

APP/SMO/1

BILSTHORPE ENERGY CENTRE

**PUBLIC INQUIRY UNDER SECTION 77 OF THE TOWN AND COUNTRY
PLANNING ACT 1990 (AS AMENDED) INTO THE PROPOSED
DEVELOPMENT OF AN ENERGY FROM WASTE FACILITY ON LAND AT
BILSTHORPE BUSINESS PARK, BILSTHORPE, NOTTINGHAMSHIRE**

PINS REFERENCE: APP/L3055/V/14/3007886

LPA REFERENCE: ES/2950

**Proof of Evidence of Stephen Othen
On
Air Quality and R1 Recovery Status**

November 2015

TABLE OF CONTENTS

TABLE OF CONTENTS	II
APPENDICES (BOUND SEPARATELY).....	III
1 Introduction	1
1.1 Background	1
1.2 Scope of Evidence	1
2 Recovery Definition.....	3
2.1 Introduction.....	3
2.2 The Formula and EU Guidance	5
2.3 Status at the time of the planning application	6
2.4 Current Status	7
2.5 UKWIN's comments on R1 status.....	8
3 Air Quality and Health Impact.....	13
3.1 Introduction.....	13
3.2 Air Quality Assessment	13
3.3 IAQM Guidance.....	14
3.4 Human Health Risk Assessment	16
4 Response to Dr Chow	19
4.1 Introduction.....	19
4.2 Applicability of Public Health England statement.....	19
4.3 Water emissions from the cleaning of syngas	20
4.4 Micro-particles from slag processing.....	20
5 Response to Third Parties	22
5.1 Introduction.....	22
5.2 UKWIN – Main Submission (CD IP1).....	22
5.3 UKWIN – Lock Street (IP12)	27
5.4 RAGE	27
5.5 Other parties.....	27
6 Conclusions	29

APPENDICES (BOUND SEPARATELY)

APP/SMO/2A	Sensitivity Calculations for R1 Formula
APP/SMO/2B	Environment Agency - Qualifying for R1 status using the R1 energy efficiency formula.
APP/SMO/2C	Commission Guidelines on the Interpretation of the R1 formula (extract)
APP/SMO/2D	Industrial Emissions Directive (extract, Article 42)
APP/SMO/2E	"Land-Use Planning & Development Control: Planning for Air Quality", IAQM, May 2015 (extract)
APP/SMO/2F	HPA Press Release, 24 January 2012
APP/SMO/2G	Using metal ratios to detect emissions from municipal waste incinerators in ambient air pollution data", Font, A. et al, Atmospheric Environment 113 (2015) 177-186.
APP/SMO/2H	Long term plant biomonitoring in the vicinity of waste incinerators in The Netherlands", van Dijk, A, van Doorn, W and van Alfen, B. Chemosphere 122 (2015) 45-51

1 Introduction

1.1 Background

1.1.1 I am the Technical Director of Fichtner Consulting Engineers Ltd. I hold a Master of Engineering degree in Chemical Engineering from the University of Cambridge and I am a Chartered Chemical Engineer and Member of the Institute of Chemical Engineers.

1.1.2 Fichtner Consulting Engineers Ltd is an engineering consultancy working mainly in the fields of waste management and renewable energy. We predominantly provide services to waste management operating and development companies and to banks and other financing bodies.

1.1.3 I have worked at Fichtner Consulting Engineers Ltd since 1998 and I have worked for a variety of clients in a number of industries, but my main focus has been the waste industry. I have provided services for all of the major energy-from-waste plant operators and developers in the UK, including Urbaser, Veolia, SITA, FCC Environmental (previously Waste Recycling Group), Amey Cespa and Viridor. These services have included reviews of operation and development of upgrade and improvement programmes. I have also been responsible for the preparation of permit applications under the Integrated Pollution Control, Integrated Pollution Prevention and Control and Environmental Permitting regimes for over thirty combustion plants processing municipal waste, refuse-derived fuel or biomass.

1.1.4 I am a member of the Environmental Services Association Renewable Energy Working Group. In this role, I was involved in discussions with the Environment Agency on the implementation of the R1 Recovery formula in the UK and the Environment Agency's intended regulatory role.

1.1.5 I have been working on the BEC proposal specifically since early 2013.

1.2 Scope of Evidence

1.2.1 My evidence addresses the following points raised by the Inspector in the pre-Inquiry meeting:

- a) "whether the facility would comprises a waste disposal or recovery operation"; and
- b) "source emissions".

1.2.2 My evidence is also provided to respond to a number of concerns raised by Dr Chow relating to health impacts, and a number of points raised by interested parties, where these are not covered by the main matters above.

- 1.2.3 I have also included eight Appendices, which include sensitivity calculations for the R1 Recovery Formula and extracts from a number of documents to which I refer.
- 1.2.4 The evidence which I have prepared and provide for this Appeal Inquiry is true and has been prepared and is given consistent with my professional standing and reputation. I can confirm that the opinions expressed are my true and professional opinions.

2 Recovery Definition

2.1 Introduction

2.1.1 In this section of my evidence, I have explained why the BEC will be a Recovery Operation under the Waste Framework Directive.

2.1.2 Under the 2006 Waste Framework Directive (2006/12/EC), which was a codified version of the original Directive on Waste (75/442/EEC) as amended:

- a) “Disposal” was defined in Article 1(e) as “any of the operations provided for in Annex II A”;
- b) “Recovery” was defined in Article 1(f) as “any of the operations provided for in Annex II B”;
- c) Annex II A included Disposal Operation D10 – Incineration on Land; and
- d) Annex II B included Recovery Operation R1 – Use principally as a fuel or other means to generate energy.

2.1.3 The interpretation of these definitions in various European Court rulings (which related to the transport of waste across borders) led to the position that the incineration of waste in an incineration plant was defined as “disposal”, even if the energy was recovered efficiently, whereas the combustion of waste in a cement kiln, for example, was defined as “recovery”.

2.1.4 The revised Waste Framework Directive (2008/98/EC) (the rWFD, CD48) includes definitions which clarify the position. It is clear from preamble (20) to the rWFD that this was the intention. Preamble (20) states “This Directive should also clarify when the incineration of municipal solid waste is energy-efficient and may be considered a recovery operation.”¹

2.1.5 Hence, under the rWFD:

- a) Article 3(15) defines “Recovery” as “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. Annex II sets out a non-exhaustive list of recovery operations”;

¹ The definition of municipal waste in this context is broad, encompassing household waste and also commercial and industrial waste which is similar to household waste. I note, in passing, that UKWIN makes this point in paragraphs 14 to 15 of CD IP1.

