 2009/30/EC, used for start-up and shutdown of the incineration process, including fuels to maintain required temperatures > 850°C by using auxiliary burners.

Note that the energy of all waste, including RDF/SRF (Refuse Derived Fuel) or waste (exhaust) gas, is to be counted within E_w and not within E_f. This shall apply also to waste oil, although exclusively used in a burner, due to its definition as waste and the fact that it can only be used when the legally required incineration temperature has been reached.

During start-up, the period where fuel contributes to the production of steam (counting as E_f) starts when the steam generator is connected to the steam grid and lasts until the legal minimum flue gas temperature (required by the legislation and/or the permit) is reached. During shut down, it lasts until the steam generator is disconnected from the grid.

3.4 Other energy imported - E_i

E_i means annual energy imported excluding E_w and E_f (GJ/year).

E_i consists of electricity, other kinds of imported non fuel energy such as steam and hot water, and of the amounts of fuel used during start-up and shut down processes before connecting and after disconnecting to steam grid (i.e. that part which is not counted as E_f), the energy for

re-heating of the flue-gas for catalysts or after the flue gas cleaning systems (e.g. with gas or oil), as well as other energies imported for the use in the "incineration facility" plant which are not used for steam production are to be counted in E_i.

Avoid double counting: The condensate (or cold water) from the condensers or backflows returned from the export of steam (or hot water) are not counted in E_i, but are to be deducted from E_p.

Circulating heat and electricity for own uses of the incineration plant are part of E_p and are not to be counted in E_i.[12]

This aspect gives an incentive to incineration facilities to make use of the energy they produce (namely heat) and avoids that sophisticated flue gas treatment used to minimize air emissions (e.g. NO_x) would have a negative impact on the ability to reach the R1 efficiency.

In this context it has to be underlined that own energy consumption of an incineration facilities is limited by process design and that own energy consumption as well as minimum annual energy exports are clearly specified in the Waste Incineration BREF document in BAT No. 61, 62, 63, 66b and 68 which shall be taken into consideration and reflected in the corresponding plant permits (limitations for internal use and minimum export requirements set in the BATs are listed in Annex 3b).

3.5 Distinction between E_f and E_i

Distinction between E_f and E_i has to be made for fuel used by the burner for start-up and shut down. The consumption at the burner during start-up and shut down periods is roughly 50% without steam being produced (E_i) and 50 % with steam production (E_f).

Although specified separately in the calculation formula, in practice there is no need to make a distinction in imported fuel consumption between E_f and E_i because the numerator of the R1-formula requests the sum $E_f + E_i$. This corresponds to the totally imported energy for which data are readily available for operators.

The routine measurements performed by operators give direct access on the one hand to $E_w + E_f$ and on the other to $E_f + E_i$ which are the elements addressed by the R1-formula.

3.6 Energy contained in waste - E_w

Annex II of the WFD defines E_w as: "…annual energy contained in the treated waste calculated using the net calorific value of the waste (GJ/year)".

This comprises all types of waste acceptable at the MSWI plant as defined in IPPC and WID (see scope of the formula). This includes secondary fuels derived from waste as long as they have not reached their end-of-waste status (Art 6 WFD).

[12] Also circulating heat and electricity, which are excluded from the calculation of Ep (see chapter 3.2.1 and Annex 3a) shall not be counted as Ei.

E_w has to be calculated for waste entering the R1 system boundary, which means after pre-treatment, if in place.

Analysis of individual waste samples is not a feasible determination method because the amount of waste to be sampled and the frequency of sampling for a reliable outcome would be too high.

The best method for the determination of the energy content of the waste or the net calorific value (NCV) is a calculation with proven process data over longer time periods (energy balance).

The method relies on a European standard developed for the specific case of Waste-to-Energy incinerators in relevant reference documents[13]. These documents describe the detailed procedure for the Acceptance Test which is performed according to the methodology and principles of the European standard EN 12952-15 once in the course of the tests on completion of the plant and during which the efficiency of the boiler is determined.

The principle of the methods is to use energy balance on the furnace and the boiler considered together as a calorimeter[14]. Energy inputs equal energy outputs plus energy losses (in flue gas, in bottom ash, by convection and radiation). The main energy outputs are measured during the comprehensive "acceptance test" at the beginning of the life of the incineration facility (e.g. steam flow) and the small ones are assessed. Boiler efficiency gives the ratio between the energy output and the overall energy input.

For calculation and measurement details see annex 4 to this document.

The energy coming from the waste (E_w) is then obtained by deducting from the total energy input the energy of fuels contributing to the production of steam/hot water (E_f) used over the same period of time.

The average NCV of the waste is obtained by dividing this waste energy input by the waste flow entering the incineration furnace/combustion chamber over the corresponding period of time. E_w is equal to the NCV by the waste flow.

Alternatively, the NCV formula given in the BREF document (chapter 2.4.2.1 and Annex 10.4.2) can be used in justified cases if the formula has been adapted to the specific installation via an initial energy balance and if recalculated to standard oxygen. According to the BREF NCV is to be measured as follows: NCV = (1.133 * (mst waste/m waste) * cst x + 0.008 * Tb)/1.085 [GJ/Mg(tonne) waste].

Although specified separately in the calculation formula, in practice there is in general no need to specifically determine E_w and NCV, because the denominator of the R1-formula requests the sum of E_w + E_f, which corresponds to the total energy input to the boiler that is directly calculated by the method using the boiler as a calorimeter (see above).

[13] Acceptance Testing of Waste Incineration Plants with Grate Firing System' Guideline Edition 04/2000 by FDBR. Available from FDBR in German and in English. Cahier des clauses techniques générales (CCTG) applicables aux marchés publics de travaux, Fascicule.' approved by "Arrêté du 6 mars 2008" of "Ministère de l'économie, de l'industrie et de l'emploi. Available in French from Mininstry of ecology:

[14] The boundary limits of the system here (furnace and boiler) are different (narrower) than the R1 boundary limits considered in the other parts of the R1 guideline document.