- b) Article 3(19) defines “Disposal” as “any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy. Annex I sets out a non-exhaustive list of disposal operations”;
- c) Annex I includes Disposal Operation D10 –Incineration on Land, which is identical to the definition in the 2006 Directive; and
- d) Annex II includes Recovery Operation R1 - Use principally as a fuel or other means to generate energy, which is superficially identical to the definition in the 2006 Directive. However, the rWFD includes a footnote to R1, which states:

“This includes incineration facilities dedicated to the processing of municipal solid waste only where their energy efficiency is equal 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:

$$\text{Energy efficiency} = (E_p - (E_f + E_i)) / (0,97 \times (E_w + E_f))$$

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.

This formula shall be applied in accordance with the reference document on Best Available Techniques for waste incineration.”

- 2.1.6 The interpretation of this formula was not clear. Therefore, the European Commission has published “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”. (APP/SMO/2C). I have considered this guidance below.
- 2.1.7 The Guidelines specifically state that “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).” This point is worth emphasising. The target is not that an energy from waste plant should have an efficiency of 65%, but that the result of the R1 Formula should be at least 0.65.

2.1.8 The Environment Agency is the responsible authority for determining whether a plant meets the definition of R1 Recovery. The Environment Agency published a briefing note (CD NCC5) on “How incinerators can be classed as energy recovery”. The latest version of this note was published in September 2014 as version 3. Version 2 of the note (APP/SMO/2B), entitled “Qualifying for R1 status using the R1 energy efficiency formula”, was published in April 2012 and was in force at the time of the planning application.

2.2 The Formula and EU Guidance

2.2.1 The footnote to the R1 definition states that the formula applies to “incineration facilities dedicated to the processing of municipal solid waste.” Section 1.1 of the Commission Guidelines (APP/SMO/2C) is concerned with the scope of the formula, and it states that

“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.”

2.2.2 Later in this section, it is stated that

“In practice, the waste input into a MSWI (an incineration facility dedicated to the processing of municipal solid waste) 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.”

2.2.3 Hence, it can be seen that the R1 Formula is applicable to the BEC, in terms of the types of waste being fed. It is also generally accepted that advanced conversion technologies (pyrolysis and gasification) are treated as incineration plants for the purposes of European Directives. This is made most clear in article 42 of the Industrial Emissions Directive (Directive 2010/75/EU) (APP/SMO/2D).

2.3 Status at the time of the planning application

2.3.1 As I have mentioned already, version 2 of the EA's guidance note was in force at the time of the planning application. I have quoted a number of points from the briefing note below:

- a) *"There is no requirement for MWI to achieve R1 status or have their performance assessed against the R1 formula in the Environmental Permitting Regulations 2010 (EPR)".* This confirms that R1 status is not obligatory in relation to MWI facilities.
- b) *"The European Commission's guidelines provide detailed guidance on how to interpret and apply the R1 Energy Efficiency formula".* This confirms that the Commission's Guidelines, discussed above, are the correct basis for interpreting the R1 Energy Efficiency Formula.
- c) *"Those plants wishing to qualify as recovery operations by virtue of the R1 formula need to make an application to the Environment Agency."* The different times at which an application could be made are explained in Table 1 in the briefing note, which shows that the plant could apply for provisional R1 status prior to building the plant and on the basis of commissioning data, but that the plant would only receive final confirmation of R1 status after the plant has been operating for at least one year and this will need to be confirmed each year.
- d) *"The application forms are available from the Waste Incineration Sector page on our website."* At this time, the application forms consisted of a spreadsheet for calculating the R1 formula and this spreadsheet had to be used.

2.3.2 Hence, there was an application route in place at the time of the planning application. However, this required the use of a spreadsheet which only worked for incineration plants which incorporated a steam cycle to generate power. Since the BEC uses gas engines, the spreadsheet could not be used. In addition, as explained in paragraph 3.2.2 of the first Regulation 22 submission dated July 2014 (CD6), an application to the EA would need to be supported by detailed design information which was not available at the time.

2.3.3 Therefore, the Applicant proposed, and the waste planning authority accepted, that a planning condition could be imposed to require the Applicant to obtain provisional R1 status prior to starting operations. This was supported by the R1 formula calculation included in the planning application, which was based on the basic specification of the plant and showed a value in excess of 0.65. The effect of the planning condition was that it was the Applicant's responsibility to obtain design R1 status and that the planning consent had no value until this has been obtained, which I consider provided sufficient reassurance.

2.4 Current Status

2.4.1 I still consider that it should not be necessary for a developer to obtain design R1 status before applying for planning consent, and that a planning condition provides sufficient reassurance. However, the Applicant recognises that this issue has been raised by a number of objectors to the scheme and that the Inspector wishes to be further informed on the matter.

2.4.2 In addition, the EA has published version 3 of their guidance (NCC5), referred to in paragraph 2.1.8 above, which indicates that it would be possible to apply for design R1 status without using the spreadsheet. The new guidance states:

- a) *“Apply using the R1 spreadsheet. If it's difficult to apply this to your process, then contact us for advice by emailing psc@environment-agency.gov.uk. You will need to support all claims in the spreadsheet with succinct evidence.”*
- b) *“We will consider an application at any point from when the plant design is settled. This could be before planning permission is sought. If you obtain the R1 decision from us as early as possible planners and the public will be able to see that it's a genuine accredited energy recovery activity. We do not need an EPR application at the same time.”*

Given the new guidance, and after an informal discussion with the Environment Agency earlier this year to establish how the R1 formula could be applied to a plasma gasification plant producing syngas for a gas engine and to establish the level of evidence required, I worked with Amec Foster Wheeler's engineers, who are providing engineering services to Waste2tricity, to enable them to produce the necessary evidence. This included process flow diagrams with an accompanying mass balance. Waste2tricity also identified the intended supplier of the gas engines and secured a clear statement on the efficiency of the gas engines.

2.4.3 With this new information, I prepared an application for R1 status and submitted this to the Environment Agency, on behalf of the Applicant, on 21 August 2015. The application is included in the third Regulation 22 submission (CD75) and the final R1 value is 0.6756. This is shown as Case 1 in Appendix APP/SMO/2A.