4 Qualification Procedure and Monitoring of Compliance

Statements in this chapter are recommendations for an appropriate and harmonized procedure resulting from the discussion in the expert working group which accompanied the preparation of this guidance. Implementation and enforcement of monitoring remains the full responsibility of Member States.

The procedures for classification of municipal waste incineration facilities as either a 'Recovery operation' or a 'Disposal operation' have to ensure sufficient legal and planning security for operators.

In this context, it has to be taken into consideration that energy efficiency is largely dependent on the technical design of the facility and will only change to a limited extent during operation.

The status of a facility should be known before the waste is treated, well in advance before the treatment begins, in order to comply with the stipulations of waste management contracts.

4.1 Applicable factor for the classification as R1 operation

According to Annex II of the WFD, incineration facilities dedicated to the processing of MSW can be classified as R1 recovery operations where their energy efficiency is equal to or above:

- 0.60 for installations in operation and permitted in accordance with applicable Community legislation before 1 January 2009,
- 0.65 for installations permitted after 31 December 2008,

In this context the meaning of "installations in operation and permitted" as mentioned above shall include installations that had a permit and were in operation before January 2009.

The factor of 0.65 applies exclusively for installations permitted after 31 December 2008. It does not apply for existing plants with a modification in a part of the installation, e.g. in the combustion chamber/furnace, boiler, turbine generator set or flue gas cleaning carried out after 31 December 2008. Existing plants shall have the possibility to reach the threshold by adjusting their efficiency.

Modification is understood as any measure to increase the recovery of energy from the incinerated waste by improving the process conditions or by establishing additional uses. An increase in capacity shall not be regarded as modification in the abovementioned meaning.

4.2 Existing plants

For existing plants ("installations in operation"), the R1-formula shall be determined on the basis of practical annual performance data of the plant (see R1 calculation procedures below).

A plant having undergone constructive or contractual adjustments concerning the energy efficiency will follow the same procedures as a new facility.

4.3 New plants

For new plants, the R1 status shall initially be granted on the basis of the planning or construction specifications, considering the energy supply contracts and by determination of the general efficiency of the facility from an energetic view. This shall be achieved by means of a comprehensive "acceptance test", determining the boiler efficiency made after commissioning, followed by a calculation on operational data made after one year in normal operation conditions on the basis of annual data.

4.4 R1 calculation procedures

According to Annex II WFD, the energy efficiency of the incineration facility is to be based on annual figures for energy production and energy consumption of the plant. This shall be understood as real practical performance and not as a theoretical maximized value which would not take into consideration periods of lower efficiency.

The calculation therefore shall be based on regular operation (including revisions) of the whole facility. The regular operation shall also include imperfect supply of electricity and heat because of lower demand.

The acquisition of data is made over a complete year. This is not necessarily a calendar year (i.e. the measuring period does not necessarily start on the 1st of January). The instruments and control equipment of the plant are maintained and controlled by the operator. Some data can be directly read from a counter as a sum, for instance fuel consumption and electricity produced. Some data require continuous computation and integration, for instance the energy of steam flows.

The R1 threshold shall be regarded as satisfied on the condition that:

- R1 calculated (with measured, assessed and corrected data);
- R1 threshold where 'R1 threshold' value is 0.6 for existing plants and 0.65 for new plants.

Calculation of the R1-formula on the basis of annual input and output data shall follow the exemplary calculation format provided in Annex 5 to this document.

4.5 R1 calculation procedures for multiple incineration lines

Multiple incineration lines are multiple facilities, and they can apply separately for the R1 status when the line(s) operate independently or the flows of each part of the plant can be clearly distinguished and calculated separately.

4.6 Approval of R1 calculation and allocation of R1 status

There are two different possibilities for initial calculation of the R1-formula.

- Calculation by the plant operator (with external control),

- Calculation by an external certified expert or an expert from competent authorities.

The R1-formula shall be either calculated or verified by an independent third person before it is presented to the competent authority of the EU Member State by the operator of the respective facility. In a normal operating year, the formula is calculated by the operator and submitted to the competent authority together with the details of the calculation. The competent authority shall receive the calculation sheet and, if needed, can carry out controls to verify whether the R1 formula is properly used. The competent authority can also request further information or verification by an independent expert, if needed. If the performance of an existing plant at initial application for R1 status is close to the threshold, the plant operator shall demonstrate to its competent authority that the R1 threshold was met over the past three years, using the mean value over the whole period ("gliding average" using two decimal places).

The R1 status of the plant shall be formally confirmed by the competent authority on the basis of the data required to calculate the R1 value and the R1 value calculated provided by the plant operators. When the calculated R1 value is above or equal to the threshold, the competent authority issues a certificate within three months attesting that the plant complies with the R1-formula condition.

4.7 Revision of monitoring results/ verification of R1 status

The calculation of the R1-formula and the statement of maintaining the energy efficiency level have to be presented on the basis of data of the preceding year (annual performance data as indicated above). The R1 classification of a municipal waste incinerator shall be confirmed by the competent authority to the operator for the running year in writing and in due time.

In order to guarantee smooth procedures and legal security, it is recommended that the confirmation is issued within 3 months from the date of the presentation of the operator's report. It shall be valid for the period of one year following the period for which the date has been provided. The operator shall annually report on the performance of the plant by means of a reporting form similar to the one presented in annex 5 to this document. This calculation shall be based on routine operator's monitoring results and cover the quantities of waste incinerated, quantities of fuel and imported electricity/heat consumed, electricity generated, heat used outside the incinerator facility. For the additional energy flows, lump sum data based on the previous R1-formula calculation of the plant might be used. The reporting shall be integrated into the reporting under Art 12(2)[15] of the WID. The report shall be made available to the competent authority not later than one month after the calculation period agreed during the initial classification or any new classification.

Due to the fact that major features of an incineration plant do not change over time, the operator's report including annual monitoring results completed by information on any structural changes that occurred in the plant during the past year (e.g. technical modification, change of customers, etc.) allows the competent authority to conduct a routine validation and check if a comprehensive recalculation is necessary. If a new comprehensive recalculation is not necessary, the installation can keep its R1/D10 status.

[15] An annual report to be provided by the operator to the competent authority on the functioning and monitoring of the plant shall be made available to the public. This report shall, as a minimum requirement, give account of the running of the process and the emissions into air and water compared with the emission standards in the WID.

A new comprehensive recalculation with external control or external expert is to be repeated after a maximum of 5 years, or in case of a substantial change of the basic conditions (modification of boiler, turbine generator, heat supply contract, the flue gas cleaning system) on which the first verification was based. If necessary, or in case of doubts, the authorities have the right to send inspectors or ask for any additional calculations/measurements they need.

4.8 Transitional periods, new application

It is the responsibility of the operator of the plant to provide sufficient certainty concerning a consistent achievement of the R1 threshold, even in case of modified circumstances for the plant's operation. Thus, an operator should aim at maintaining the energy efficiency well above the R1 threshold in order to be able to compensate for a modification in the conditions of operation. However, in case where an E-parameter changes due to circumstances which cannot be influenced by the plant operator (*force majeure*, e.g. loss of industrial heat consumer, unexpected climatic conditions, breakdowns or other outage periods) and the R1 threshold cannot be met in the annual reporting, the status of the plant will not be withdrawn immediately.

In such cases, the plant operator may – on the basis of the annual performance over the past three years – provide a justified statement why the threshold could not have been met. The plant operator will then be authorized to adjust/remediate in such a manner that the efficiency ratio complies with the thresholds again until the following year. If this result is achieved, the R1 status is maintained.

In case of a long-lasting breakdown or disturbance with significant impact on the efficiency (e.g. turbine breakdown or customer's failure), after expertise and assessment of the duration of the unavailability, the operator may: (i) give up the R1 status (and inform the competent authority thereof) and recover it as soon as the breakdown or failure is fixed (and calculate the R1 value over a year starting when the incineration facility is back to normal operation conditions); (ii) continue to try to achieve the R1 threshold.

When a plant cannot reach the R1 status or loses it due to not being able to meet the threshold in two subsequent reporting years, the operator can try again to obtain the R1 status by applying for a new test, after documentation of procedural changes or changed energy supply contracts.

4.9 Communication on R1 status in the context of transboundary shipment

The operator of a MSWI plant with R1 classification has to communicate the status of his plant to his clients by means of appropriate documentation (official certificate). In case of doubts, the competent authority can be asked for confirmation by other involved authorities and potential economic partners. A valid permit is a prerequisite for transboundary movement. The procedural requirements of the Waste Shipment Regulation should apply for MSWI with R1 classification as for any other facility.

ANNEX 1: The R1 calculation formula

The formula in the WFD is related to the plant efficiency formula (Pl ef) in the "Integrated Pollution Prevention and Control Reference Document on the Best Available Techniques for Waste Incineration", from August 2006 (hereinafter referred to as BREF document), Annex 10.4.5, as described hereinafter.

$$Pl\ ef = (O_{exp} - (E_f + E_{imp}))/(E_f + E_{imp} + E_{circ})$$

all figures as equivalents in accordance to BREF, Chapter 3.5.6
E_f = annual energy input to the system by fuels with steam production (GJ/y)
E_{imp} = annual imported energy (Note: energy from the treated waste (Ew) is not included)
E_{circ} = annual energy circulated
O_{exp} = annual exported energy (combined total of heat plus electricity as equivalents)

"If the result is higher than 1: This shows that the plant minus imported energy with steam production is exporting (BREF) or producing (ECJ C-228/00) more energy than that which is required to operate the total waste incineration process"

According to the BREF document, all amounts of energy (E_p, E_f, E_i, and E_w) are declared in GJ/a or MWh/a and equivalent values are used for heat and electricity in accordance to BREF, Chapter 3.5.6. Primary fuels are taken into account without equivalent value (i.e. with a factor of 1) because no conversion of energy is connected with it.

The R1-formula can be deduced from the energy calculation formulas presented in BREF WI (Annex 10.4.4) as follows:

The denominator of the boiler efficiency by heat/steam production in correlation to the total heat/steam producing energy input, taking into account energy losses due to bottom ash and radiation or to remaining carbon content in the residues which can technically not be avoided (factor 0.97). (BREF WI Annexes 10.4.4, page 599),

$$\eta b(97\%) = \left(\frac{Eh\ st\ boiler}{0.97\ *\ (Ef + Ew)}\right) * 100\%$$

was used to derive the denominator of the R1-formula "0.97 * (E_f + E_w)".

The numerator of the R1 energy efficiency formula is related to the numerator of the boiler efficiency (E_h st boiler). However, instead of the total thermal energy (E_h/st boiler) generated by the boiler, only the energy (heat and or electricity) factually recovered - or in other words produced and utilized –from the waste, as the sum of the energy exported to third parties and the energy used within the installation forms the calculation basis for E_p. The numerator of the R1 energy efficiency formula can also be deduced from the numerator of the plant efficiency (Pl ef) formula $Pl\ ef = O_{exp} - (E_f + E_{imp})$. In contrast to Pl ef however, the recovery efficiency of an incineration plant according to the Formula in Annex II to the new WFD is based on the

energy in terms of heat and electricity factually utilized from the energy generated at the boiler (O_{prod}) and on the energy exported from the plant (O_{exp}). (For standardization purpose Oprod was changed to E_p and E_{imp} to E_i).