2.4.4 I wish to note a few features of the R1 application.

- a) A design stage application has to be based on a single design point, rather than a range. The selected design point is for a waste with a net calorific value of 12.581 MJ/kg, because the design is based on tests run with a specific waste. I have considered the effect of operations with different types of waste below.
- b) As part of the design development process, a specific gas engine was selected², which means that the overall efficiency of the plant has improved. At the design point, the plant is expected to generate 13.77 MW of power from energy inputs of 43.684 MW in the waste and 4.143 MW of coke, giving a gross efficiency of 28.8%. With a parasitic load of 4 MW, the net efficiency is 20.44%.
- c) The application is based on the generation of power only. If heat were exported, the R1 value would increase. I have considered the situation if 4 MW of heat were to be exported and the R1 value increases to 0.702. This is Case 2 in Appendix APP/SMO/2A.

2.5 UKWIN's comments on R1 status

2.5.1 UKWIN mentions in its submissions to the Inquiry that it considers that the BEC is a disposal operation. I feel it is most convenient to address their points at this point in my proof. I am responding, unless otherwise stated, to points made in their statement to the Inquiry dated 24 February 2015 (CD IP2).

2.5.2 Paragraphs 5-19 focus on the need for an R1 certificate to demonstrate that the BEC is a recovery facility. While I do not agree that it is necessary to do this at this stage, it may become necessary at a later stage.

2.5.3 Paragraphs 20-23 cover the applicant's suggestion that it would be possible for a gasification plant to be classified as a recovery plant if the syngas is demonstrated to have passed the "end of waste" test and become a product. Under these circumstances, a gasification plant would be a recovery operation by definition, as it would have recovered waste into a product. The subsequent combustion of the syngas would be a combustion operation. UKWIN doubts whether this was discussed with the EA; I can confirm that I discussed this with the EA personally, although I do not have documentary proof of the conversation. However, this is not relevant to this Inquiry as the applicant is not claiming that the BEC is a recovery operation on this basis.

² A Caterpillar G3520C, as referenced in Appendix C to the R1 application in CD75.

2.5.4 In paragraphs 30- 44, UKWIN suggests and attempts to justify that the BEC can only be treated as recovery if (a) it has a design stage R1 certificate before being granted planning consent and (b) the Inspector is convinced “beyond reasonable doubt that the facility would actually operate as a recovery operation throughout the facility’s operational life.” I have already stated above that I do not accept (a). I also do not accept the level of proof suggested as (b), but I have explained below why the Inspector should be confident that the facility is likely to operate as a recovery operation.

2.5.5 At paragraph 40, UKWIN states six reasons why it considers that the claim should be rejected, although the last two were really aspects of the same reason. I have addressed each below.

The applicant’s proposal only just exceeds the threshold

2.5.6 The R1 application shows that the R1 value is 0.6756, which is about 4% over the threshold. However, this is on the basis of electricity-only operation, so there is the prospect of an increase. In any event, the threshold is exactly that, a threshold, and so it is not reasonable to set, in effect, a higher threshold for planning purposes.

No evidence of sensitivity analysis

2.5.7 I am not clear which assumptions UKWIN considers should be subject to a sensitivity analysis. I have addressed the most likely sensitivity, waste composition, below. I also note that UKWIN has included some evidence from the Battlefield inquiry in which Veolia included an R1 calculation for a sensitivity case of 97% of normal performance and 80% of standard waste throughput. Therefore, I have carried out a similar sensitivity analysis.

- a) At 97% of normal performance (i.e. a reduction in electricity generation to 13.36 MWe), the R1 value is 0.65242 (Case 3 in Appendix APP/SMO/2A),
- b) A sensitivity at 80% of normal waste throughput is a little more complicated. If less waste is loaded into the plant, then less syngas will be produced. In addition, less coke will be required in the gasifier, but this will not necessarily be reduced in proportion as one of the purposes of the coke is to provide a bed structure. The efficiency of the gas engines will be unaffected, although it is possible that fewer gas engines will run.

Given this, I have considered two cases. In the first, the coke is reduced in proportion to the reduction in waste flow. The R1 value in this case is barely changed at 0.674 (Case 4). In the second, the coke throughput is reduced to 93.7%, which means that it is reduced by a third as much as the waste is reduced. In this case, the R1 value is 0.660 (Case 5).

2.5.8 I note, although UKWIN doesn't, that Staffordshire Friends of the Earth appears to have taken a similar line of argument at the Battlefield inquiry to the line of argument that UKWIN is taking here, and that the inspector at the Battlefield inquiry rejected that line of argument.

No track record

2.5.9 This objection is clearly unreasonable, as it means that a new technology could never be defined as recovery before construction and so would always be treated as disposal. This conflicts with paragraph 4 of the National Planning Policy for Waste, which states (in part):

“Waste planning authorities should identify, in their Local Plans, sites and/or areas for new or enhanced waste management facilities in appropriate locations. In preparing their plans, waste planning authorities should:

- identify the broad type or types of waste management facility that would be appropriately located on the allocated site or in the allocated area in line with the waste hierarchy, taking care to avoid stifling innovation....”.*

Assumptions have not been made public and so cannot be scrutinised

2.5.10 The design stage R1 calculation for the BEC is based on the conversion rate of waste to syngas, which is based on operational performance, and the conversion rate of syngas to electricity, which is confirmed by the gas engine manufacturer. The basis for this calculation is set out in the design stage application to the EA, so that it can be scrutinised by the relevant authority. It would not be appropriate to expect the planning authorities, including the Inspector or the Secretary of State, to duplicate or supersede the role of the EA. This is why the applicant proposed a planning condition requiring a design stage R1 certificate to be secured from the EA.

Concerns over feedstock composition assumptions

2.5.11 UKWIN appears to consider that the efficiency of an energy recovery plant depends on the composition of the waste which it processes. This is incorrect for a conventional combustion plant and is not that significant for a plasma gasification plant.

- 2.5.12 In a conventional plant, the driver for capacity is the thermal release in the boiler. If there is more energy per tonne of waste (i.e. if the calorific value of the waste is higher) then the plant simply burns less waste to achieve the same thermal release, and vice versa. The efficiency, and hence the R1 value, is unaffected.
- 2.5.13 For the plasma gasification technology to be used at the BEC, the situation is a little more complex. While the composition of waste is variable, it can effectively be thought of as a mixture of three things – ash, moisture and volatile materials. The volatile materials can be biogenic or non-biogenic but, in both cases, the main components are carbon, hydrogen and oxygen. A waste with a higher calorific value has less ash and/or moisture than a waste with lower calorific value.
- 2.5.14 The syngas is formed from the volatile material in the waste and the moisture; the incombustible material (ash) leaves from the bottom of the chamber as a slag. In the BEC, the moisture in the syngas is condensed out in the treatment stage, leaving a relatively dry syngas which consists mainly of carbon monoxide, carbon dioxide and hydrogen.
- 2.5.15 The limitation on gasifier capacity is the volumetric flowrate of syngas out of the gasifier. This means that the amount of incombustible material in the waste is relatively unimportant, but the moisture content does matter. If there is more moisture in the waste, then this takes up some of the volumetric capacity, leaving less capacity for the rest of the syngas. This means that a lower calorific value waste produces less syngas, which can mean that less power is generated. This in itself does not reduce the efficiency of the plant, as there was less energy in the waste anyway, but it might mean that more energy needs to be provided by coke and the plasma torches. This would not affect the efficiency of the plant, as the additional coke would lead to the production of additional syngas, but it could reduce the R1 efficiency.
- 2.5.16 The design case R1 calculation, as I mentioned earlier, is based on waste with a net calorific value of 12.581 MJ/kg. This is lower than the calorific value of the waste envisaged in the Heat Plan (included in Part 6 of the Planning Application documents, CD1) of 14.46 MJ/kg. If the plant received waste with this higher calorific value, the effect would be that less coke is required and more syngas could be produced, per tonne of waste. I have considered this case and the R1 value is 0.694 (Case 6). I have also considered a case with waste with a lower net calorific value of 10.5 MJ/kg (which I consider to be a reasonable minimum figure for the calorific value of RDF), but with waste throughput limited to 95,000 tonnes per year. This gives an R1 value of 0.661. (Case 7).

Summary

2.5.17 I have run a number of sensitivities and demonstrated that the R1 value remains above 0.65 in all cases. I consider that this demonstrates that the Inspector can conclude that the BEC is a recovery plant.

3 Air Quality and Health Impact

3.1 Introduction

3.1.1 The Inspector has asked to be informed about “source emissions”, which I consider to be referring, primarily, to emissions to atmosphere. However, it is important to note that none of the statutory authorities have raised concerns about the actual impact of the Appeal Proposal on air quality or health.

3.1.2 In this section, I have:

- a) Summarised the approach taken in the air quality assessment in chapter 12 of the Environmental Statement (CD2); and
- b) Identified that new guidance has been published by the Institute of Air Quality Management (IAQM) and considered whether the conclusions of the air quality assessment change as a result of this new guidance.

3.1.3 I have not responded to Dr Chow’s comments in this section; this is covered later in section 4 of my proof.

3.2 Air Quality Assessment

3.2.1 The impacts of the Appeal Proposal on local air quality were assessed as part of the Environmental Impact Assessment. Full details can be found in Appendix 12.1 to the Environmental Statement (within CD3).

3.2.2 I and my team used atmospheric dispersion modelling software, ADMS5.0, to model the dispersion of emissions from the exhaust stacks. The model takes account of the impact of buildings and local terrain on air flows across the land and the dispersion of the plume from the Facility. We used five years of weather data to ensure that variability in weather conditions would be fully taken into account.

3.2.3 In order to ensure that our results would be conservative, we assumed that the BEC would operate for the entire year at the maximum levels permitted by the Industrial Emissions Directive (IED). In reality, the BEC would be taken offline for an annual maintenance shutdown and it is expected to operate well below the emission limits for most of the time.

3.2.4 The results of the modelling are summarised in Table 12.15 and paragraph 12.4.21 of the ES, which states:

“As set out in Table 12.15, the additional contribution from the proposed BEC development would not cause an exceedance of any AQO / EAL. For most pollutants the impact can be screened out as insignificant. Where impacts cannot be screened out as ‘insignificant’, when the PEC (Predicted Environmental Concentration) is considered the significance of effect is considered negligible.”

3.2.5 We also assessed the impact on local sensitive habitats, including the Birklands and Bilhaugh Special Area of Conservation (SAC). This assessment can be found in sections 9.4 and 10 of Appendix 12-1 to the ES and took account of atmospheric concentrations and deposition of pollutants. We determined that the emissions would be unlikely to have a significant effect at any of the sites. The assessment at the SAC was repeated when the Nottinghamshire Wildlife Trust explained that lichens had been found in the SAC. The revised assessment can be found in Appendix 10-4 to the first Regulation 22 submission (CD6). The conclusion was unchanged.

3.2.6 Finally, we provided information on the impact on local wildlife sites, as reported in Appendix 2-2 to the second Regulation 22 submission (CD7), so that Argos Ecology could assess the effect on these sites. This assessment did not indicate any additional vulnerabilities to air quality impacts which had not already been considered.

3.3 IAQM Guidance

3.3.1 The assessment criteria in the air quality assessment were taken from the Environmental Protection UK 2010 publication “Development Control: Planning for Air Quality.” In May 2015 the Institute of Air Quality Management (IAQM) launched their guidance document “Land-Use Planning & Development Control: Planning for Air Quality” (APP/SMO/2E). This is an update to the EPUK guidance and would be used if the application were made now. Therefore, I have re-evaluated the impact of emissions on local air quality using this new guidance.

3.3.2 The IAQM 2015 guidance sets out the following two stage approach for assessing the impact of a development:

- a) a qualitative or quantitative description of the impacts on local air quality arising from the development; and
- b) a judgement on the overall significance of the effects of any impacts.

3.3.3 A matrix is provided (Table 6.3 in the IAQM Guidance) which should be used to describe the impact based on the change in concentration relative to the Air Quality Assessment Level (AQAL) – in this case the Air Quality Objective (AQO) or Environmental Assessment Level (EAL) - and the overall predicted concentration with the scheme – i.e. the future baseline concentration plus the process contribution. This matrix is provided in the following table.