Energy efficiency = O_{prod} - (E_f + E_{imp}) =>E_p - (E_f + E_i).*That means that the energy efficiency formula in the new WFD corresponds to the "recovery of energy from waste" as stipulated in chapter 3.5.4.1 and 3.5.4.2 (Tables 3.40 to 3.43) p. 195/196 of the WI BREF and not to the plant efficiency potential as described in chapter 3.5.6 titled "data comparing energy required by, and output from, the installation".*

The calculated R1-factor gives the relation between:

(a) the energy recovered from waste (exported energy plus internally used energy) minus the imported energy, and

(b) the energy from waste plus other imported energy used for steam production.

ANNEX 2: System Boundaries of R1-formula

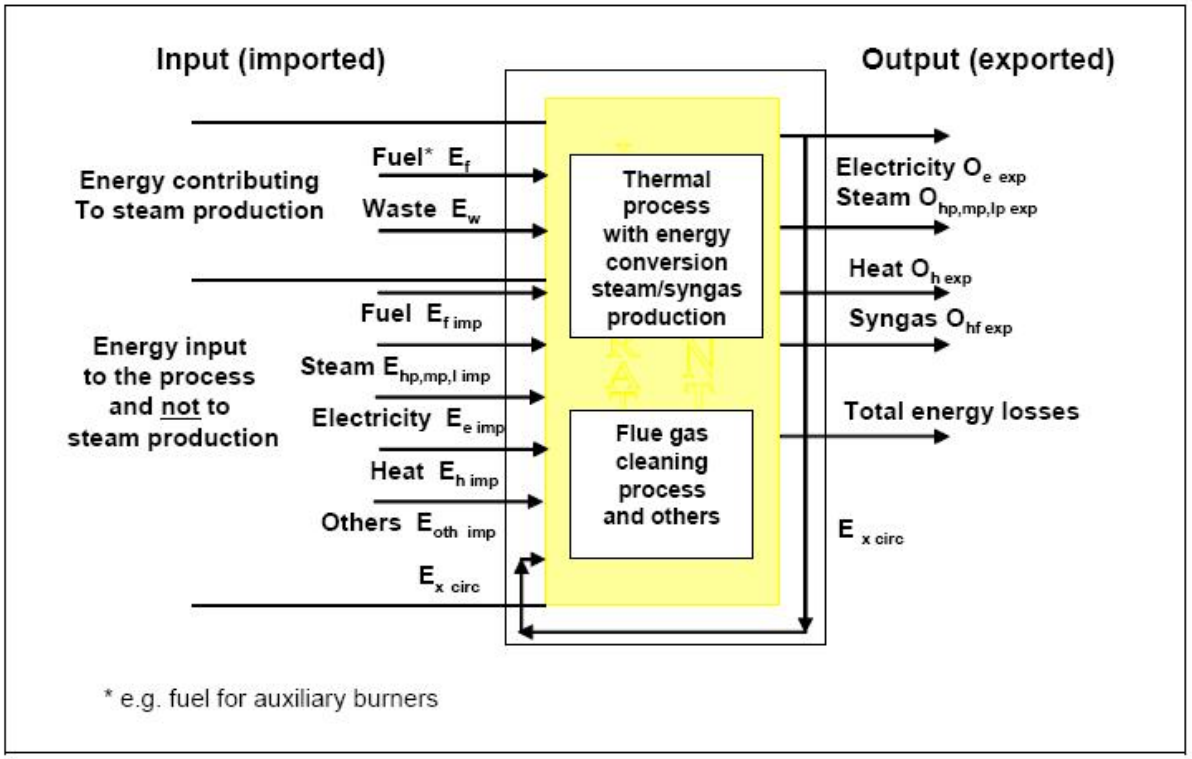

Figure 1: Energy efficiency system boundary according to BREF WI (Figure 10.14)