Table 1: IAQM Magnitude of Change Descriptors

Long term average concentration at receptor in assessment year	% change in concentration relative to Air Quality Assessment Level (AQO/EAL)			
	1	2-5	6-10	>10
75% or less of AQO/EAL	Negligible	Negligible	Slight	Moderate
76-94% of AQO/EAL	Negligible	Slight	Moderate	Moderate
95-102% of AQO/EAL	Slight	Moderate	Moderate	Substantial
103-109% of AQO/EAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQO/EAL	Moderate	Substantial	Substantial	Substantial

3.3.4 Notes below the table make it clear that it is intended that the change in concentration relative to the AQO/EAL (the process contribution) is rounded to the nearest whole number. Therefore any impact which is between 0.5% and 1.5% will be classified as a 1% change in concentration. The notes also say that any change below 0.5% is treated as a change of 0% and is described as negligible irrespective of background concentrations. This is an important change from the 2010 Guidance, under which a change below 1% was described as negligible.

3.3.5 The matrix above is only designed to be used with annual mean concentrations. For short term concentrations (i.e. those averaged over a period of an hour or less) the following descriptors of change should be used to describe the impact:

- a) < 10% of AQO/EAL - negligible;
- b) 10 – 20% of AQO/EAL - slight;
- c) 20 – 50% of AQO/EAL - moderate; and
- d) > 50% of AQO/EAL - substantial.

3.3.6 I have reviewed the background concentrations and process contributions from Table 9.1 in Appendix 12-1 to the Environmental Statement and compared these against the new guidance.

- a) All short term contributions are less than 10% and so can be described as negligible.

- b) The long term process contribution of nitrogen dioxide, cadmium and VOCs are greater than 0.5% but less than 5.5%. All other long term process contributions can be described as negligible irrespective of background concentrations.
- c) The background concentration of nitrogen dioxide, cadmium and VOCs are all less than 75% of the relevant AQO. Therefore, the magnitude of change can be described as “negligible”.

3.3.7 Hence, there is no change to the conclusions of the air quality assessment as a result of applying the new 2015 guidance.

3.4 Human Health Risk Assessment

3.4.1 Typically, concern about health effects for EfW plants relates to emissions of persistent pollutants. Heavy metals and dioxins and furans will remain in the environment and have the potential to accumulate in the soil, unlike, for example, nitrogen oxides which do not accumulate but convert to nitrogen in the soil.

3.4.2 Once in the soil the persistent pollutants can be taken into plants through the roots, and then work their way into the food chain through animals and into humans. Humans receive virtually all of their exposure to dioxins through food, as an example. Therefore, we carried out a human health risk assessment, using a methodology developed by the US Environmental Protection Agency. This models all potential exposure routes for dioxins and metals, so that the level of exposure to these substances can be estimated.

3.4.3 The results of this modelling, described in Appendix F to Appendix 12-1 to the ES (CD3), showed that the emissions from the BEC would not have an appreciable health risk.

3.4.4 This conclusion concurs with the view of the Health Protection Agency, now Public Health England. In their September 2009 statement on “The Impact on Health of Emissions to Air from Municipal Waste Incinerators” (KC2), they state:

“The Health Protection Agency has reviewed research undertaken to examine the suggested links between emissions from municipal waste incinerators and effects on health. While it is not possible to rule out adverse health effects from modern, well regulated municipal waste incinerators with complete certainty, any potential damage to the health of those living close-by is likely to be very small, if detectable. This view is based on detailed assessments of the effects of air pollutants on health and on the fact that modern and well managed municipal waste incinerators make only a very small contribution to local concentrations of air pollutants. The Committee on Carcinogenicity of Chemicals in Food, Consumer Products and the Environment has reviewed recent data and has concluded that there is no need to change its previous advice, namely that any potential risk of cancer due to residency near to municipal waste incinerators is exceedingly low and probably not measurable by the most modern techniques. Since any possible health effects are likely to be very small, if detectable, studies of public health around modern, well managed municipal waste incinerators are not recommended.”

- 3.4.5 In January 2012, the HPA announced that further research had been commissioned into the “potential link between the emissions from municipal waste incinerators and health outcomes”. When announcing this research, the HPA issued a press release (APP/SMO/2F), which included the following statement.

“It is important to stress that our current position on the potential health effects of well run and regulated modern Municipal Waste Incinerators remains valid. This is that while it is not possible to rule out adverse health effects from modern, well regulated municipal waste incinerators with complete certainty, any potential damage to the health of those living close-by is likely to be very small, if detectable. This view is based on detailed assessments of the effects of air pollutants on health and on the fact that modern and well managed municipal waste incinerators make only a very small contribution to local concentrations of air pollutants.”

“However, we recognise that there are public concerns about this issue and this study will provide valuable new evidence. HPA continually seeks to review and extend the evidence base on which it bases its advice. We are therefore delighted to support this new study with researchers from the MRC-HPA Centre for Environment and Health.”

3.4.6 The first results of the HPA/PHE studies are now beginning to be published. A paper was published in July 2015³ on emissions of metals from incinerators (APP/SMO/2G). The authors, from Imperial College London, Kings College London and the National Physics Laboratory, used stack emission samples of heavy metals from six municipal waste incinerators, all of which are located within 10 km of established monitoring sites for heavy metals. The ratios of metal concentrations in the emissions and at the monitoring sites were compared to see whether metal emissions from the incinerators could be detected. The authors concluded:

“From our analysis we found no evidence of incinerator emissions in ambient metal concentrations around four UK MWIs. The six UK MWIs studied contributed little to ambient PM10 concentrations.”

3.4.7 I would also like to mention a study carried out in Holland and published in March 2015⁴ (APP/SMO/2H). The authors of this paper carried out biomonitoring between 2004 and 2013 around three waste incineration plants in Holland. All three plants operate to the most recent standards. The authors planted spinach and kale downwind of each plant and in three other directions, as well as in a control location some 10 km away. Concentrations of cadmium, mercury and PAHs were monitored in these crops. In addition, cow milk from farms in the vicinity of the incinerators was sampled for dioxins and furans and compared with cow milk from further away. The conclusion was:

“The results showed that the emissions did not affect the quality of crops and cow milk. Concentrations of heavy metals, PAHs and dioxins/PCBs were generally similar to background levels and did not exceed standards for maximum allowable concentrations in foodstuffs (e.g. vegetables and cow milk).”

3.4.8 These papers confirm that there is no reason to move away from the HPA’s position.

³ “Using metal ratios to detect emissions from municipal waste incinerators in ambient air pollution data”, Font, A. et al, Atmospheric Environment 113 (2015) 177-186.

⁴ “Long term plant biomonitoring in the vicinity of waste incinerators in The Netherlands”, van Dijk, A, van Doorn, W and van Alfen, B. Chemosphere 122 (2015) 45-51.

4 Response to Dr Chow

4.1 Introduction

4.1.1 In this section of my proof, I have responded to three points made by Dr Chow:

- a) That the statement by Public Health England on incineration plants is not applicable to the BEC;
- b) That there is a health risk from water emissions from the cleaning of syngas; and
- c) That there is a health risk from the release of micro-particles from slag processing.

4.1.2 I note that the Inspector stated, in her notes on the Pre-Inquiry meeting, that *“parties should note that health can only be considered in the context set by paragraph 7 bullet 5 of the National Planning Policy for Waste.”* This states that:

“When determining waste planning applications, waste planning authorities should... concern themselves with implementing the planning strategy in the Local Plan and not with the control of processes which are a matter for the pollution control authorities. Waste planning authorities should work on the assumption that the relevant pollution control regime will be properly applied and enforced.”

4.1.3 Therefore, I have not covered any other more general points made by Dr Chow.

4.2 Applicability of Public Health England statement

4.2.1 In section 4.1 of his statement, Dr Chow quotes from the HPA study which I mentioned above (in paragraph 3.4.4) and suggests that this is only applicable to conventional incineration. He describes the BEC as producing “unspecified complex ‘syngas’, which would be ‘cleaned’ by an unproven industrial process”, as well as drawing attention to the release of effluent.

4.2.2 I acknowledge that the HPA study only focuses on emissions to atmosphere (paragraph 5), on the basis that emissions via solid ash residues and cooling water are adequately controlled. However, this is also the case for the BEC as I discuss later in this section. For emissions to air, the BEC would be required to meet the same emission standards as a conventional incineration plant. The syngas which is produced would be fully combusted in the gas engines. This means that the HPA study, which draws on studies into emissions from incinerators, is entirely applicable to the BEC.

4.3 Water emissions from the cleaning of syngas

- 4.3.1 Dr Chow is concerned that the effluent produced by washing the syngas will contain multiple pollutants and that these pollutants would be released into the local aquifer. I do not accept either of these assertions.
- 4.3.2 As stated in paragraph 4.3.41 of the ES (CD2), the main source of effluent from the plant will be the syngas cleaning and cooling processes. The scrubbing system removes soluble contaminants (hydrogen chloride and ammonia) and particulate matter.
- 4.3.3 The effluent would be passed through an effluent treatment plant on site before being discharged to sewer for further treatment in a sewage treatment works off site. The effluent discharged to sewer would need to meet the emission limits required by an effluent treatment consent from Severn Trent Water and the discharge would also be regulated by the Environment Agency under the terms of the Environmental Permit, although the Environment Agency may not choose to set additional emission limits. This means that the effluent would not be released into the local groundwater and Dr Chow's concerns are groundless.
- 4.3.4 Dr Chow appears to be comparing the regulated discharge of a small amount of treated effluent into a regulated sewage treatment system with the discharge of untreated mining waste from a large zinc mine in Japan into a river for over fifty years in the first half of the 20th century, with the river water being used directly for irrigation. This is simply not a reasonable comparison to make.

4.4 Micro-particles from slag processing

- 4.4.1 Dr Chow is concerned about the release of small particles from slag handling. However, I consider that his concerns are unfounded and stem from a misunderstanding of the process. Dr Chow's understanding of the process is best explained in the second paragraph of section 2.2.3 of his Statement of Case (KC1), where he states:

"...pollution from toxic solid pollutant of PM10, PM2.5 and nano particles should be assessed and monitored. This toxic solid pollutant is a likely consequence of sudden quenching of molten 'glass-like slag' in water. The created steam would distribute these particles and can be classed as diffuse emission by the BEC project. Although it is likely to produce vast amounts of steam emission created by 5.5 MW of thermal waste, it has only relatively low cooling towers of 7 meters. This suggests steam related pollution would be extremely local and concentrated onto the site location."

- 4.4.2 This paragraph contains two key misunderstandings. First, the slag handling system does not produce steam. The molten slag leaves the gasifier through a tap hole and then falls down a steel chute. Water is flowing down the chute to quench the slag. The water and slag flow into a quench bath, filled with water and the cooled slag is then removed in a horizontal drag conveyer. Water in the quench bath is removed and cooled in a heat exchanger before being returned to the quench bath and steel chute, and the flow and temperature of the water are designed to avoid the production of steam. All of this equipment is contained within the building so that, even if some steam is formed occasionally, this will not be released to atmosphere.
- 4.4.3 Secondly, the cooling towers are unrelated to the slag quenching – they are used to support the syngas cooling circuit. As described in paragraph 4.3.31 of the ES, the syngas is cooled in the direct contact cooler (DCC). Hot water from the DCC is cooled in a heat exchanger with cooling water. The cooling water is then returned to the cooling towers to be cooled, in its turn, by air in the aforementioned cooling towers. This means that the cooling towers are only cooling water which has had no contact with the syngas or, indeed, the slag.
- 4.4.4 Hence, Dr Chow does not need to be concerned about the release of small particulates from the cooling tower exhaust.

5 Response to Third Parties

5.1 Introduction

5.1.1 In this section, I have responded to concerns raised by UKWIN, RAGE and other interested parties.

5.2 UKWIN – Main Submission (CD IP1)

5.2.1 I have already addressed, in section 2.5, UKWIN's comments on whether the BEC is a recovery facility.

5.2.2 In paragraphs 88ff, UKWIN suggests that the BEC is incompatible with UK waste policy as it is less efficient than conventional incineration. UKWIN effectively suggest, in paragraphs 92-93, that this is true for all gasification/pyrolysis plants and hence all such plants are incompatible with UK waste policy. Given that the government explicitly provides additional support for this type of plant through the Renewables Obligation and the new Contracts for Difference regime, UKWIN have misinterpreted government policy here.

5.2.3 In paragraph 93, UKWIN quotes from page 13 of the DEFRA Waste Technology Brief on Incineration of Municipal Solid Waste, but the quote is incomplete. The full quote is below, with the missing text underlined.

"An Incinerator will typically have a higher net electrical and thermal efficiency than a comparable ATT process that also generates steam for power generation or direct heating. This is mainly due to the energy required to sustain the gasification or pyrolysis process. There is scope however for ATT to use other power generation technologies that could yield greater efficiencies; these are considered in the Advanced Thermal Treatment Brief, in this series of publications."