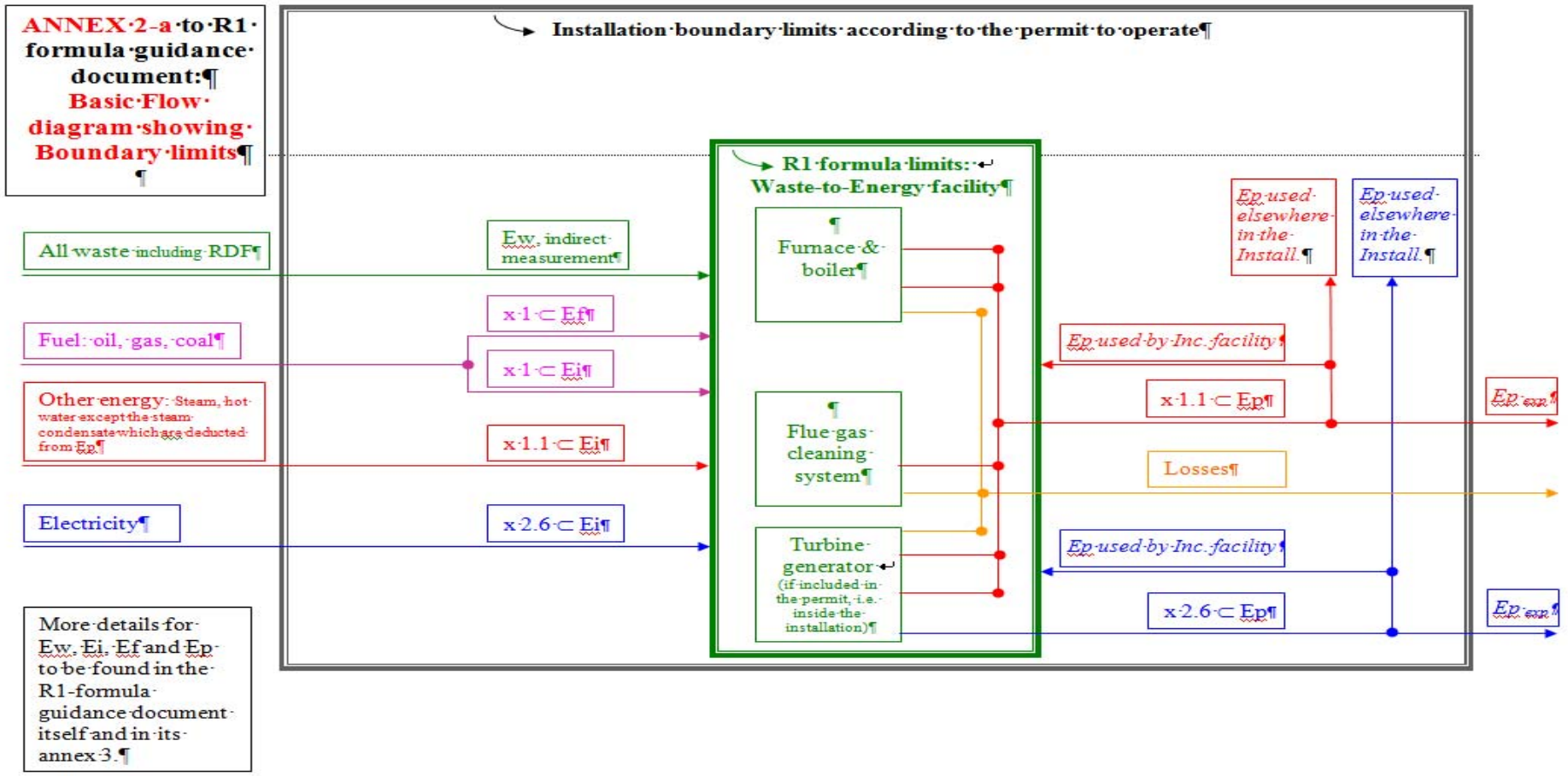

Figure 2: Distinction between R1 system boundary and permit boundary for MSWI (Source: CEWEP-ESWET-FEAD Proposal for a Guideline for the use of the R1 energy efficiency formula for incineration facilities dedicated to the processing of Municipal Solid Waste (Waste Framework Directive 2008/98/EC, Annex II, R1-formula), 30 Nov 2009.

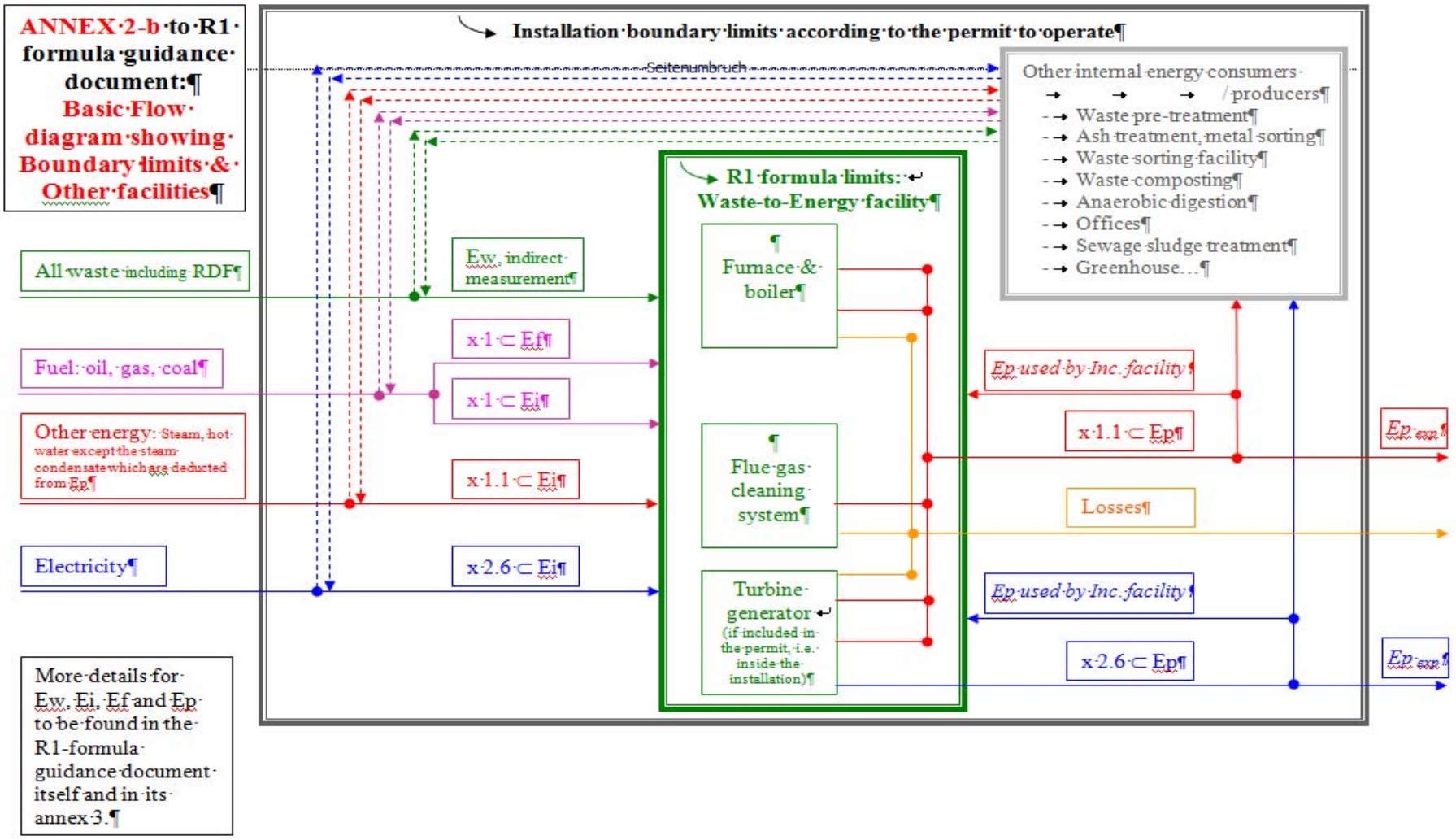

Figure 3: Other internal uses excluded from the R1 system boundary

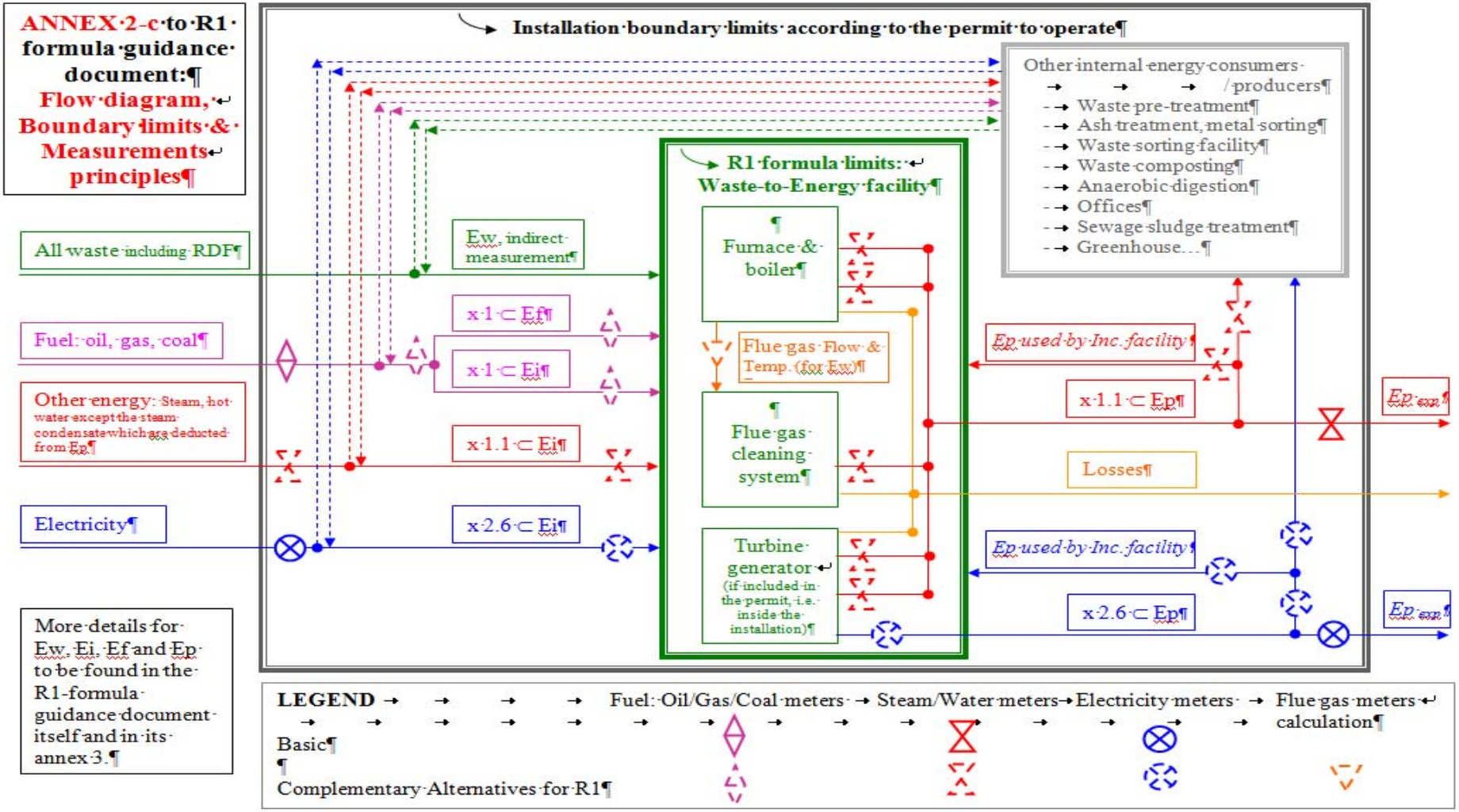

Figure 4: Position of measurement devices to determine energy flows relevant for the R1 calculation

ANNEX 3a: Energy to be counted in E_p, E_f and E_i

E_p	E_f	E_i
• Electricity produced (self use and delivery*) • District heating produced (self use and delivery*) • Process steam produced (self use and delivery*) • Other types of heating (local heat, mobile heat accumulator) • Incineration facility self use as electricity, steam/heat are e.g. - Energy used for evaporation or injection e.g. NH_4OH injection with steam, water for cleaning purpose or waste water from wet scrubbing - Energy used for soot blowers - Steam driven devices such as pumps, compressors, vacuum pumps - Energy used for steam trace heating - Electricity used for all electrical systems (pumps, motors, fans, compressors, trace heating, control systems etc.), buildings and infrastructure (e.g. illumination, air conditioning etc.) - Energy used for re-heating of flue-gas (before catalytic reactor, after scrubber, before fabric filter) - Use of condensing energy from the steam in the flue gas - Heat for concentration process (salt concentration, spray drier) - Energy used for Apparatus, silos and buildings heating incl. warm water feed (administration, social buildings, other constructions)	• Support combustion with fuels for maintaining the minimal temperature/ incineration conditions • Start-up process with fuels starting when the steam generator is connected to the grid (usage of steam) • Shut-down process with fuels until decoupling of the steam generator with the grid (usage of steam)	• Support combustion with fuels in the start-up- and shut-down processes without connection of steam generator with the grid. • Imported energy for re-heating of the flue gases, e.g. with in duct burner (oil, gas) before catalytic reactor (SCR) or scrubber • Import of electricity (e.g. plants without turbine)

* Energy "self use and delivery" means the energy used by the incineration facility and the energy delivered inside the installation to other users as well as the energy delivered outside of the installation.