5.2.4 The underlined section is crucial, since the BEC does not generate steam but, instead, utilises another form of power generation technology, gas engines, which are more efficient than a steam cycle.

5.2.5 In paragraph 96, UKWIN asserts that the applicant has conceded that the BEC would be less efficient than conventional plants. Since the July 2014 Regulation 22 response, the design of the plant has progressed. As I mentioned earlier (paragraph 2.4.4), the net efficiency has increased to 20.44%, compared to the previous figure of 18.78%, which means that the efficiency would clearly be comparable to conventional plants of a similar scale.

- 5.2.6 In paragraphs 103-104, UKWIN suggests that the actual performance of the BEC will be worse than claimed. There are limited details in the statement, but there are more details in UKWIN's original Part 1 objection, which is referenced and which is in CD8. This shows that UKWIN's main concerns in this context are that:
- a) The plant might not work well or at all, using as an example the performance of the Dargavel facility; and
 - b) The performance of the plant will vary because the feedstock varies.
- 5.2.7 Considering the Dargavel plant, it is important to note that it used a very different technology of batch gasification, with the syngas combusted in a secondary combustion chamber and then fed to a steam boiler. While UKWIN quotes an efficiency of 3%, taken from SEPA's status report, it is important to understand that this low figure was mainly due to the plant failing to generate electricity at all for much of the time, even when processing waste. This is not an economically sensible way to run a plant and so it is not surprising that the company running the plant went into receivership. There is a danger that quoting this figure could lead to confusion between two very different issues – whether the plant is efficient when running and whether the plant works at all.
- 5.2.8 The question of feedstock is more complex. I have already addressed this, to an extent, in the discussion on R1 earlier. I would now like to respond to UKWIN's implication that it is necessary to know exactly what the feedstock is before the plant can be granted planning consent and UKWIN's statement, in the sixth bullet of paragraph 40, that the applicant stated that "the feedstock composition assumptions contained within the Regulation 22 responses should not be seen as an accurate reflection of what the applicant actually expects to treat at the facility."
- 5.2.9 First, I would like to outline the sequence of events.
- 5.2.10 The LPA raised a number of questions about the composition of the waste, which were responded to in section 4 and Appendix 4-1 of the first Regulation 22 response (CD 6). The main focus of these questions was the influence of waste composition on the carbon balance, in order to support the assumptions made. Part of the response was a compositional analysis of the feedstock, which I prepared.
- a) I took three sets of composition data for Commercial and Industrial Waste.
 - b) For each set of data, I removed some of the recyclable materials to allow for improved source segregation since the data was collected.

- c) I then modelled the operation of the on-site MRF by removing a fraction of plastic bottles, metals and aggregate materials, leaving a feedstock for the gasifier.
- d) I reported on the carbon and biocarbon content of the remaining waste. One of the questions had asked for evidence that 51.43% of the waste would be carbon and that 55% of that carbon would be from biodegradable sources. The analysis showed that the carbon content was, if anything, higher than 51.43% and that more than 55% of that carbon was derived from biodegradable sources, thus supporting the original assumptions.
- e) Finally, I demonstrated that, in each case, the BEC would have a beneficial impact on carbon dioxide emissions.

5.2.11 UKWIN commented on this analysis in their Part 2 Objection (CD8). I responded to these in section 3 of Appendix 4-1 to the second Regulation 22 submission (CD7). I rejected almost all of the criticisms, but I did accept that I did not allow for the increased source segregation of food waste. I had intended to, but I had removed it for one of the data sets as that was clearly collected after food waste had been removed, and I failed to reinstate it for the other sets. However, the impact of this change was actually marginal. While the biocarbon content dropped a little, while still supporting the original assumption of 55%, the overall carbon benefit actually improved.

5.2.12 UKWIN responded to this further information in their Part 3 objection (CD8). I will cover the substance of these points later, but at this point the relevant assertion is that the feedstock contains a large proportion of WEEE material. I responded to this point at the planning committee, explaining that I had not removed the WEEE material because I was focussing on materials which would actually have an effect on the matter at hand; namely the carbon balance. I stated that *“All three of the compositions used included small fractions of hazardous substances in the residual waste. For analysis purposes, we did not remove these fractions. If we did, the climate change performance of the facility would improve and so it was more conservative to leave them in for analysis purposes.”* I stand by this position, and consider that it does not undermine the analysis in any way. I do not understand how UKWIN can take this statement and turn it into the disparaging comment that *“the feedstock composition assumptions contained within the Regulation 22 responses should not be seen as an accurate reflection of what the applicant actually expects to treat at the facility.”*

- 5.2.13 The remainder of UKWIN's comments on the waste composition analysis in their Part 2 and Part 3 objections are based on two misunderstandings. First, UKWIN failed to understand the purpose of the analysis, which was to provide evidence for the carbon balance. The analysis does this, as well as showing the sensitivity of the analysis to different waste compositions. UKWIN has provided no alternative waste composition data and no alternative analysis; they have merely attempted to make criticisms of the analysis which I carried out. It is noticeable that when I have responded to two of the main criticisms (the need to remove food waste and the simplification in failing to remove WEEE), the effect on the analysis has actually been to improve the performance of the plant.
- 5.2.14 Second, and most importantly, UKWIN fails to understand that a merchant waste gasification plant will, almost by definition, treat a variety of waste and that the developer cannot be expected to predict precisely what the waste will be. The plant will process commercial and industrial waste which has been subject to source segregation and is further subject to onsite materials separation. This ensures that the remaining waste is residual. It is, of course, true that the composition of waste may change in the future. However, if this were a valid reason to refuse planning consent, then it would be impossible to secure planning consent for any merchant facility.
- 5.2.15 Returning to UKWIN's statement to the Inquiry dated 24 February 2015 (CD IP1), in paragraphs 166-185, UKWIN suggests that the weight to be given to the benefits of the plant should be reduced because of the uncertainty around the performance. While UKWIN claim that they are not saying that an experimental or new technology should automatically be refused, this is the effect of their approach. If the benefits of a new technology are to be discounted because, by its very nature, the benefits cannot be proven, then any new technology will find it hard to secure planning consent.