ANNEX 3b: Relevant BAT to limit self demand and determine export minimums

Extract from***: Integrated Pollution Prevention and Control, Reference Document on the Best Available Techniques for Waste Incineration, August 2006***

Reference: 5.2 Specific BAT for municipal waste incineration

In addition to the generic measures given in Section 5.1, for municipal waste incineration BAT is in general considered to be:

61. the location of new installations so that the use of CHP and/or the heat and/or steam utilisation can be maximised, so as to generally exceed an overall total energy export level of 1.9 MWh/tonne of MSW (ref. Table 3.42), based on an average NCV of 2.9 MWh/tone (ref. Table 2.11) 62. in situations where less than 1.9 MWh/tonne of MSW (based on an average NCV of 2.9 MWh /tonne) can be exported, the greater of:

a. the generation of an annual average of 0.4 – 0.65 MWh electricity/tonne of MSW (based on an average NCV of 2.9 MWh/tonne (ref. Table 2.11) processed (ref. Table 3.40), with additional heat/steam supply as far as practicable in the local circumstances, or

b. the generation of at least the same amount of electricity from the waste as the annual average electricity demand of the entire installation, including (where used) on-site waste pretreatment and on-site residue treatment operations (ref. Table 3.48).

63. to reduce average installation electrical demand (excluding pretreatment or residue treatment) to be generally below 0.15 MWh/tonne of MSW processed (ref. Table 3.47 and section 4.3.6) based on an average NCV of 2.9 MWh/tonne of MSW (ref. Table 2.11).

Reference: 5.3 Specific BAT for pretreated or selected municipal waste incineration

For pre-treated or selected municipal waste (including municipal refuse derived fuels) incineration BAT is in general considered to be:

66. at new and existing installations, the generation of the greater of:

a. an annual average of generally at least 0.6 – 1.0 MWh electricity/tonne of waste (based on an average NCV of 4.2 MWh/tonne), or

b. the annual average electricity demand of the entire installation, including (where used) on-site waste pretreatment and on-site residue treatment operations.

67. the location of new installations so that:

a. as well as the 0.6 – 1.0 MWhe/ tonne of electricity generated, the heat and/or steam can also be utilised for CHP, so that in general an additional thermal export level of 0.5 – 1.25 MWh/tonne of waste (ref. section 3.5.4.3) can be achieved (based on an average NCV of 4.2 MWh/tonne), or

b. where electricity is not generated, a thermal export level of 3 MWh/tonne of waste can be achieved (based on an average NCV of 4.2 MWh/tonne).

68. to reduce installation energy demand and to achieve an average installation electrical demand (excluding pretreatment or residue treatment) to generally below 0.2 MWh/tonne of waste processed (ref. Table 3.47 and section 4.3.6) based on an average NCV of 4.2 MWh/tonne of waste.

ANNEX 4: Determination of the Energy input ($E_w + E_f$) and of NCV

The ratio between the energy output and the energy input is the boiler efficiency and therefore:

$E_w + E_f$ = [(Energy of steam or hot water – Energy of feedwater) / boiler efficiency] – Energy of combustion air,

Physical quantities required and related instruments:

- Steam or hot water flow and enthalpy (Flow meter, Pressure, Temperature) at boiler outlet (usual location; can be adapted if more favourable location elsewhere).

- Steam flows and enthalpy (F, P, T) extracted before the main steam flow meter if any, e.g. from the drum if the unit consuming it is external to the 'calorimetric system' boundary limits and if these flows cannot be calculated from design data parameters or lump sum values be agreed.

- Feedwater flow and enthalpy (Flowmeter if flow not calculated, Temperature), usually at economizer inlet.

- Sensible heat of primary and secondary combustion air. This can be taken from the Acceptance Test or a lump sum value agreed, typically 7 to 8% of ($E_w + E_f$) if primary and secondary air is pre-heated and 5 % if only primary air is pre-heated. If not possible: Flow meter, Temperature after pre-heating.

Physical quantities measurement:

- The physical quantities which are not re-calculated from other data nor taken as lump sum values are usually measured continuously.

- The corresponding energy flows can be calculated continuously by local counters or the plant CS (Control System) and averaged over the period of testing.

ANNEX 5: Example and calculation form for the determination of the R1 energy efficiency factor

			Reporting year		
	Type of energy	**unit**	**amount [Mg(tonne)]**	**NCV [kJ/kg]**	**energy E_x [MWh]**
1.1	amount of incinerated waste (without 1.2 and 1.3)		701,182	10,264	1,999,148
1.2	e.g. amount of incinerated sewage sludge		0		0
1.3	e.g. amount used activated carbon incinerated		0		0
1	**E_w: energy input to the system by waste**	**MWh**			**1,999,148**
2.1	$E_{f\,1}$: amount of light fuel oil for start up (after connection with the steam grid)	litre	335,834	42,000	3,370
2.2	$E_{f\,2}$: amount of light fuel oil for keeping the incineration temperature	litre	323,193	42,000	3,243
2.3	$E_{f\,3}$: amount of natural gas for start up and keeping incineration temperature	Nm^3			0
2	**S E_f: energy input by imported energy <u>with</u> steam production**	**MWh**			**6.612**
3.1	$E_{i\,1}$: amount of light fuel oil for start up/shut down (no connection with the steam grid)	litre	111,945	42,000	1,123
3.2	Ei 2: e.g. natural gas for heating up of flue gas temperature for SCR and start up/shut down	Nm^3	0		0
3.3	$E_{i\,3}$: imported electricity (multiplied with the equivalence factor 2.6)		0		0
3.4	$E_{i\,4:}$ imported heat (multiplied with the equivalence factor 1.1)		0		0
3	**S E_i: energy input by imported energy <u>without</u> steam production**	**MWh**			**1,123**
4.1	$Ep_{el\ internal\ used}$: electricity produced and internally used for the incineration process	MWh	-		82,807
4.2	$Ep_{el\ exported}$: electricity delivered to a third party	MWh	-		339,982
4	**S $Ep_{el\ produced}$ = $Ep_{el\ internal\ used}$ + $Ep_{el\ exported}$**	**MWh**			**422,789**
5.1	$Ep_{heat\ exp.1}$: steam delivered to a third party without backflow as condensate		11,750	3,023	9,867
5.2	$Ep_{heat\ exp.2}$: district heat delivered to a third party with backflow as condensate (hot water)				71,445
5	**S $Ep_{heat\ exported}$ = $Ep_{heat\ exp.1}$ + $Ep_{heat\ exp.2}$**	**MWh**			**81,312**

			Reporting year		
	Type of energy	**unit**	**amount [Mg(tonne)]**	**NCV [kJ/kg]**	**energy E_x [MWh]**
6.1	$Ep_{heat\ int.used1}$: for steam driven turbo pumps for boiler water, backflow as steam		42,831	397	4,723
6.2	$Ep_{heat\ int.used2}$: for heating up of flue gas with steam, backflow as condensate		120,404	2,225	74,416
6.3	$Ep_{heat\ int.used4}$: for concentration of liquid APC residues with steam, backflow as condensate		23,863	2,730	18,097
6.4	$Ep_{heat\ int.used5}$: for soot blowing without backflow as steam or condensate		38,026	2,918	30,822
6.5	$Ep_{heat\ int.used7}$: for heating purposes of buildings/instruments/silos, backflow as condensate		23,638	2,490	16,351
6.6	$Ep_{heat\ int.used8}$: for deaeration- demineralization with condensate as boiler water input		21,972	2,699	16,475
6.7	$Ep_{heat\ int.used9}$: for NH_4OH (water) injection without backflow as steam or condensate		10,517	2,918	8,525
6	**$S\ Ep_{heat\ int.used} = S\ Ep_{heat\ int.used1-9}$**	**MWh**			**169,409**
	R1 = (Ep - (Ef + Ei)) / (0.97 * (Ew + Ef))	**[-]**			
	$Ep = 2.6*(S\ Ep_{el\ int.used} + S\ Ep_{el\ exported}) + 1.1*(S\ Ep_{heat\ int.used} + S\ Ep_{heat\ exported})$	**MWh**	**1,375,044.5**		
	R1=((2.6*(422,789)+1.1*(250,721))-(6,612+1,123))/(0.97*(1,999,148+6,612)		**0.703**		

Remarks:

to 2.1 Amount of light fuel oil (ρ_{lfoil} = 0,86 kg/litre) during start up/shut down with steam production, determined from the light fuel oil demand during the relevant time period: connected to the steam grid but yet without release of waste into the furnace.
to 2.2 Amount of light fuel oil (ρ_{lfoil} = 0,86 kg/litre) with steam production, during the relevant time period: keeping incineration temperature.
to 3.1 Determined as difference out of total light fuel oil demand minus demand by 2.1 and 2.2.
to 5.1 In this example there is no backflow of condensate, therefore difference of enthalpy equal to the enthalpy of middle pressure (mp) steam (advice: in case of backflow of condensate Dc is the difference out of enthalpy from delivered steam minus enthalpy of condensate).
to 5.2 Amount of district heat determined from the quantity of transported hot water (deviation concerning the steam quantity about 3%).
to 6.1 Steam driven turbo pumps for boiler water using high pressure (hp) steam, decompressing to low pressure (lp) steam; Δc = 397 kJ/kg.

to 6.2 Heat exchangers for heating up flue gas are operated with middle (mp) pressure steam (13 bar). Depending on the fouling of the heat exchangers and throughput, so that the steam pressure is in the range of 9-12 bar. Only the difference of enthalpy, that means the enthalpy of mp steam (as average 10 bar) with backflow of the condensate into the condensate collecting tank (3.2 bar) and therefore on energy losses are taken into account (in the condensate collecting tank decompression to lp steam, which goes into the lp steam net).

to 6.3 Liquid APC residues are treated with mp steam, condensate at 70°C flows back into the boiler (feed) water tank.

to 6.4 Hp steam used for soot blowing with an energy demand of $\Delta c = 3{,}211 - 293 = 2{,}918$ kJ/kg. Amount of energy used for soot blowing taking part in the hp steam production was neglected.

to 6.5 Heating of buildings e.g. administration, boiler houses and other sectors of the WtE plant as well as preparation of warm water for sanitary demand is processed by heat exchangers with lp steam. Backflow of condensate at about 70°C.

to 6.6 Temperature of fresh water from the demineralization installation about 20°C. This energy shall only be considered, if it does not increase directly or indirectly the temperature of the feed water, used for energy generation (for details see chapter 3.2.1 of this Guidelines).

to 6.7 NH_4OH injection with hp steam.

(Source: Based on Draft Guidance for the determination of the energy efficiency factor R1 (Waste Framework Directive 2000/98/EC, Annex II, R1-formula elaborated by ITAD in coordination with the German Environment Ministry and the Environment Agency, May 2009).