- 5.2.16 I would like to respond to UKWIN's use of a quotation from a Fichtner document in paragraph 178, which is used to support UKWIN's assertion that *"even the applicant's own consultants have their doubts about plasma arc technology, regarding both the track record and the level of efficiency associated with plasma arc gasification."* The quote in paragraph 178 is a partial quotation from a response to a question from the Environment Agency relating to the proposed gasification plant at Charlton Lane in Surrey, proposed by SITA Surrey Ltd. This company holds the residual waste management contract for Surrey and is required, under that contract, to develop a gasification plant for municipal solid waste and operate it for a long period against a number of performance targets, with commercial penalties for poor performance. This context is important, as it means that it was crucial for SITA Surrey Ltd to choose a proven technology which would ensure that the required performance could be guaranteed.
- 5.2.17 The company had secured an environmental permit for a batch gasification plant but wished to secure a variation to use a different gasification technology. The Environment Agency asked "Why have you chosen the particular gasification technology proposed in the variation application?" Fichtner prepared the response to this question, in which we considered conventional gasification (the production of syngas and its subsequent combustion in a gas engine or gas turbine), close coupled gasification (the production of syngas and its subsequent combustion to generate steam for a steam turbine) and plasma gasification.
- 5.2.18 In this context, the reasons put forward by Fichtner on behalf of SITA Surrey Ltd for selecting close coupled gasification were understandable. The key advantage of this option was that it was commercially proven. The use of syngas from plasma gasification in a gas engine or gas turbine was not commercially proven in February 2014, but it was not completely unproven either as explained in section 6.2 of the first Regulation 22 response (CD6). This does not mean that we, as Fichtner, expressed doubts about the track record of the technology, but we (and SITA Surrey Ltd) did not consider that the track record was appropriate for a long term municipal waste management contract.
- 5.2.19 I would also note that we did not express doubt about the efficiency of plasma gasification. On the contrary, we concluded that it would have energy efficiency similar to that of conventional energy-from-waste. As I have demonstrated earlier, this continues to be our position.

5.3 UKWIN – Lock Street (IP12)

- 5.3.1 UKWIN has submitted a copy of the planning inspector's report into the proposed gasification plant at Lock Street, St Helens, and has suggested that this appeal raises similar issues to those at the BEC Inquiry. I have assisted Mr Roberts in responding to this submission and the full response can be found in APP/NR/2-X. In the context of my evidence, I wish to point out that there is a critical difference between the Lock Street proposal and the BEC.
- 5.3.2 The appellant at the Lock Street inquiry provided an R1 calculation which achieved a value of 0.59 (i.e. below 0.65) when the plant was operating in electricity-only mode. Consequently, the Lock Street plant could only be considered a Recovery facility if it exported heat, and the inspector was not convinced that heat would be exported. Therefore, the inspector treated the Lock Street facility as a disposal facility. In contrast, the BEC would achieve a value of more than 0.65 when operating in electricity-only mode, as I have demonstrated earlier, and so should be treated as a recovery facility.
- 5.3.3 This difference means that the Lock Street decision is not relevant. In any event, each scheme must be assessed on its own merits.

5.4 RAGE

- 5.4.1 The only points raised by RAGE in my areas of expertise are whether the facility is a recovery facility, where RAGE duplicates and relies on UKWIN, and general air quality and health issues which are fully considered in section 3 above. Therefore, I have no specific comments to make on RAGE's submissions.

5.5 Other parties

- 5.5.1 In this section, I have responded to specific concerns raised by other parties in my areas of expertise. I have not responded to general concerns about the impact of the BEC on air quality and health, as I consider that these are fully considered in section 3 above. For example, Center Parcs, in paragraph 3.2 of its objection of 15 September 2015, states:

“There is a real risk that steam and vapour generated from the Energy Centre may contain contaminants that would be released in to the atmosphere and then would ultimately fall to ground within the local vicinity that contains residential dwellings and other holiday/recreational dwellings and thereby posing a risk to human health.”

- 5.5.2 While the vapour, by which I assume Dr Chow means the gas engine exhaust gases, would contain contaminants, the impact of these contaminants was assessed in detail in the ES, as I explained in section 3 above, and the risk to human health is negligible.

- 5.5.3 Mr and Mrs Yates are concerned about the impact of the emissions on local wildlife, including insects and bees. Since the impact of the plant on local air quality will be negligible, I consider that there will be a negligible impact on insects and bees as well.
- 5.5.4 A number of local residents commented on the experimental nature of the technology and the risks that this could lead to. The technology is not experimental. The conversion of waste to syngas via plasma gasification has been carried out at a number of plants around the world and is considered proven. The part of the BEC which is not commercially proven is the generation of power in a gas engine from the syngas over a sustained period. However, it is important to understand the consequences if this part of the plant is not successful, as it puts the supposed risks into perspective.
- 5.5.5 The syngas would be supplied to the gas engines for combustion.
- a) If the syngas is not suitable for the gas engines for a short period, then it would be combusted in a flare at high temperatures. While this is clearly not ideal from an energy efficiency perspective, the syngas would be fully combusted and the emissions would actually be dispersed even more effectively as they would be released at a higher temperature.
 - b) If the syngas continues to be unsuitable, the plant would be closed down. An important source of income for the plant is sales of electricity, so there is clearly no point in running the plant if electricity is not being generated.
 - c) The main technical concern is not that the gas engines cannot use the syngas to generate the power, but that contaminants within the syngas would make the gas engine dirty so that it needs to be closed down for cleaning. If this happens, the availability of the gas engines to generate power would be reduced. However, the plant would have eight engines, so it would be entirely possible for the plant to run with seven engines while the other one is maintained. While this is a commercial risk for the applicant, it does not present an environmental risk.
- 5.5.6 It is possible that local residents are concerned about the risk of fire. There have been a number of fires at waste storage and treatment facilities over the last few years, but it is noticeable that only one of these, to my knowledge, has occurred at an energy recovery facility. This was in August 2013 at Dargavel in Scotland, a plant which had a number of problems as identified by UKWIN and which is based on an entirely different technology.

6 **Conclusions**

- 6.1.1 In my evidence, I have demonstrated that the proposal would be defined as a Recovery Operation under the revised Waste Framework Directive, because the R1 Formula gives a result of 0.6756, which is greater than the threshold of 0.65, and this would increase when heat users are connected.
- 6.1.2 I have explained the assessment which I and my team carried out on air quality and health effects and confirmed that adverse impacts are highly unlikely. I have demonstrated that Dr Chow's concerns about other health impacts are without substance.
- 6.1.3 Finally, I have responded to concerns raised by UKWIN and other interested parties.